Smokey Point Master Plan

June 2008

Design and Development Guidelines

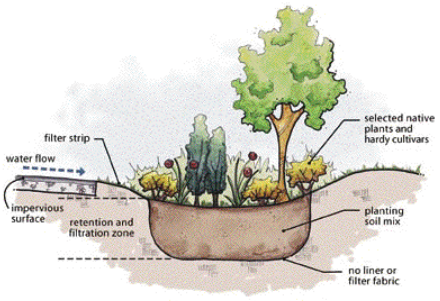

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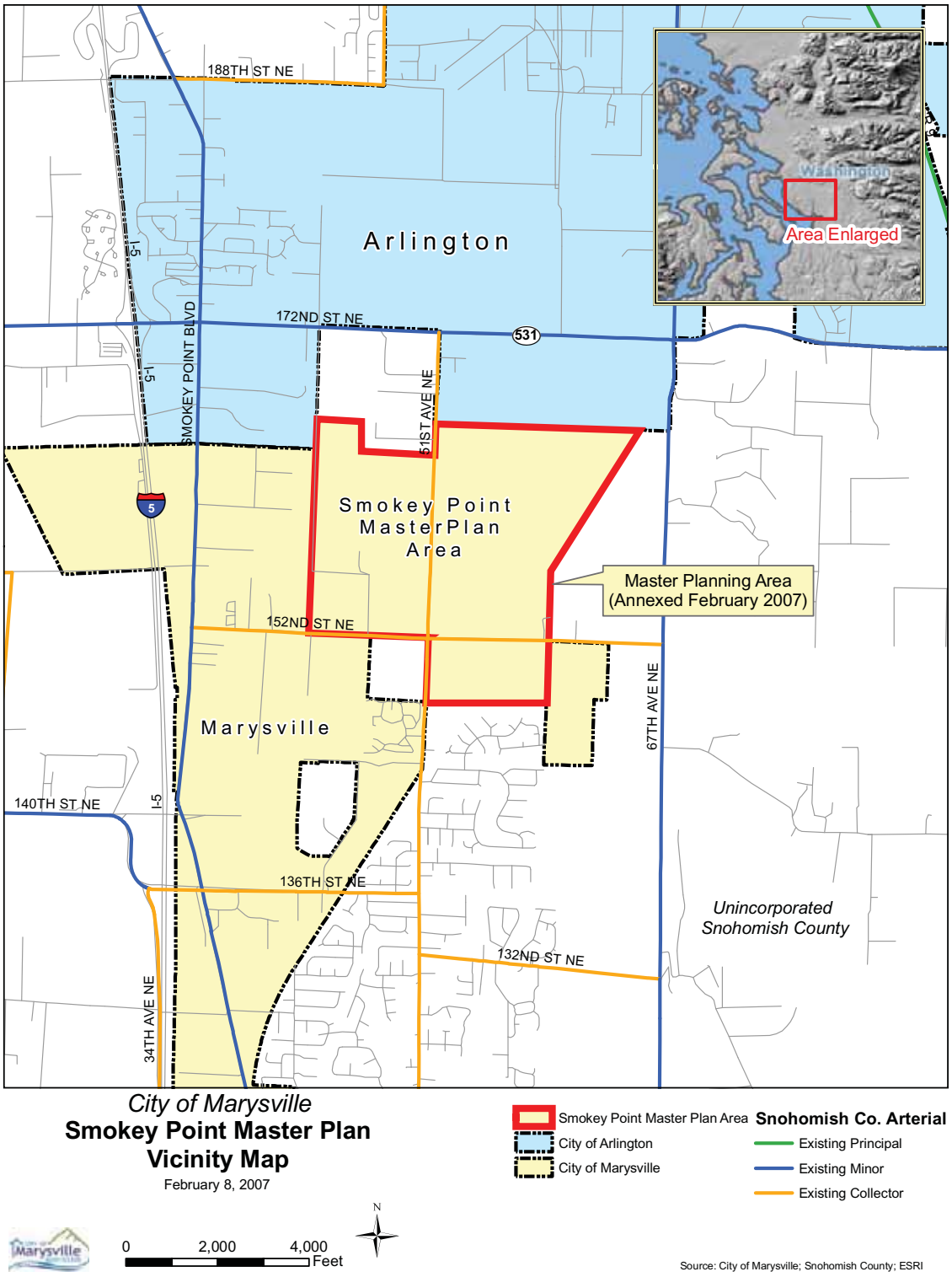
Table of Contents

List of Figures

List of Tables

List of Appendices

Figure 1:
Vicinity Map



Chapter 1 INTRODUCTION

This Smokey Point Master Plan Area (Smokey Point MPA) is a guidance and policy document for the overall development of a light commercial/industrial park in the northeast portion of the City of Marysville, as shown in Figure 1. This area was designated for a Master Plan Overlay in the City's 2005 Comprehensive Plan Update.

The Smokey Point MPA is ordered in the following chapters:

Chapter 1 – Introduction
Chapter 2 – Purpose and Intent
Chapter 3 – Land Use
Chapter 4 – Transportation
Chapter 5 – Critical Areas
Chapter 6 – Utilities
Chapter 7 – Drainage
Chapter 8 – Airport Compatibility
Chapter 9 – Design Guidelines
Chapter 10 – Landscaping
Chapter 11 – Implementation and Funding

The Smokey Point MPA provides guidelines that focus on the development layout, building orientation, architectural elements and relationships to parking, open space, landscaping, and signage/way finding. The Smokey Point MPA includes restoration/enhancement alternatives for Edgecomb Creek, a street network plan, and a conceptual storm water system.

1.1 BACKGROUND

The Smokey Point MPA, established by the annexation ordinance and the City's comprehensive plan, is located in the northern portion of the City and is contained within the Smokey Point Neighborhood Planning Area No. 10, as shown in Figure 2. This Smokey Point MPA is a master plan overlay and amends the City of Marysville Comprehensive Plan. The importance of this area was identified in the 1980's by the City and County as defined in the Economic Development Element [1] in the Smokey Point Neighborhood Planning Area No 10:

> *"This area plays a key role in meeting the economic development goals for the City of Marysville and Snohomish County. Historically and currently, both the City and County have designated Smokey Point for urban industrial uses in land use plans since the early 1980's.*
>
> *"…Smokey Point was identified as the City's most valuable assets for future economic development in said plan – specifically for light industrial parks and business parks. The current employment ratio for Marysville UGA is 0.236 jobs per person. Strengthening Marysville's employment base is a strong desire of the community and City leadership."*

[1] City of Marysville Comprehensive Plan - Adopted May 2, 2005.

Since the 1980's, the following decisions have been made to realize that vision and those goals:

- The Smokey Point Neighborhood became part of Marysville's Urban Growth Area following a settlement between the cities of Arlington and Marysville in 1996.
- The Smokey Point MPA, in the 2005 Comprehensive Plan update, was identified in the City's Urban Growth Area with the goal that it would be annexed to be an asset for the City's future economic development.
- The 2005 Comprehensive Plan (Ordinance 2568) included an amendment that established – upon annexation of this area - a Light Industrial zoning designation on these properties with a required master plan overlay. The City's vision, established during the 2005 Comprehensive Plan process, for this designated MPA is a light industrial employment center that will provide "living wage" job opportunities for the community. The area now referred to as the Smokey Point MPA was annexed into the City of Marysville in February of 2007. (Ord. No. 2687 - Appendix A)
- The area now referred to as the Smokey Point MPA was annexed into the City of Marysville in February of 2007. (Ord. No. 2687 - Appendix A)

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Chapter 2 PURPOSE AND INTENT

2.1 PURPOSE AND VISION FOR THE SMOKEY POINT MPA

The vision of the Smokey Point MPA, for the City of Marysville, is to establish a commercial/light industrial park that, based on the allowable uses in the zoning designations, provides jobs for the residents of Marysville and will expand the City's commercial/light industrial base. This vision is implemented through the Smokey Point Master Plan that builds off of the zoning code with additional development guidelines, design guidelines, and natural resource enhancements for the Edgecomb and Hayho creek environments. These design guidelines bring the typical light industrial or commercial development to a higher level of urban design and connects to the natural environment. The urban design element leads to an attractive and positive development and environment for the workers, employers, and businesses. The design guidelines are part of an overlay with the controlling authority based on the City of Marysville Comprehensive Plan and underlying zone classification of Light Industrial (LI).

The City of Marysville has experienced steady growth over the last ten years in the retail, commercial, and residential areas of the City, with some limited industrial uses. In the 2005 Comprehensive Plan update, the City identified the importance of establishing further commercial/light industrial businesses and providing jobs and living wages for residents of Marysville and north Snohomish County. The annexation of the Smokey Point MPA provided that land for commercial/light industrial development, which is compatible with the City of Arlington Airport, WSDOT airport guidelines, and FAA safety zone restrictions. In order to effectively implement these visions and goals, this Master Plan, with defined elements and restrictions, provides the guidance and framework for development in this area.

The intent of an overall master plan for development is to provide design guidance that coordinates the "look and feel" of the project while ensuring ecological and environmental responsibility and providing for efficient functioning of the whole area. In the competitive world of land development, a thoughtful master plan can provide added value to the property owner through quality design and predictability of development standards.

Site planning for individual parcels is the arrangement of landscaping, open spaces, buildings, circulation elements, and other features. A strong site concept displays a clear and unifying site organization and pleasing composition of buildings and landscape features. A well organized site is easy to understand (destinations are clear), and allows pedestrian and vehicular movement without conflict. Lastly, a strong site plan should relate well in functional and visual terms to adjacent sites, rights-of-way, and natural features. All of these elements are formed with the Master Plan's guidance.

Although the different types of light industrial and commercial land uses are envisioned within the Smokey Point MPA, the overall plan and vision can bring the range of uses together by individual site plans that will:

- Demonstrate how the elements of the site relate to the street front;
- Provide for compatibility with adjacent land uses;
- Provide protection or mitigation of natural features;
- Enhance street fronts and street corners;

- Promote public safety;
- Incorporate service areas and storm water facilities in a non-obtrusive manner; and
- Provide convenient pedestrian and vehicle circulation connecting on-site activities with adjacent pedestrian routes and streets.

2.2 DEVELOPMENT GUIDELINES AND DESIGN GUIDELINES

Throughout this Smokey Point MPA document, there are two types of guidelines - Development Guidelines and Design Guidelines - which are presented to address infrastructure and urban design and development site patterns.

2.2.1 Development Guidelines (Gray Shaded Boxes in Chapters 4-7)

The development guidelines focus on the major infrastructures that will need to be constructed to support the proposed land uses and linkages to the adjacent land uses. Specifically, the development guidelines are defined by each topic: transportation, critical areas, utilities, drainage, and airport compatibility. The existing conditions are described followed by the supporting analyses (or references) which provide the basis for defining the development guidelines. The development guidelines recommend how the infrastructure will be developed under the City's direction for the road networks, transit networks, drainage systems, utility networks, and wetlands/creek mitigation areas. Identified infrastructure will be constructed over time by private development interests as well as public agencies.

The actual funding and construction of the recommended sub regional to regional development infrastructure will be determined through the City's adopted code requirements and also prioritized by the City in its Comprehensive Plan and Capital Improvement Plans. The Master Plan includes a recommended implementation strategy in Chapter 11. The intent of the Development Guidelines is to present the best available options for the City to consider in dealing with a range of land uses.

2.2.2 Design Guidelines (Gray Shaded Boxes in Chapter 9-10)

The Design Guidelines apply to all new construction in the Smokey Point MPA. The Design Guidelines direct the building and parking lot orientations, landscaping standards, architectural features, pedestrian facilities, pedestrian amenities, and signage. On an area-wide and site by site basis, the guidelines are intended to supplement the existing and future standards in the Marysville Municipal Code. The underlying zoning Light Industrial (*LI – MMC Chapter 19.08)* will apply as the baseline in regard to permitted uses, conditional uses, lot coverage, building height, setbacks, landscaping, parking, and signage code standards (*MCC Chapter 19.12, 19.14, 19.16, 19.18, 19.20, 19.42* and sections as further defined by the City). The design standards will be in addition to the base standards and a site plan approval process will be required by the City of Marysville. Due to the high variety of uses allowed in this MPA, some incompatibility between this plan and the Marysville Municipal Code may arise. If there is a conflict that arises between this Master Plan and the Marysville Municipal Code, the Planning Director will issue an administrative interpretation to define which code standard will apply.

2.3 AUTHORITY

The Development Guidelines and the Design Guidelines are intended to supplement the zoning code standards in the Marysville Municipal Code. Where the guidelines and zoning ordinance standards conflict, the City will determine which regulation applies. The City retains full authority to determine whether or not a proposal meets these guidelines.

Within the guidelines, certain words are used to indicate the relative importance and priority the City places upon the particular guideline. The words "***shall***," "***must***," "***will***", and "***is/are required***" mean that the development proposal (site plan) must comply with the guidelines unless the City finds that:

- The guideline or requirement is not applicable or appropriate in the particular instance; or
- The development proposal meets the intent of the guidelines in some other manner.

The word "**should**" means that the development proposal or related infrastructure requirement is to be complied with if at all possible unless the City finds:

- The guideline or requirement is not applicable or appropriate in the particular instance; or
- The development proposal meets the intent of the guidelines in some other manner; or
- There is a compelling reason to the contrary.

The words "**is/are encouraged**" mean that the action or characteristic is allowed and will usually be viewed as a positive element in the City's review.

Chapter 3 LAND USE

This chapter briefly reviews the existing land uses, the existing and future demographics and land uses, the general zoning classification intent, the supporting comprehensive plan policies, and a development scenario of land uses for programmatic analysis purposes, and parks/recreation facilities.

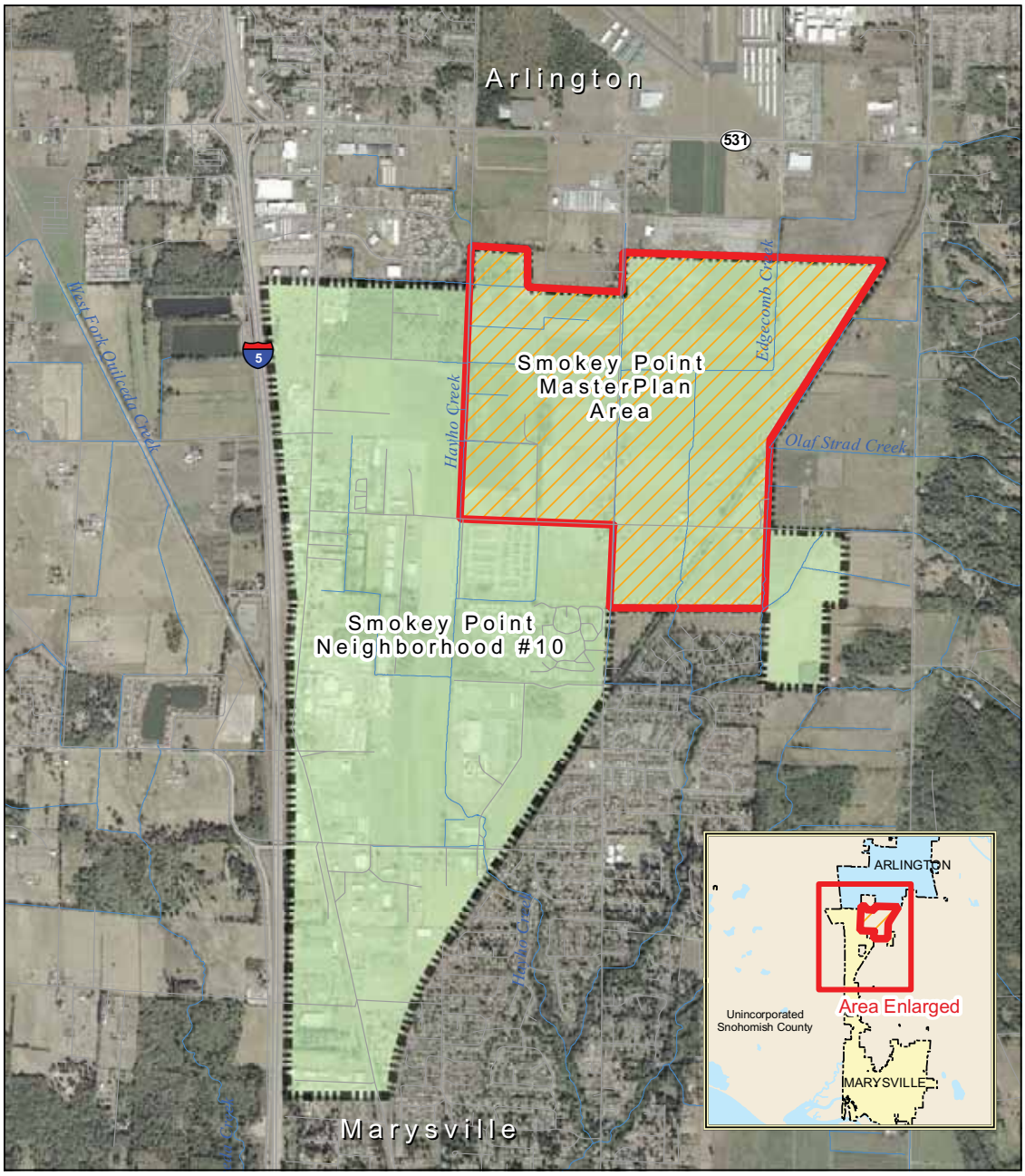
3.1 BACKGROUND AND EXISTING LAND USE

The Smokey Point MPA of 675 acres has historically been managed as agricultural lands ranging from sod farms to horse pastures. The area is comprised of 23 parcels ranging in size from one quarter of an acre to 90 acres with an average parcel size of 26 acres. The area includes portions of the Hayho Creek Drainage Basin and the Edgecomb Creek Drainage Basin.

Underdeveloped parcels dominate this MPA, which makes it prime for future development. The MPA frames the appropriate development and ultimate build out compatible with adopted City Goals and Policies.

The Smokey Point Neighborhood Planning Area (No.10) covers 1,859 acres, with 1,089 net acres for development, with the Smokey Point MPA covering 675 acres of the overall 1,859 acres. The Smokey Point MPA focuses on the northeast corner of the neighborhood that is generally located between 172nd Street to the north, 152nd Street to the south, 43rd Avenue to the west, and the Burlington Northern Rail Road tracks to the east (see Figure 2). Any portion of the Smokey Point Neighborhood Planning Area No. 10 outside of the Smokey Point MPA is not subject to the provisions of the Smokey Point Master Plan.

Figure 2:
Master Planning Area



City of Marysville
Smokey Point Master Plan
Master Planning Area
February 8, 2007

Streams
Smokey Point Master Plan Area
Smokey Point Neighborhood

0 1,500 3,000 Feet

N

Source: City of Marysville; Snohomish County; ESRI

3.2 HOUSING, EMPLOYMENT, AND LAND USE

The 2005 Comprehensive Plan provided a snapshot of existing dwelling units, population and employment and forecasted growth in Planning Area No. 10 through 2025[2].

	2005	2025
Dwelling Units	834	982
Population Estimates	2,121	2,417
Employment Estimate	2,724	11,965

It is important to note that the growth is directed to employment through commercial and industrial uses. The percentages of land uses from referenced reports and assumptions that are utilized in the Master Plan analyses are general planning level allocations used for analysis purposes. Actual development uses will be based on the Comprehensive Plan and Zoning Code.

3.3 PARKS AND RECREATION

No existing parks are located inside the MPA, but there are three nearby recreational opportunities to future tenants. There are two athletic complexes south and a regional trail east of the MPA:

1. Marysville Soccer Complex
2. Strawberry Fields Athletic Park on 152nd NE.
3. The Centennial Trail, which is the regional trail, can be readily accessed by linking it to the MPA east of 67th Avenue NE.

To take advantage of these facilities, there are recommended bike / pedestrian trail alignments from downtown Marysville, and internally from the MPA, which are outlined in the Chapter 4 Transportation analysis under the Non-Motorized section.

3.4 LAND USE ZONING REQUIREMENTS

The purpose of the LI zone is:

> *[T]o provide for the location and grouping of industrial enterprises and activities involving manufacturing, assembly, fabrication, processing, bulk handling and storage, research facilities, warehousing, heavy trucking and certain uses, though perhaps inherently commercial, that are best suited to industrial areas of the city. It is the purpose of this zone to protect a land base for the aforesaid businesses and the employment opportunities they represent. These purposes are accomplished by:*
>
> *(a) Allowing for a wide range of industrial and manufacturing uses, but providing also for certain commercial uses that have a need to be separated from residential areas;*
>
> *(b) Establishing appropriate development standards and public review procedures for the aforesaid businesses; and*

[2] 2005 Integrated Comprehensive Plan, Development Regulations and FEIS – Smokey Point Neighborhood Planning Area No. 10 – II. Housing & Employment Analysis

(c) Except for the permitted uses, limiting other service, residential and commercial uses to those necessary to directly support the permitted uses.

MMC 19.42.020. The permitted uses in the LI zone are set forth in MMC 19.08.

3.5 COMPREHENSIVE PLAN POLICIES

The 2005 Comprehensive Plan supports the City's vision and provides policy direction for the Smokey Point MPA. A brief summary of key infrastructure improvements and urban design goals[3] from the Smokey Point Neighborhood Planning Area element include the following:

- Consider the long-term benefit of land uses within a community. Balance jobs, retail revenues, and aesthetic benefit and appeal to the citizens.
- Recognize that area development will require significant infrastructure costs (roads, stormwater, wetlands) and designate uses that will support these costs.
- Provide standards that assure attractive structures, uses, and signage for development.
- Recognize Smokey Point (including South Smokey Point) as an economic center. The Smokey Point neighborhood will be an economic engine for Marysville and North Snohomish County. This area is proposed for an employment center for Arlington and Marysville. Area access, topography, parcel ownership patterns, historic and current zoning patterns, and infrastructure support the proposed employment land uses for this MPA.
- Provide and plan for access – including roadways, pedestrian walkways and bridges to connect land uses and areas.
- Incorporate environmental measures such as wetland banking, stream restoration and enhancement into preferred land use concept.
- Incorporate stormwater planning into preferred land use concepts by considering potential regional stormwater facilities for flood attenuation and aquifer recharge.
- Incorporate stormwater and wetland mitigation into land use concepts.
- Incorporate stormwater planning into land use concepts by coordinating the siting of land uses that can effectively utilize regional detention facilities in addition to reducing impervious surfaces through joint or shared parking, increased transit usage, and the use of low impact development standards.

3.6 LAND USE SCENARIO AND ASSUMPTIONS

The preferred land use scenario, presented in Table 1, was established as a range. This range is only for the purposes of allowing for conceptual storm drainage analysis and transportation analysis. The actual uses developed and the percentage of light industrial/manufacturing (or other uses allowed in the LI zone) to office may vary based on the market and property consolidations that take place over time.

The preferred land use and build-out scenario within the LI zone classification, regardless of present lot configurations and ownership, was established with the following assumptions:

3 2005 Integrated Comprehensive Plan, Development Regulations and FEIS – Smokey Point Neighborhood Planning Area No. 10.

- 25 percent of the land within the planning area is assumed to be wetlands, streams and buffers, and not available for development. It should be noted that this percentage can, and most likely will, be lower depending upon actual field checks and site specific critical area reviews.
- Lot coverage of the developed land area by buildings/structures will be no greater than 50 percent.
- 60 percent of the developed land area will be in light industrial/manufacturing.
- 40 percent will be in office space.
- 85 percent of developed areas will be impervious surfaces.
- The remaining 15 percent will be landscaped surfaces or open space.

Table 1: Preferred Land Use Scenario

Land Use Mix	Assumptions	Office square footage	Light Industrial/Manufacturing square footage	Total square footage
Business - Light Industrial and manufacturing use 60 percent	35% - Two floors Office 65% - Light Industrial	5,453,616	5,064,072	10,517,688
Office uses 40 percent	100% - Three floors Office	15,581,760	0	15,581,760
Total		**21,035,376**	**5,064,072**	**26,099,448**

It is important to note that this is a planning scenario and not a project-SEPA level analysis. The scenario has higher than anticipated office uses to establish a high end traffic generation impact. This MPA policy and code document establishes the guidelines for the infrastructure and development; it does not establish or address the specific impacts of each individual development. An individual SEPA, on a project by project basis, or an area-wide Environmental Impact Statement would be necessary prior to issuance of building permits.

Chapter 4 TRANSPORTATION

The Transportation evaluation considers the long-term potential development of the neighborhood (developable land capacity), adjacent neighborhoods inside the City, the City of Arlington, Snohomish County, and other jurisdictions. The evaluation also takes into consideration existing and future regional roads, transit services, and non-motorized facilities.

4.1 TRAFFIC FORECASTING METHODOLOGY

Travel forecasting for the Smokey Point neighborhood employed the City of Marysville's current T-Model/2 program, which was developed in 2004 to predict traffic volumes for the year 2025. This model covers the City of Marysville and its UGA areas, and uses external traffic inputs from the regional traffic model developed by the Puget Sound Regional Council (PSRC).

Land use assumptions in the Traffic Analysis Zones (TAZs) of the City's T-Model that relate to the Smokey Point neighborhood were reviewed for compliance with the land use assumptions proposed in the neighborhood plan. The land-use assumptions were adjusted in the T-Model/2 program for the Smokey Point neighborhood, the Lakewood neighborhood and the Tulalip Indian Reservation.

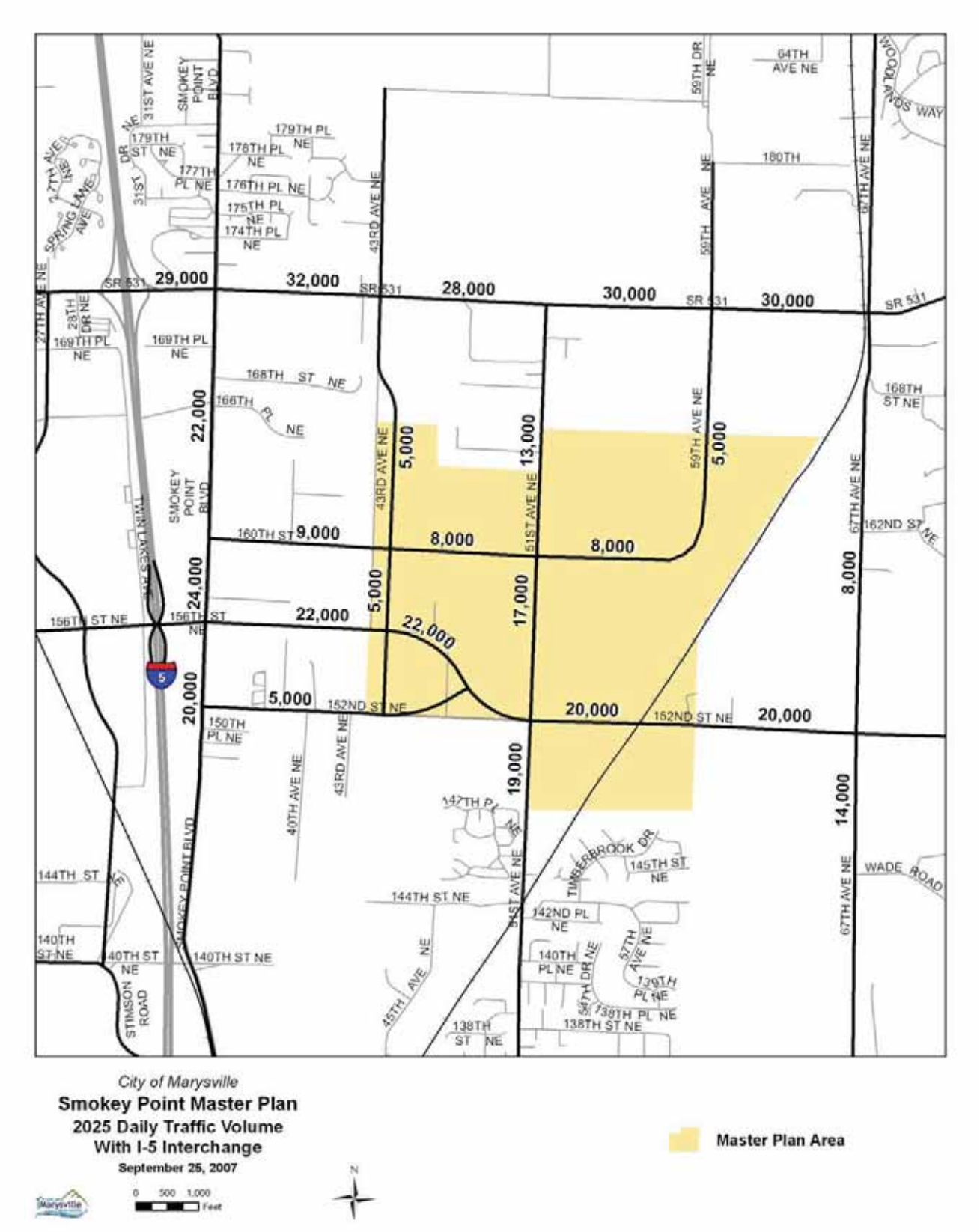
The road network assumptions of the current T-Model/2 program were also revised to include future road connections.

A new cross-town principle arterial road would be constructed from the Lakewood Neighborhood to the west on the 156th Street right-of-way, across I-5 to intersect with Smokey Point Boulevard, continuing east and curving south to align with the 152nd Street right-of-way at some point east of 43rd Avenue, and then continuing east to 51st and 67th Avenues, or ultimately even to SR 9. A new interchange could make a more direct connection to I-5 at the 156th Street intersection in the long-term future. The T-Model/2 program was run to provide new traffic forecasts for the year 2025 using these land-use and road network adjustments, with and without a new interchange at I-5.

4.2 TRAFFIC DEMANDS AND ARTERIAL ROAD CLASSIFICATIONS

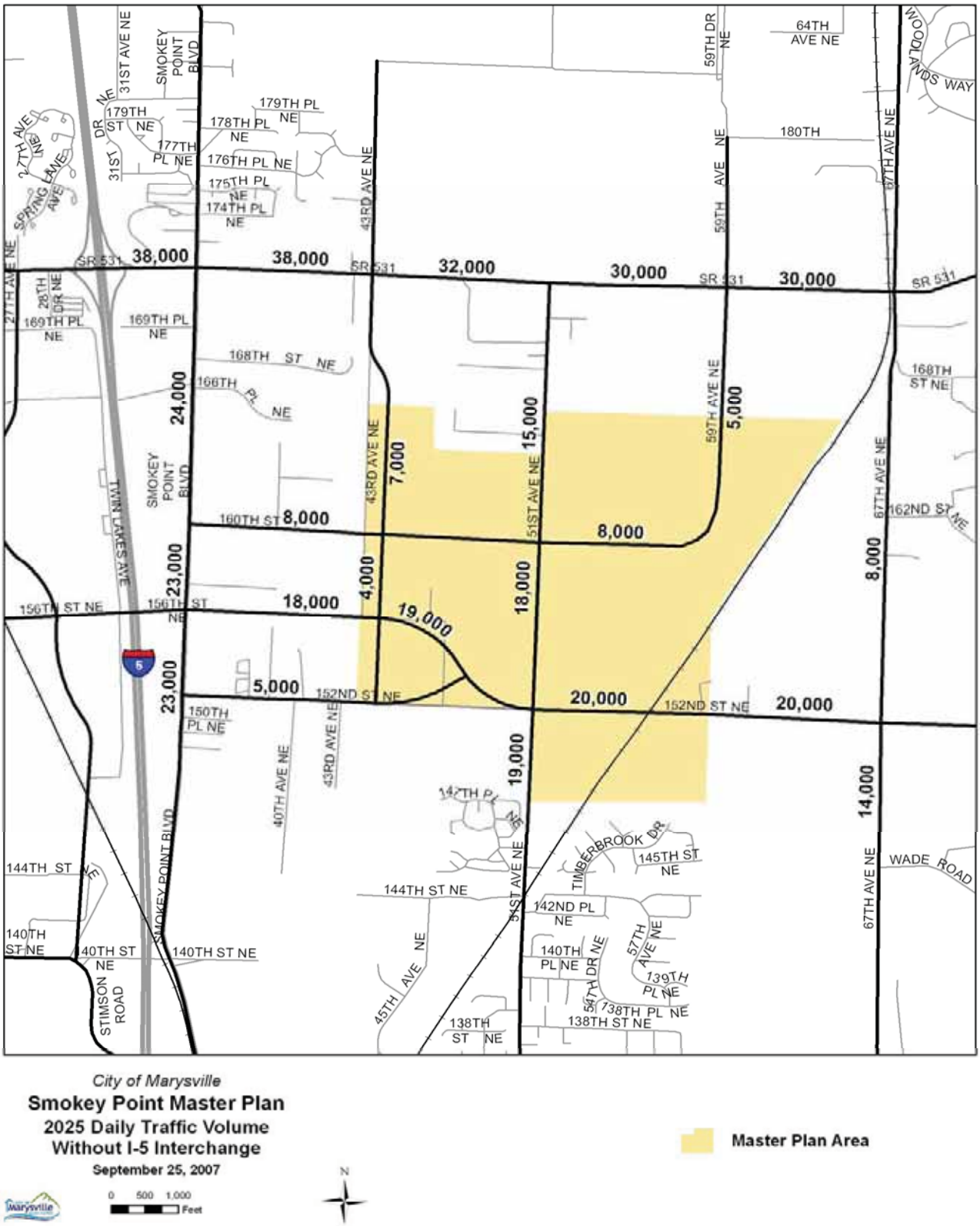
Results from the traffic model are shown on Figure 3, with a future interchange at I-5 and 156th Street, and on Figure 3a, without an interchange on I-5 at 156th Street. The estimates are summarized by road in Table 2. These estimates indicate that there will be heavy traffic demands in the east-west direction on 172nd Street and 156th / 152nd Streets and in the north-south direction on Smokey Point Boulevard, 51st Avenue, and 67th Avenues.

Figure 3:
2025 Daily Traffic Volume with I-5 Interchange



City of Marysville
Smokey Point Master Plan
2025 Daily Traffic Volume
With I-5 Interchange
September 25, 2007

Figure 3a:
2025 Daily Traffic Volume Without I-5 Interchange



City of Marysville

Smokey Point Master Plan

2025 Daily Traffic Volume Without I-5 Interchange

September 25, 2007

0 500 1,000 Feet

N

Master Plan Area

One corridor under consideration at the City is the proposed extension of 152nd Street west and north through the MPA to connect to a new I-5 interchange at 156th Street, which could carry up to 22,000 vehicles per day, at the west end. If the interchange is not constructed, then traffic from the Smokey Point MPA will generally flow north to the interchange at 172nd Street resulting in congestion, and 156th Street might only carry 18,000 vehicles per day east of Smokey Point Boulevard. A new minor arterial street on the 160th Street alignment could carry up to 9,000 vehicles per day.

The highest volumes in the north-south direction will be just outside the Smokey Point MPA on Smokey Point Boulevard, where traffic demands could reach 24,000 vehicles per day. 67th Avenue, also outside the MPA, could carry up to 14,000 vehicles per day south of 152nd Street. At the south end within the MPA, 51st Avenue could carry up to 19,000 vehicles per day. 43rd Avenue could carry up to 7,000 vehicles per day and 59th Avenue could carry up to 5,000 vehicles per day in the MPA.

Table 2: Estimated 2025 Daily Traffic Volumes

Corridors	Minimum	Maximum
East-West Streets		
172nd Street (SR 531)	28,000	38,000
160th Street	8,000	9,000
156th / 152nd Street	18,000	22,000
152nd Street (West)	5,000	5,000
North-South Streets		
Smokey Point Blvd.	20,000	24,000
43rd Avenue	4,000	7,000
51st Avenue	13,000	19,000
59th Avenue	5,000	5,000
67th Avenue	8,000	14,000

4.3 STREET NETWORK AND ALTERNATIVE NETWORK IMPROVEMENTS

Based on these analyses, the following road improvements, defined within the Development Guidelines, are recommended as illustrated on Figure 4 and summarized in Table 3. Typical street sections are described and illustrated in Section 4.6. The included alternatives (with optional networks illustrated in Figure 4a and 4b) provide for north-south and east-west road connectivity. The north-south alignments shown for 43rd Avenue NE and 51st Avenue NE provide for future continuity between 172nd Street NE (SR 531) and 152nd Street NE. The east-west alignments shown for 156th/152nd Street NE reflect continuity between Smokey Point Boulevard and 67th Avenue NE. The road concepts depicted herein may be revised as more advanced critical area review and engineering analyses is completed. Other road alignments are acceptable, as long as the north-south, or east-west continuity goals are reached, and the affected property owners demonstrate funding support and mitigation (if critical area crossing and fill is required) for the alignment.

Table 3: Recommended Arterial Road System

	From	To	Lanes
Principle Arterials			
SR 531 (172nd Street)	I-5 Interchange	SR 9	5
152nd / 156th Street	I-5 Interchange	67th Ave. / SR 9	5
Smokey Point Boulevard	152nd Street	172nd Street	5
51st Avenue	1400' south of 152nd Street NE	172nd Street	5
Minor Arterials			
160th Street	Smokey Point	59th Avenue	3
152nd Street West	Smokey Point	43rd Avenue	3
43rd Avenue	152nd Street	172nd Street	3
59th Avenue	160th Street	172nd Street	3

Development Guidelines – Street Network

The street networks in regards to right of way and landscape widths will be designed pursuant to the City's street design standards, with exceptions to right-of-way width and median/street landscaping width(s) considered during design review.

- **152nd Street** will be realigned to 156th Street east of 43rd Avenue and classified as a Principle Arterial, with two travel lanes in each direction and a center landscaped boulevard (width to be determined during design review) with left-turn pockets at key intersections. Traffic control signals will be required at the intersections of 43rd Avenue and 51st Avenue. A multi-purpose trail or road-side path will be provided on the south side of the road to connect Lakewood with Strawberry Fields Park. 152nd Street will be designed for primary bus routes. A corridor design study will be initiated by the City to determine a preferred alignment to connect 152nd Street to 156th Street, which will consider access management to adjacent property developments.

- **152nd Street West of 43rd Avenue** will be retained as a Three Lane Minor Arterial from Smokey Point Boulevard through to 43rd Avenue.

- **160th Street** will be classified as a Minor Arterial and designed for three lanes east of Smokey Point Boulevard to 59th Avenue.

- **43rd Avenue** will be classified as a Minor Arterial and designed for three lanes from 152nd Street to 172nd Street (SR 531). The final alignment will consider the parallel Hayho Creek and wetlands. Bike lanes will be provided or a multi-purpose trail could be incorporated into the buffers areas, as determined by the City code, on the west side of the road.

- **51st Avenue** will be classified as a Principle Arterial and designed for five lanes with bike lanes. 51st Avenue will be designed for primary bus routes. Traffic control signals will eventually be required at 160th Street and 152nd Street. Additional traffic control signals could be provided at one or two other locations along 51st Avenue to provide access to Collector Streets to service developments in the MPA.

- **59th Avenue** will be classified as a Minor Arterial and designed for three lanes from 172nd St (SR 531 to 160th Street). 59th Avenue could be extended south of 160th Street to 152nd Street, if a new grade-separation crossing of the BNSF railroad tracks is approved and constructed.

- **Collector Streets**, in conjunction with adopted City street standards, may be designed by developers to provide the appropriate level of access to adjoining properties. These streets may have signal controlled intersections on the Principle Arterials if appropriately spaced as illustrated on Figure 4.

Figure 4:
Arterial Functional Classifications

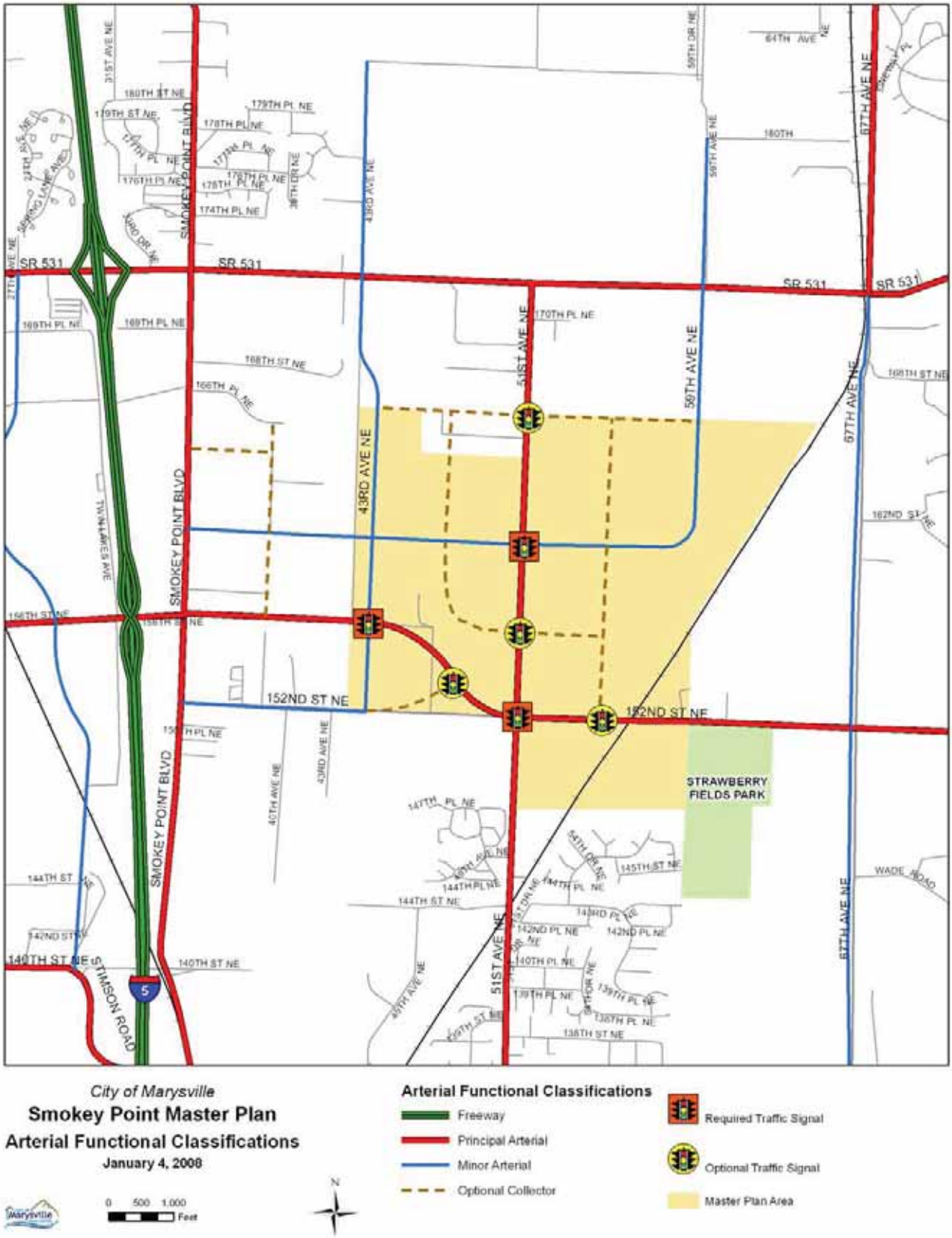


Figure 4a:
Optional Arterial Network

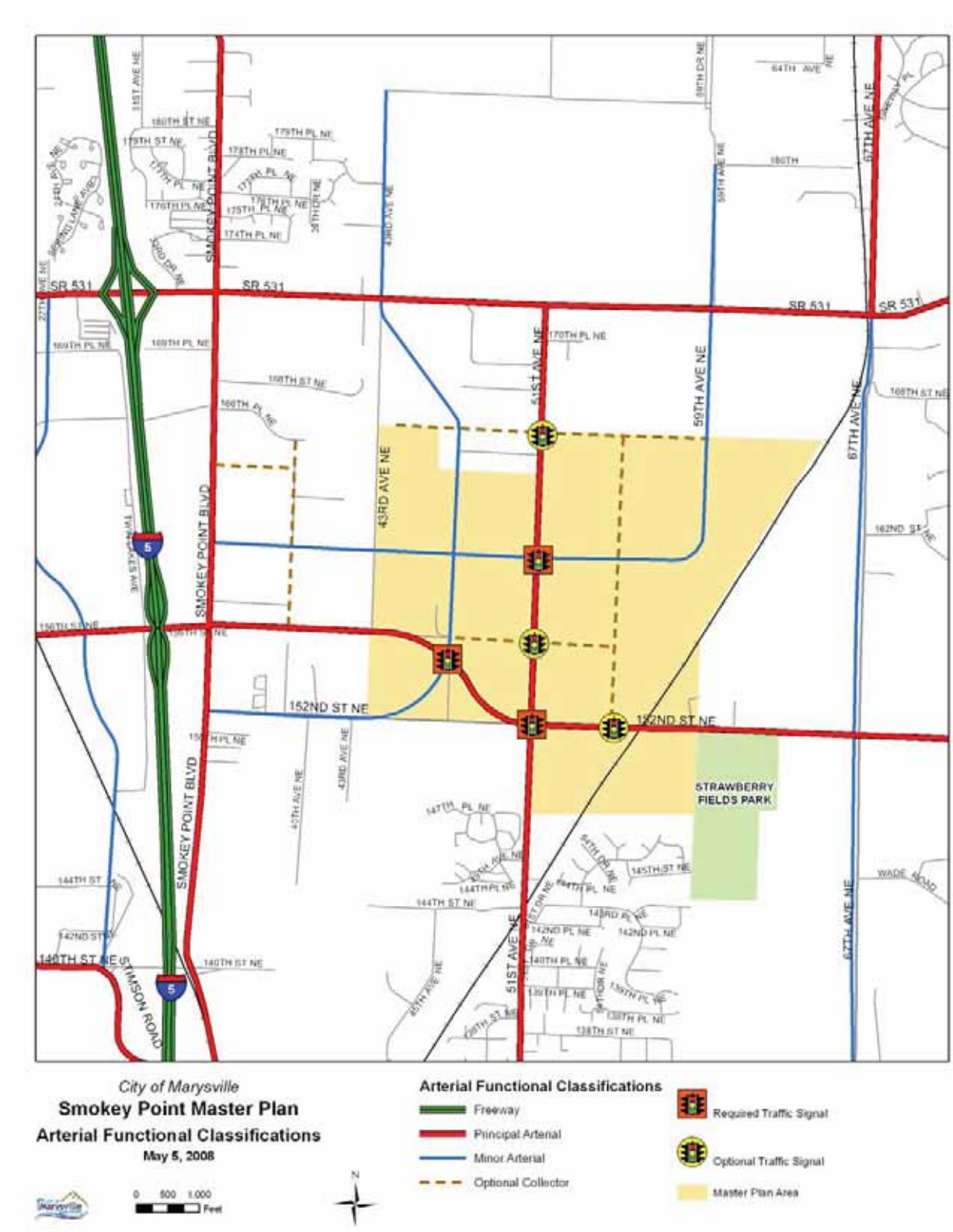
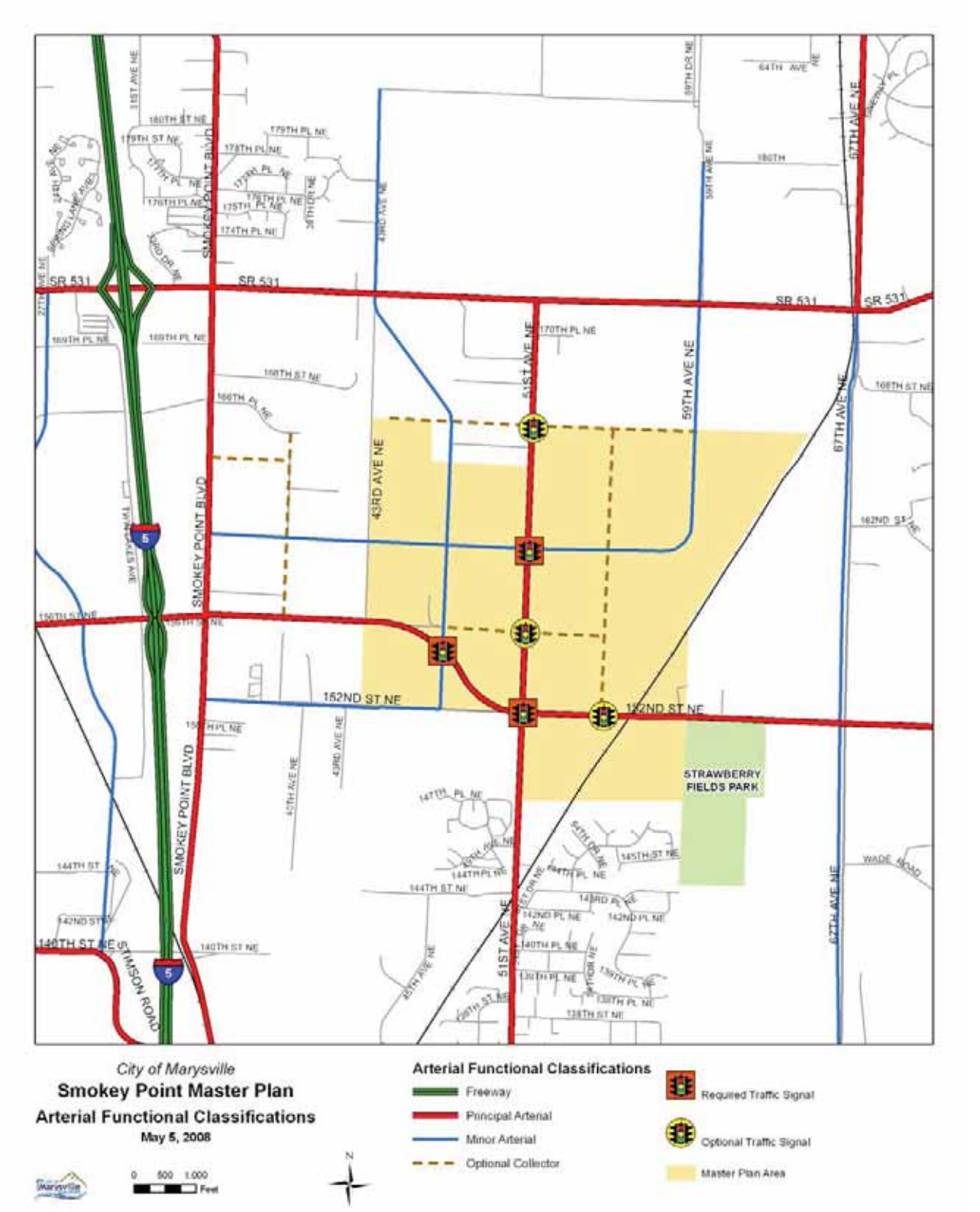


Figure 4b:
Optional Arterial Network



4.4 TRANSIT FACILITIES

Transit service through the Smokey Point MPA is provided by Community Transit. There are currently five Community Transit routes that directly serve the MPA, or nearby such as Smokey Point Boulevard. These include routes 200, 201, 202, 207 and 230. Existing transit service is shown in Figure 5.

Routes 200 and 202 provide commuter and all day service on weekdays between the Everett Station Transit Center and Smokey Point at 35th Avenue, via 51st Avenue, 152nd Street, and Smokey Point Boulevard. Route 201 provides all day service on weekdays and weekends between the Lynnwood Transit Center and Smokey Point via Smokey Point Boulevard. Route 207 provides weekday commuter service only between Smokey Point and the Everett Boeing plant. Route 230 provides weekday and weekend service between Darrington and Smokey Point.

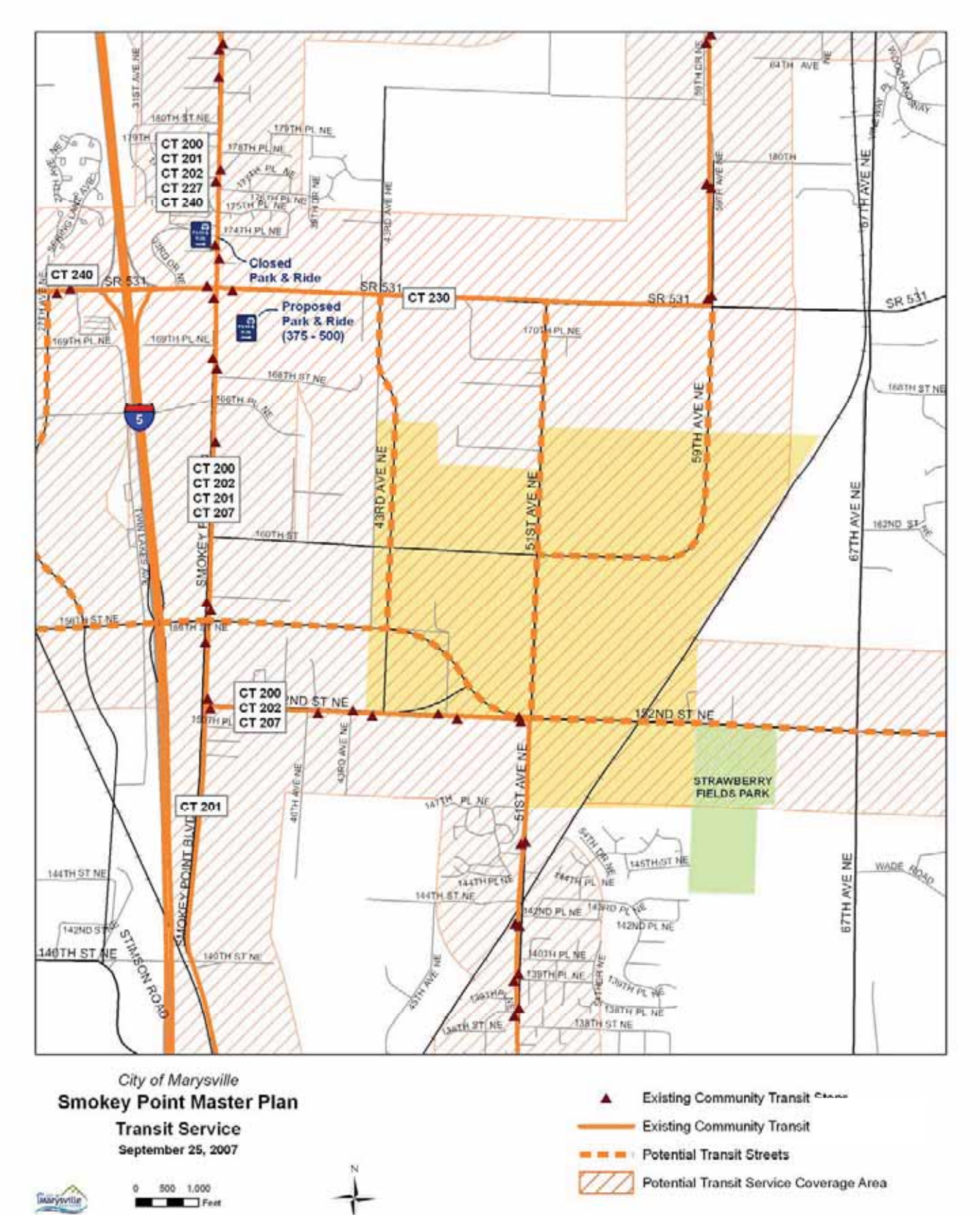
Transit service is also provided to disabled persons through Community Transit's paratransit service, also known as DART. This service is provided to disabled residents living within 3/4 mile of existing local fixed routes.

Within the MPA, bus stops are located along 152nd Street and 51st Avenue. Most of the bus stops include only a bus stop sign without a pad, and are therefore not ADA compliant. Bus pullouts with adjacent sidewalk are located on the south side of 152nd Street, immediately east of 43rd Avenue, and on the west side of 51st Avenue NE, south of 152nd Street. Outside of the planning area, along Smokey Point Boulevard, the bus stops will often include a bus pullout, sidewalk or pad and sign. No bus shelters are located within the Smokey Point MPA.

The Community Transit Six-year Transit Development Plan (2004-2009) includes proposed improvements to extend Route 201 east along 172nd Street (SR 531) into Arlington and potentially a commuter route from Arlington / 172nd to Downtown Seattle. There is a transition between the park and ride site north of 172nd Street in Arlington with a new park and site proposed south of 172nd Street near Smokey Point Boulevard, also shown on Figure 5.

Transit service areas are usually defined as the properties within 1,500 feet of a bus route where stops are made. Because the existing transit routes are only on streets that are along the periphery of the MPA (152nd Street west of 51st Avenue and 51st Avenue south of 152nd Street), a relatively small segment of the planning area is currently served by transit.

Figure 5:
Transit Service



4.4.1 Recommended Transit Improvements

As the MPA is developed to its capacity, it will require additional public transit services. Future transit routes should be designed to provide service to within 1,500 feet of as many residents and employees as possible. A future transit route along 51st Avenue, north of 152nd Street to 172nd Street, and into Arlington would provide the greatest benefit in capturing potential riders within the Smokey Point MPA. In the long-term, a transit route on the 152nd/156th Street corridor to Lakewood should also be considered. Additionally, routes could be considered along collector roadways such as 43rd Avenue and 59th Avenue to provide full coverage.

The City will need to update their street design standards to incorporate the development guidelines and to design these streets to support future bus routes to serve future residents and employees. Street design considerations should include providing additional right-of-way for key bus stop locations, bus pads for shelters at key locations, and sidewalk or trail access. This infrastructure should be considered a mitigation expense in the same manner as road facilities and non-motorized facilities. Coordination with Community Transit to locate a regional transit station is an important component in supporting local and regional capabilities.

4.5 NON-MOTORIZED FACILITIES

Multi-purpose trails, bike lanes, sidewalks and other non-motorized facilities should be provided for recreational purposes and to encourage commuters to use modes other than automobiles to travel to work sites and schools.

It is also important to maintain a grid system of non-motorized facilities so that pedestrians and cyclists are not discouraged by long and winding routes. Sidewalks should be provided on all arterial roads unless a road-side multi-purpose path is provided. A network of existing and proposed trails and bike lanes is illustrated in Figure 6**.**

Multi-purpose Paths and Trails are recommended in the following corridors:

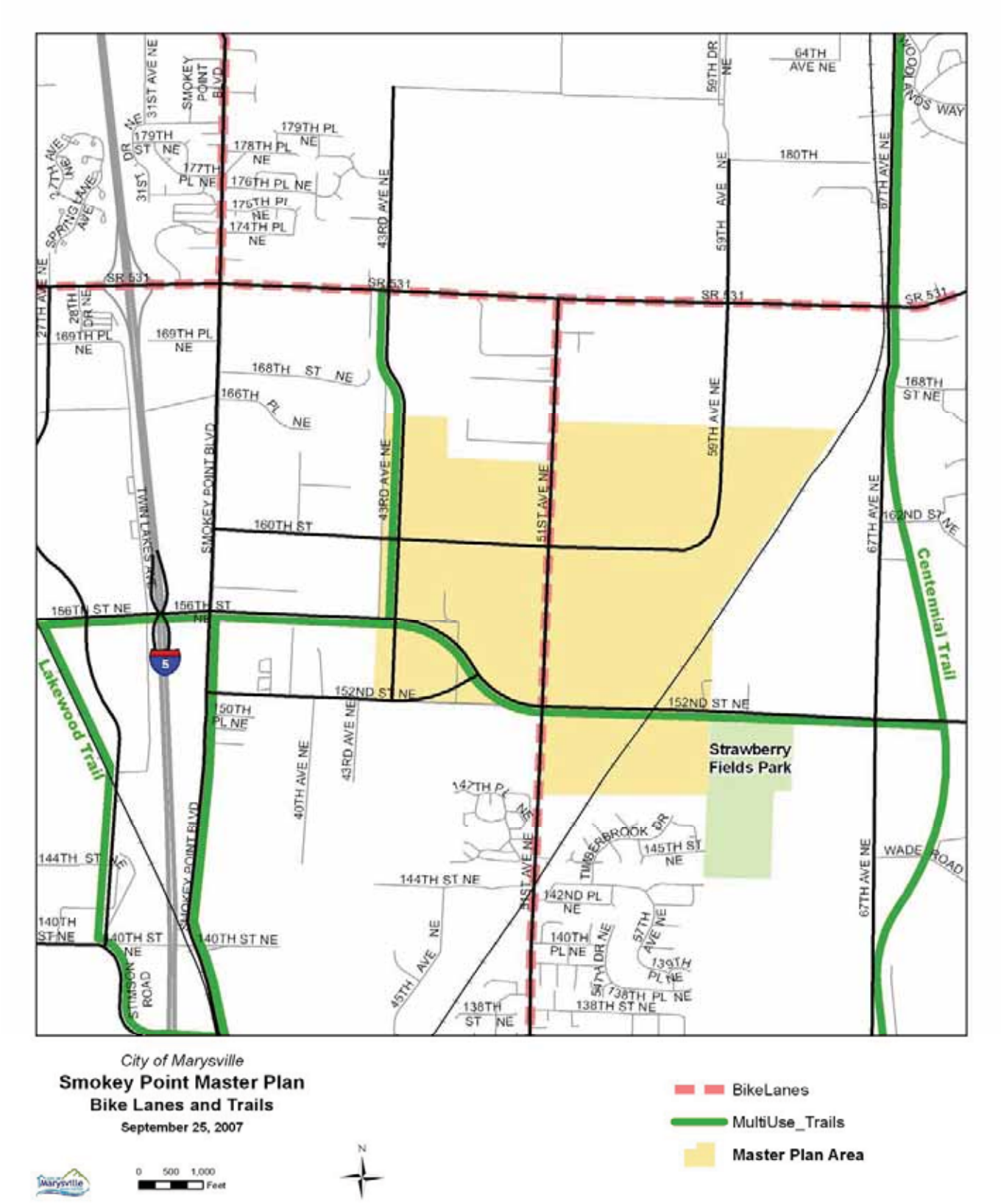
- 152nd/156th Street corridor: This path should be located on the south side of the road to connect the Centennial Trail and Strawberry Fields Park to the MPA and ultimately to the potential Lakewood Trail via the 156th Street bridge crossing I-5.

- 43rd Avenue: This path would provide an excellent north-south opportunity for a road-side path to connect the 152nd/156th Street Corridor Trail to 172nd Street bike lanes, residents and commercial properties in Arlington. Bike lanes will be provided or a multi-purpose trail could be incorporated into the buffer areas on the west side of the road as determined by the City staff.

Bike Lanes are recommended on the following roads:

- 51st Avenue: from south of the152nd / 156th Street Corridor Trail to the bike lanes on 172nd Street in Arlington. Although this is recommended as a Principal Arterial with bus service, bike lanes are recommended for continuity with the bike lanes already planned on 51st Street into downtown Marysville.

Figure 6:
Bike Lanes and Trails



4.6 RIGHTS-OF-WAY AND STREET DESIGN STANDARDS

The MPA is proposed to be an upscale commercial / light industrial neighborhood. The rights-of-way need to accommodate the needs of cars, trucks, transit buses, bicycles and pedestrians. Landscaping should be used to buffer traffic impacts and increase the value of the adjacent properties.

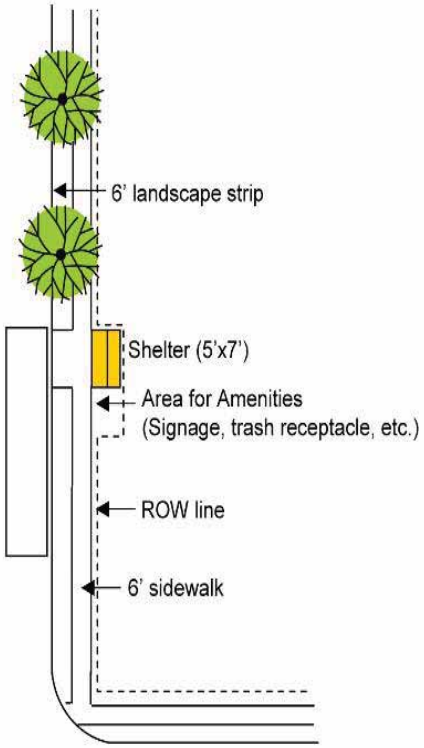
Where possible, it is preferable to include landscaped medians on Minor and Collector Arterial streets. These landscaped medians can be transformed into left-turn pockets where warranted at intersections or major driveways. Where feasible, U-turn capability should be considered at intersections where roadway medians limit driveway access. The design standards should include sidewalks on both sides of a street, unless there is a multi-use path in the right-of-way. Landscaped buffer strips should also be provided between vehicular travel lanes and sidewalks or paths.

Each street design must consider the need for transit stops and bicycle lanes. Key transit stop locations will require allowances for pads (designed to ADA standards) to accommodate future bus shelters. Minor arterial, collector, and local streets should also allow for parking pockets between landscaped bulb-outs at key intersections, at the discretion of the City. On-street parking along a property frontage will be credited to the off-street parking as required by MMC 19.18.160.

Transit facilities at key stops require right-of-way allowances for transit shelter pads. The minimum extra right-of-way allowance for a transit pad at an in-lane transit stop should be five feet in width and about 15 feet in length, as illustrated on the diagram to the right. This allowance will provide sufficient space for a standard shelter with adjacent room for other transit amenities such as signs, schedules, and trash receptacles.

Based on the adopted City of Marysville's street design standards, the objective of providing a high quality of street landscaping, and the above recommendations for the needs of vehicular travel, transit services, and non-motorized facilities, the following right-of-way standards and cross-sections are recommended.

Right of WayNeeds for Transit Stop (In Lane)



Design Guidelines - Five-Lane Principal Arterial Streets

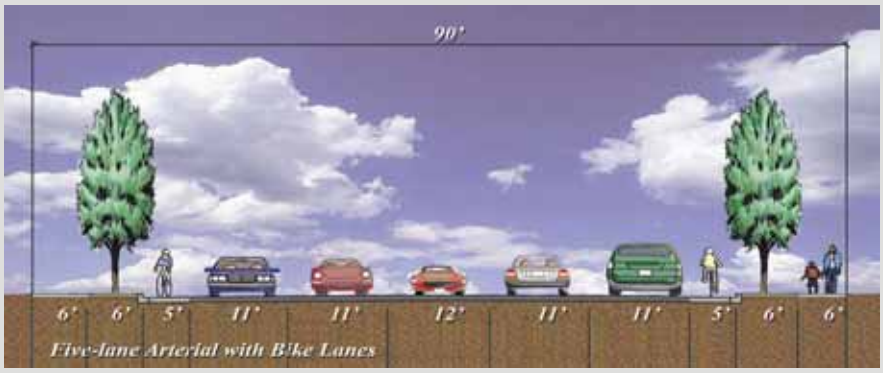
The street networks in regards to right of way and landscape widths will be designed pursuant to the City's street design standards, with exceptions to right-of-way width and median/street landscaping width(s) considered during design review.

Two standard cross-sections are proposed for five-lane arterial streets, both on rights-of-way of 90 feet.

Five-lane Principal Arterial with Bike Lanes (51st Avenue)

This standard provides:

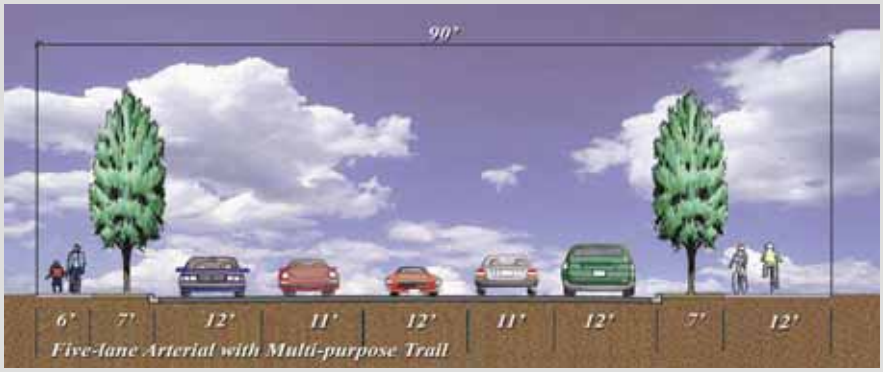
- Up to a maximum 12-foot wide landscaped median or left-turn lane.
- Two travel lanes in each direction
- Side walks and bike lanes in each direction
- Bus stops would be in-lane without pull-outs
- Key bus stops should be provided with extra right-of-way for shelter pads and should be planned for every intersection that might be controlled by a traffic signal



Five-lane Principal Arterial with Multi-Use Trail (152nd / 156th Street)

This second standard provides:

- Up to a maximum 12-foot wide left-turn lane with some landscaping medians
- Two travel lanes in each direction
- Multi-use path at a minimum in one direction or both sides. Direct impacts related to the integration of the road elements into the buffer must be avoided or mitigated.
- Bus stops would be in-lane or pull-outs, depending on the final designs
- Key bus stops would also be provided with extra right-of-way for shelter pads and should be planned for every intersection that might be controlled by a traffic signal



Design Guidelines - Three-Lane Minor Arterial Streets

The street networks in regards to right of way and landscape widths will be designed pursuant to the City's street design standards, with exceptions to right-of-way width and median/street landscaping width(s) considered during design review.

Two standard cross-sections are proposed for three-lane arterial streets in the Smokey Point MPA, both on rights-of-way of 70 feet, which can be reduced with elimination of parking pockets. A third standard, which includes bike lanes, is not currently planned but could be considered in the future.

Three-lane Minor Arterial with Multi-Use Trail (43rd Avenue Corridor)

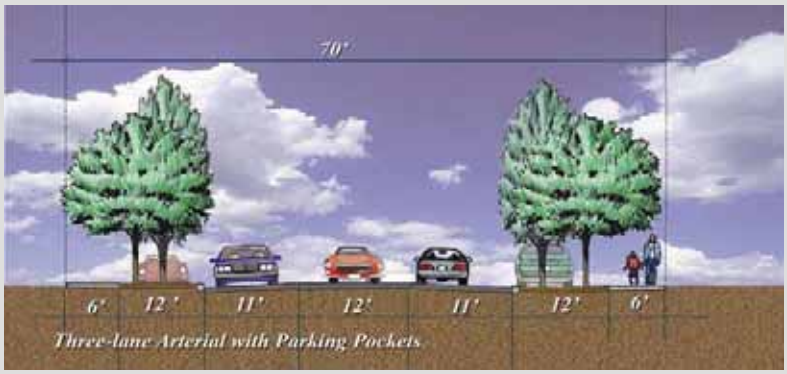
This standard provides:

- Up to a maximum 12-foot wide landscaped median or left-turn lane
- One travel lane in each direction
- A multi-use path along one side (could be integrated into some buffers)
- Bus stops would be in-lane with no requirement for shelter pads
- An alternative design with 50-feet of ROW can be considered in order to coordinate design with the required buffer of Hayho Creek. This must include the pedestrian path. A 60-foot ROW will be required if the roadway is moved to the east to enable development on both street frontages.

Three-lane Minor Arterial with Parking (160th Street and 59th Avenue)

This standard provides:

- A 12-foot wide landscaped median or left-turn lane
- One travel lane in each direction
- Parking pockets (To be determined by adjacent land uses and logical transitions on a block by block basis)
- Bus stops would be in-lane with no requirement for shelter pads



Design Guidelines - Two-Lane Local Commercial Streets

The street networks in regards to right of way and landscape widths will be designed pursuant to the City's street design standards, with exceptions to right-of-way width and median/street landscaping width(s) considered during design review.

Two-lane local Commercial Street

This standard provides:

- 60-foot right-of-way, which can be reduced to 50 feet with elimination of parking pockets.
- A maximum 12-foot wide travel lane in each direction
- A landscaped buffer
- Sidewalks and parking pockets on each side (To be determined by adjacent land uses and logical transitions on a block by block basis)
- Parking may be eliminated at intersections warranting a left turn pocket
- Bus stops would be in-lane with no requirement for shelter pads

This Two-lane Local Commercial street standard would apply to all other streets that are not classified as arterials in the MPA.

Chapter 5 CRITICAL AREAS

This chapter focuses on the known streams, wetlands, fish, and wildlife habitat which are also known as critical areas. Critical areas can, and will, impact the net, or developable, land in the MPA. The primary focus of this chapter is on the realignment of Edgecomb Creek and alternative off-site, or add-on, mitigation site.

The Smokey Point MPA is comprised of two drainage basins. These are the Hayho Creek Drainage Basin and the Edgecomb Creek Drainage Basin. Of the 675 total acres within the Master Plan area, approximately 190 acres, or 28 percent, are located in the Hayho Creek drainage basin and 485 acres, or 72 percent, are located in the Edgecomb Creek basin.

Wetlands and streams perform many important biological and physical functions that benefit the City of Marysville and its residents by:

- Maintaining water quality;
- Storing and conveying stormwater and floodwater;
- Recharging groundwater;
- Providing an important fish and wildlife habitat; and
- Serving as areas for recreation, education and scientific study and aesthetic appreciation.

Within the Smokey Point MPA, two types of critical areas dominate the landscape: wetlands and streams. The supporting figures of the analysis can be reviewed in ***Appendix A -Edgecomb Creek Relocation – Alternative Analysis-August 10, 2007.***

5.1 WETLANDS

Wetlands exist within the MPA; however, not all wetlands have been delineated for individual parcels. As of February 2008, there is no complete inventory of existing of wetlands within the Smokey Point MPA. Field visits by the City's on-call wetland biologist has indicated that the majority of site wetlands fall within either Category III or IV wetlands, but actual field verification will be needed to determine the actual wetland category. Due to the uncertainty of type, size, and location of wetlands, their locations are not illustrated in this MPA. It is the responsibility of property owners/developers to provide complete critical area studies as required under MMC Code Section 19.24.060 and 19.24.340.

Development Guidelines – Wetlands and Critical Areas

- Wetlands and on-site critical areas will be investigated and delineated under the City's Critical Areas and Critical Areas Guidelines. MMC Chapter 19.24, Critical Areas Management. Applicants will conduct site specific wetland studies and verify hydrology during the spring growing period prior to permit application submittal to determine the level of potential wetland impact and mitigation.
- The City will pursue a regional public/private partnership for a regional mitigation approach on the wetlands, ditches and potential creek relocations. A memorandum of understanding between the City and developers will be required to establish a level of commitment to the approving natural resource agencies.
- New development may conduct delineation and proposed mitigation approaches on an individual parcel basis. The applicant would mitigate the impacts of development as determined by City Staff in review of submitted technical reports. There may be a fee in lieu of mitigation, if the City has reached agreement on a regional approach with appropriate State agencies.
- Wetland mitigation areas should be located at either the proposed east side add-on site that will serve as both a wetland mitigation site and potential regional detention facility; or at any other site approved by the City of Marysville.

5.2 STREAMS

There are at least two streams or creeks located within the MPA that will require mitigation and realignment. These are Hayho Creek and Edgecomb Creek.

5.2.1 Hayho Creek

Hayho Creek is a tributary to Quilceda Creek, which discharges into Ebey Slough, a side channel of the Snohomish River. Hayho Creek flows in the north-south direction along the 43rd Avenue alignment between 172nd Street to the north and 151st Street to the south. This creek has been documented as a salmonid fish stream by both the City of Marysville and by the Department of Fish and Wildlife. Unlike Edgecomb Creek, the City intends to maintain the location of this stream in its current alignment and, as development occurs along this stream, segment buffers will be provided as required by the Marysville Municipal Code, Chapter 19.24, Sensitive Areas and Critical Areas Management.

Development Guidelines – Streams and Buffers

As new development occurs within the project area, developers will prepare a stream buffer study prior to permit application submittal to evaluate the effectiveness of any existing buffer and to determine if buffer enhancement is warranted. Any development in Hayho Creek will be required to participate in the Critical Area Mitigation under alternatives described above. There is a Hayho Mitigation Plan on file at the Marysville Community Development Offices.

5.2.2 Edgecomb Creek

Edgecomb Creek is a tributary to Quilceda Creek which discharges into Ebey Slough, a side channel of the Snohomish River. The geography of the Quilceda basin is dominated by the Marysville Trough, an expansive, nearly flat, alluvial plain stretching between the cities of Arlington to the north and Marysville to the south. This plain is bordered by moderate to steep slopes rising to the gently sloping Tulalip plateau to the east and the Getchell Hill plateau to the west. The headwaters of Edgecomb Creek originate on the hillsides east of 67th Avenue and are fed by seeps and springs. This headwater channel provides a good salmon spawning habitat, but is being degraded by impacts from adjacent land uses. Downstream of the steep slopes, Edgecomb Creek has been diverted from its historical path into a series of ditches to accommodate a railroad bed and agriculture usage.

The Smokey Point sub basin currently experiences flooding events, primarily caused by the high groundwater levels. Historically, the plains contained extensive wetlands but these were mostly eliminated about 100 years ago when a system of ditches was created to drain fields, relocate channels, and lower the water table so that the land could be used for agriculture. Groundwater contributes a significant portion of the summer base flow, but also contributes to flooding and drainage problems. Many of the drainage issues are related to difficulties in providing adequate stormwater detention storage and infiltration due to the high groundwater table. These problems are then exacerbated by the lack of slope to convey runoff into the stream system.

Relocating the stream away from the ditches and into a more naturally sinuous channel with a riparian corridor would benefit wildlife and stream habitat and provide an opportunity to integrate the stream with a regional approach to stormwater management.

5.3 EDGECOMB CREEK RELOCATION ALTERNATIVE ANALYSIS

Two alternative channel alignments for Edgecomb Creek were considered as part of this MPA analysis, which are further detailed in *Edgecomb Creek Relocation Alternative Analysis, August 10, 2007 – Shaw Environmental Inc. (***Appendix A)**. Both alternatives have similar channel designs; however, the first alignment brings Edgecomb Creek to the west of the Burlington Northern Santa Fe Railroad (BNSF) tracks, whereas the second alignment keeps Edgecomb Creek on the east side of the BNSF tracks.

The relocation of Edgecomb Creek provides an opportunity to create habitat within the network of ditched stream channels, a protected riparian corridor, where none previously existed. Flooding problems identified along the creek (Snohomish County, 2002) will be addressed by incorporating both a low-flow channel for year-round stream flow and a high-flow channel to convey 100-year flood events at future land use, or build-out conditions. All existing and / or new crossings will be designed to convey flood waters and to be passable by fish. An off-stream rearing habitat will be provided throughout the length of the restoration.

The two conceptual alternative channel alignments developed for Edgecomb Creek are referred to as the West Alternative and the East Alternative. Each alternative has several common concepts which include:

- Creation of 100-year flood capacity in the high-flow channel at anticipated built-out conditions
- Construction of a low-flow channel for year-round stream flow
- Placement of in-stream large woody debris (LWD) for habitat
- Installation of native vegetation throughout the channel and buffer
- Retention of 100 to 150 foot buffers on each side of the Creek along the entire project length
- Construction of off-channel rearing habitats
- Creation of connection to some of the hillside streams north of 162nd Street NE

In addition to the two alternatives, an add-on component is proposed that could be paired with either of the two alternatives: acquisition of land and/or easements on properties bounded to the east by the railroad, to the west and north by Olaf Strad Creek (existing location) and to the south by a housing development along Timberbrook Drive. The benefit of this component is creation of a regional detention/wetland-mitigation/parkland area.

5.3.1. Summary of West Alternative

In summary of the relocation to the west side, this alternative does meet the project objectives and the following advantages and disadvantages have been identified:

Advantages of the West Alternative:

- Property consolidation has taken place and would facilitate the mitigation element
- Within the existing 2008 City Limits and within the MPA
- Conceptual design provided by ownership group

Disadvantages of the West Alternative:

- The West Alternative would place the Creek closest to light industrial development and does not easily lend itself to potential opportunities for increasing the riparian corridor by pairing it with a potential wetlands land mitigation area ("Add-On") on the East side.
- If future rail access is necessary, bridging the realigned creek mitigation area will be required.
- There is a potential of low-flows due to reduce water resource connectivity to the hillside streams to the east of the BNSF rail bed. Additional analysis of hydrology connectivity to support low flow events is necessary.
- Historical ditches and wetlands no longer exist due to allowable agricultural practices and may have long term effect on groundwater levels.

5.3.2 Summary of East Alternative

In summary of the relocation to the east side, this alternative does meet the objectives of the project and the following advantages and disadvantages have been identified:

Advantages of the East Alternative:

- 54 additional acres would be retained for development within the MPA
- Better salmonid access to hillside creeks thus improving fish migration
- Direct connection to potential mitigation areas
- Fewer road/bridge crossings are needed, and most importantly, none would involve the BNSF railroad. This would considerably reduce time and cost required for coordination with BNSF for upgrading and creating new railroad crossings.
- Because the new stream channel would be routed through an existing scrub-shrub wetland east of 67th Avenue and through existing scrub-shrub and emergent wetlands on the north end of the alignment west of 67th Avenue NE, the quality of habitat is expected to be higher with implementation of the East Alternative.
- The north end of the stream would have a riparian corridor consisting of shrubs and trees, and the shading and organic inputs would be available immediately.
- Additional habitat benefits would be expected because the new stream channel would encounter a decreased potential for disturbance since it will be farther from the planned commercial development west of the railroad.
- The East Alternative has the potential of greater connectivity to the water resources in the hillside to the East.

Disadvantage of the East Alternative:

- Complexity and length of implementation may be complicated by property purchases
- Outside of City and MPA limits
- Additional analysis is required to establish impact to upstream tributary systems as well as groundwater levels west of the BNSF

5.4 ADD-ON MITIGATION ALTERNATIVE

This element is to provide for an area that would support wetland mitigation requirements and potential flow control on stormwater approaches. The concept is to acquire land bounded by BNSF Railroad to the west, the MPA to the east and southward (outside of Master Plan Area) and north of the City's Strawberry Fields athletic park.

5.4.1 Description

The Add-On Alternative could be paired with either the West or East Alternative alignment options for Edgecomb Creek. The Add-On could be implemented either in the future, when more funding is available, or concurrently with the selected West or East Alternative. The conceptual plan is to build a regional stormwater detention facility to store stormwater and reduce peak flows. Wetlands would be restored and created to be used as mitigation for wetland impacts from the development in the area west of the MPA and railroad.

Edgecomb Creek would flow through this area and an expanded floodplain could be built to provide additional surface water storage during storm events. High flow diversion structures would be installed to direct floodwaters out of the stream channel and into the floodplain, providing downstream protection outside of the project area. Off-channel habitats and riparian plantings would improve habitat conditions compared to the depressed existing condition. Existing wetlands in the southwest portion of the property could be enhanced by removing non-native, invasive vegetation and planting native shrubs and trees. The adjacent Strawberry Fields Park could be improved to include a wetland interpretation area and trail system. This portion of the MPA is somewhat isolated from adjacent areas due to the railroad ROW on the west and lack of road access to the east. Therefore, this area may have lower demand for future development than the area west of the railroad. Additional plans could include relocating the Middle Fork Quilceda (MFQ) to flow through the area to enhance stream habitat conditions and to provide increased floodplain storage.

5.4.2 Other Considerations

The MPA approach is to include this stream segment within the Edgecomb Creek alternative, ensuring that sufficient wetland and stream mitigation is incorporated into the selected alternative to address impacts to water quality, quantity, and habitat impacts associated with the screening and filling, or relocation of an unnamed tributary paralleling 51st Avenue. This roadside ditch is classified as a Type 5 stream and fish do access this section from the associated stream system. The planned relocation of Edgecomb Creek should also include screening and filling, or relocation of this channel with mitigation area(s). Road widening anticipated for 51st Avenue with area development will result in the relocation of this section. If a regional mitigation strategy is not established within the MPA, the relocation will occur section by section with multiple roadway and driveway crossings as each property and lot is developed east of 51st Avenue NE.

5.4.3 Summary

The Add-On feature has several benefits that make it worthy for consideration. Conducting the relocation outside of the Smokey Point MPA on the east side of the railroad provides a significant incentive for use of this area for locating a regional detention facility. Edgecomb Creek's floodplain could be enlarged to provide further stormwater storage opportunities and protect downstream properties. Existing wetlands could be enhanced and the adjacent Strawberry Fields Park could be improved to include a wetland interpretation area and trail system. Furthermore, a large area of land would be protected from future development; preserving a unique ecological setting and wildlife habitat area within a growing city.

Ultimately, it is advisable to combine the Add-On with the East Alternative or in conjunction with the construction of the West Alternative. Including the Add-On with the East Alternative would simply require the acquisition of an additional 31 acres in the area identified on ***Appendix A – Attachment 2/Figure 2-B***. Joining the Add-On with the West Alternative is a unique solution that takes advantage of existing property owner support of the West Alternative and results in the acquisition of an additional 52 acres of land for use as a regional detention facility. Combining the Add-On with the West Alternative at a later date is inadvisable from a financial perspective and it would most likely be difficult to implement because regulating agencies could likely take issue with the abandonment of a portion of a previously-mitigated creek area. Costs are summarized for the Add-On Alternatives in Table 7.

5.5 FUTURE HYDROLOGY AND HYDRAULIC DATA NEEDS

The hydrology and hydraulics of both Edgecomb and Olaf Strad Creeks will be affected by the range of relocation alternatives presented.

The hillside streams currently flow into Olaf Strad Creek. Changing their route to flow into Edgecomb Creek would increase flows in Edgecomb Creek and reduce flows in Olaf Strad Creek. This increase in flows in Edgecomb Creek could result in sufficiently large enough changes in baseflow and stormflow conditions to trigger the need to enlarge the proposed size and geometry of the creek. Conversely, reducing the inputs into Olaf Strad Creek could potentially cause baseflow conditions to be too low during the dry season to support what fish populations now exist there. However, portions of Olaf Strad Creek already either appear to dry up or experience low dissolved oxygen conditions during the summer months. In order to address these comprehensively, hydrologic modeling for these unknowns would be necessary prior to implementing either alternative.

In addition, the modifications to groundwater and base flows in support of agricultural practices on the West side of the rail right-of-way have effectively drained the historic hydrologic conditions. "Drain tile" installation has been a common practice for draining excess water and/or wetlands to create or enhance useable agricultural crop land. In many cases, these prior wetlands are exempted from Federal wetland regulations through an agricultural exemption. Given the substantial change to both the hydrology and hydraulics of this area, it is reasonable to assume that the drain system may prevent proper inundation in potential future stream channels (i.e. ground water in the hyporeic zone would drain to quickly to keep the channel wetted during low flows). Any potential realignment in this area will require a thorough hydraulic analysis to determine what the current groundwater and baseflow conditions are compared to historical conditions, and also how the existing drain tile system would affect future flows in the new creek channel.

Hydraulic analysis at creek crossings downstream of these new inputs would also be required to determine if the proposed culvert sizes are still appropriate and if flooding problems would be created in the stream channel located in the housing development upstream of the Edgecomb-MFQ confluence. No hydrologic or hydraulic changes would occur downstream of this confluence.

5.6 SUMMARY AND RECOMMENDED REALIGNMENT ALTERNATIVE

The two alternatives presented in this report would both result in significant improvements over the existing conditions of fish and wildlife habitat in Edgecomb Creek. Both alternatives are feasible and would move the stream out of the existing ditch network and away from planned development. The alternatives would create a meandering stream channel and adjacent floodplain that would add off-channel fish habitat, provide improved fish access to the upper reaches of Edgecomb Creek east of 67th Avenue NE, improve thermal and chemical water quality, and improve surface water conveyance.

Although both alternatives would improve conditions in Edgecomb Creek, the East Alternative has some advantages over the West Alternative, as shown in Table 5. The advantages are primarily associated with the quality of fish, wildlife habitat, and potential higher groundwater connectivity.

- The quality of habitat is expected to be higher under the East Alternative because the new stream channel would be routed through an existing scrub-shrub wetland east of 67th Avenue and through existing scrub-shrub and emergent wetlands on the north end of the alignment west of 67th Avenue NE.

- The north end of the stream, which would ideally be aligned with the City of Arlington's realignment and will require the coordination with the City of Arlington and natural resource agencies. The north end would have a riparian corridor consisting of shrubs and trees and the shade and organic inputs would be available immediately. Additional habitat benefits would be expected because the new stream channel would be farther from the planned commercial development west of the railroad, which would result in a decreased potential for disturbance.

- Further wildlife benefits would be realized if the Add-On Alternative were to be constructed because the new riparian corridor would be immediately adjacent to created and restored wetlands and ponds.

- The East Alternative's location would also keep open the possibility of future wildlife habitat improvements adjacent to the riparian corridor. The farmland east of the riparian corridor could potentially be used for wetland and stream mitigation and restoration needed to offset future development of the area.

- Locating future mitigation sites adjacent to the East Alternative riparian corridor would further enhance wildlife habitat and water quality functions and provide wildlife corridor connections between Edgecomb, Olaf Strad, and MFQ Creeks.

- The construction costs for both alternatives are expected to be similar. The East Alternative would also retain 54 acres of the high-value land west of the railroad ROW for potential development and would also facilitate future rail access in line with regional freight mobility goals.

The increase in ecological benefits for the East Alternative could facilitate obtaining agency approval for the project and the lower overall cost should help with securing necessary funds. The opportunity to retain more of the high value land for development within the MPA and the potential for ultimate sales of conservation easements on land east of the railroad should aid in receiving land owner approval of the project.

Additional features can be added to the West Alternative to make it comparable to the East Alternative from an environmental and freight mobility standpoint. The MPA mitigation approach identifies key features that must be a component of the selected alternative, which could be either the East or West Alternative.

Table 4: Summary of Conceptual Alternative Realignment Options

Option	West Alternative	East Alternative	West Add-On Alternative	East Add-On Alternative
Construction Cost	+			+
Land Cost	+	TBD	TBD	TBD
Design Cost	+			+
Maximize In-stream Habitat		+		+
Number of potential Road /Railroad Crossings on Edgecomb	6	5	2	0
Maximize Riparian Habitat Corridor		+		+
Regional Detention	+	+	+	+
Property Owner Support	+	+		
Potential For Riparian &/or Wetland expansion		+	+	+
Maximize developed area in MPA area		+		+

Note: + indicates relative advantage over other alternatives.

Table 5: Summary of Creek Crossings and Potential Culvert Upgrades for Alternatives (includes main channel and headwater tributaries)

Option	West Alternative	East Alternative	West Add-On Alternative	East Add-On Alternative
Total number of crossings	6	5	2	0
Number of road crossing upgrades	1	2		0
Number of new road crossings	1	3	1	0
Number of railroad crossing upgrades	1	0		0
Number of new railroad crossings	1	0	1	0
Number of existing crossings with no upgrades needed	2	0		

Note: The crossing at 67th Avenue is not proposed to be upgraded (Though Quilceda DNR, Ch. 8, 2002, identifies it as a fish passage barrier, per field observation on December 12, 2006, adult salmonids were seen to be migrating upstream of it. It may only be a barrier in the summer, or has been upgraded since the report was written)

Table 6: Summary of Alternative Implementation Costs[1]

	West Alternative	East Alternative	Add-On West, in conjunction	Add-On West, at a later date (in addition to West Alt. costs)	Add-On East
Cost (rounded to nearest $1,000)	$423,000	$454,000	$423,000	$515,000	no-cost

1 Land costs are not included.

5.7 MITIGATION STRATEGY

Based on the analysis and the potential of both the West and East alternatives, the following guidelines will apply:

Development Guidelines - Mitigation Strategy

The City of Marysville supports the relocation of Edgecomb Creek from its current ditch configuration to either the West or East Alternative Alignment. This includes identifying specific parcels for the stream relocation, preparation of a comprehensive stream relocation mitigation plan, permitting, and construction. The relocation alternative should also include the unnamed tributary paralleling 51st Avenue NE. Hydrologic modeling for either alternative will need to be conducted to assess current and proposed flows in the realigned stream (i.e. will there be sufficient low flows during summer months to support fish presence). In particular, the agricultural drainage system (also known as "drain tiles") installed on the west property has effectively drained those parcels. Hydrologic analysis for either alternative will be necessary to determine how a proposed channel design would function as a fish habitat and to understand the potential for any negative impacts within the area.

The selected alternative will need to address freight mobility for rail access to industrial properties west of BNSF. If the West Alternative is selected, industrial developments will be required to provide stream crossings and access to the spur line for loading areas. This could entail creation of two or more centrally located roadways or drive aisles to provide common access for properties as they develop. This will be addressed in the Edgecomb Creek relocation concept.

The selected alternative must include designated wetland mitigation areas to address wetland or buffer fill proposed for the MPA. The relocation of Edgecomb Creek and the potential impacts on several area streams will result in the need for mitigation areas to compensate for these areas if filled or utilized for urban development. Local mitigation is preferred to out of area banks. Therefore, the MPA proposes that critical area impacts within the MPA be addressed as part of the Edgecomb Creek relocation concept. In conjunction with the State natural resource agencies, the City will explore a programmatic approach on the mitigation plan for the MPA.

The City of Marysville may consider creating a wetland / stream mitigation bank in the triangle area north of 152nd Street and bound by 67th Avenue and the rail road spur.

5.8 AGENCY PERMITTING CONSIDERATIONS

The City met with State and Federal agencies regarding permitting requirements and determined that there will be a range of permitting required. This range of permits, as noted below, will require upfront analysis and negotiations and should be started as soon as a viable design and alternative is approved by the City.

Critical Area Permit Approach

From a permitting perspective, both the West and East Alternatives will have similar issues and permits. Both will need City permits, ACOE 404, Ecology 401/CZM, and WDFW HPA. The East alternative may also include Snohomish County permits. Stream and wetland mitigation issues will need to be addressed either on a property by property basis or on a Programmatic Permit approach with Ecology may be an option.[4]

4 City of Marysville Smokey Point Master Plan Multi-Agency Meeting March 14, 2007

Chapter 6 UTILITIES

6.1 INTRODUCTION AND PURPOSE

This chapter documents the data gathering process, summarizes the existing utility information, and provides the available information on proposed improvements to meet future development of the Smokey Point MPA. This chapter was limited to water, sewer, electrical, natural gas, and telecommunication utilities. Stormwater is addressed separately in Chapter 7 – Drainage.

6.2 DATA GATHERING

The information used to develop this chapter was obtained by reviewing publicly available planning documents and discussions with individual utilities, where appropriate. The following planning documents were utilized:

- City of Marysville Comprehensive Plan, May 2005
- City of Marysville Water System Plan Update, February 2003
- City of Marysville Sewer Comprehensive Plan, May 2005
- City of Arlington Comprehensive Water System Plan, August 2004

Phone conversations were conducted with the following utilities regarding their existing service, proposed improvements, and their ability to serve future development in the Smokey Point MPA:

- Digital Cable: Comcast
- Telephone: Verizon
- Power, Natural Gas: Puget Sound Energy
- Power, Electric: Snohomish County PUD No. 1

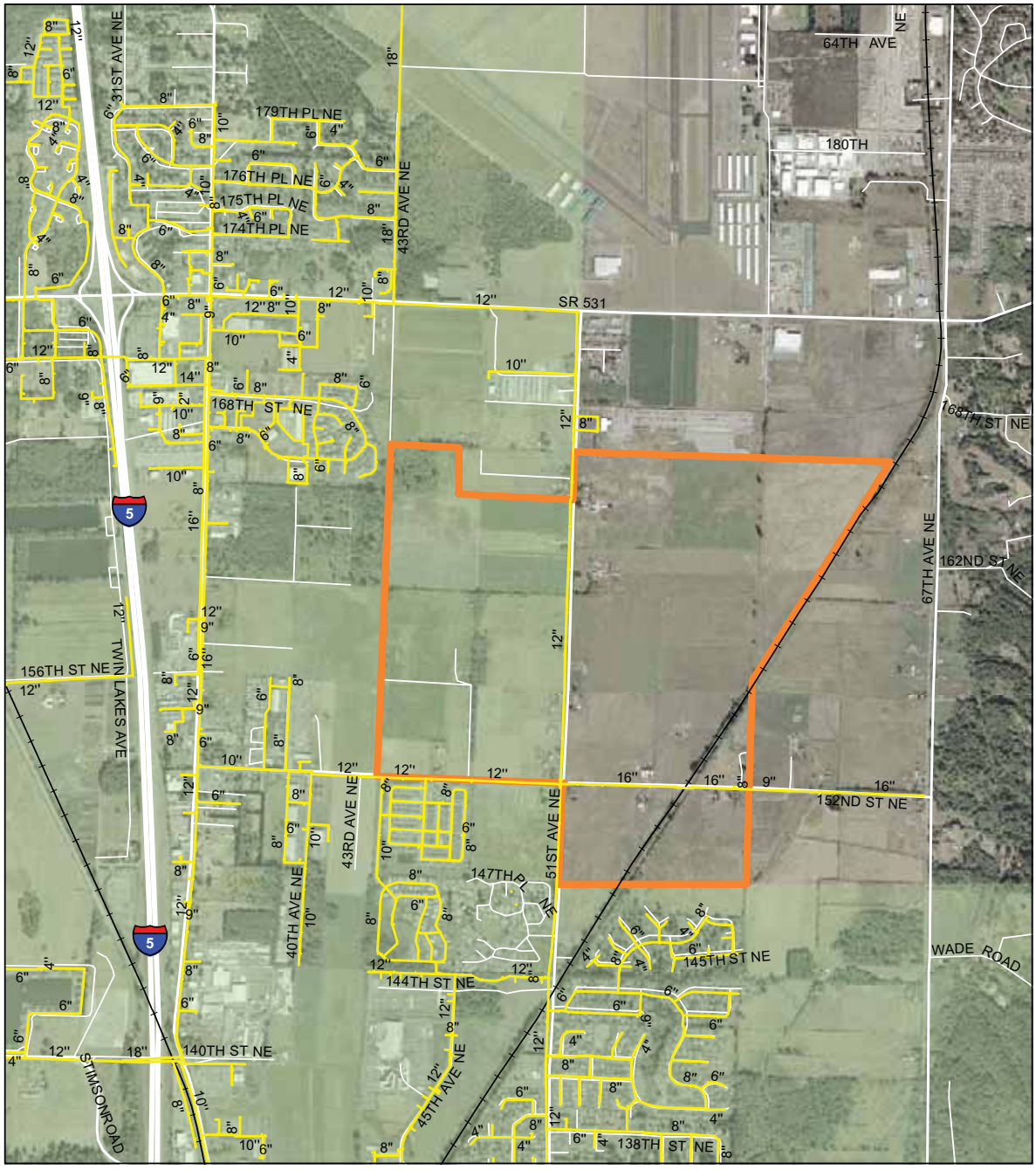
6.3 WATER

According to the City of Arlington's 2004 Comprehensive Water System Plan, the Smokey Point MPA is located primarily within the City of Arlington's water service area, though Marysville's Comprehensive Plan shows that the MPA is located within the Marysville City limits. The City of Marysville, with the existing water infrastructure in and around the MPA, will be providing service to this area. Currently there is a 12-inch main in the north/south corridor of 51st Ave, which would be the primary supply line for future uses, as shown Figure 7.

The Smokey Point MPA is located in an area that is served by the City of Marysville North 240 Zone; however, the City of Marysville will be coordinating with the City of Arlington on transiting the service to the City of Marysville. Water supply to the North 240 Zone is provided by the City's Edward Springs, Stillaguamish Ranney Collector, and Lake Goodwin well sources. Storage to the North 240 Zone is provided by the City's 6.0 MG (million gallon) Edwards Springs Reservoir and a recently constructed 3.0 MG reservoir. The new 3.0 MG reservoir, which is located southeast of the Smokey Point MPA off of Wade Road, will provide additional storage for expected development in the northern part of the City. According to the City of Marysville 2003 Water System Plan Update, the City has sufficient water supply and storage to meet the needs of the system through the year 2022. Water main extensions from the existing water system to the

west and south of the Smokey Point MPA will be required to extend water service and fire flow into the area. The size of these water main improvements will be determined by hydraulic analyses and driven primarily by the fire flow requirements of the proposed developments within the Smokey Point MPA. Figure 7 presents the water infrastructure currently in place within the Smokey Point MPA.

Figure 7:
Existing Water System



City of Marysville

Smokey Point Master Plan

Existing Water System

June 2, 2008

0 1,000 2,000 Feet

N

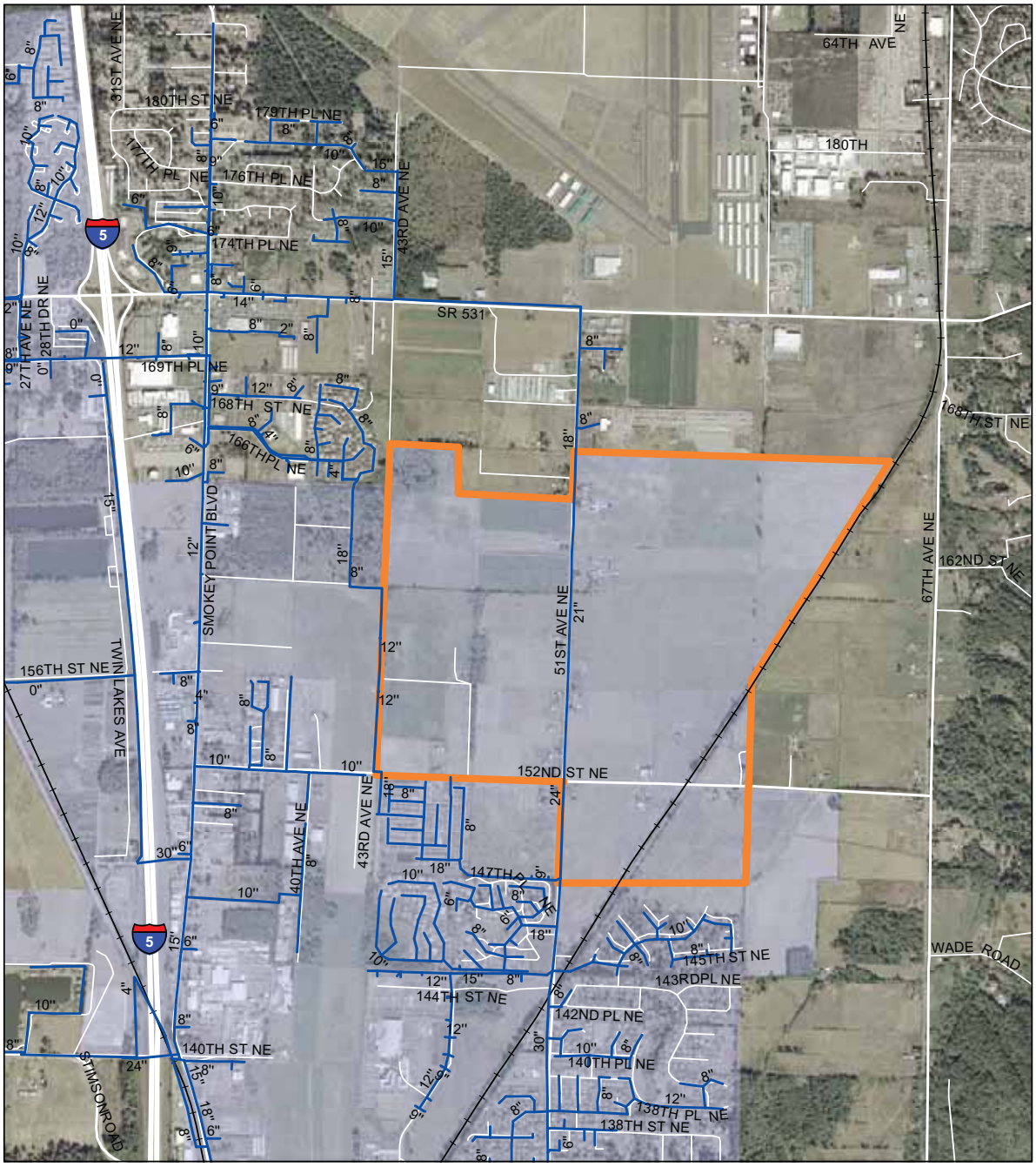
Water Lines
Railroads
Marysville Water Service Area
Smokey Point MP Area

Source: City of Marysville Water System Plan Update, February 2003

6.4 SEWER

Sewer service for residences and businesses within the Smokey Point MPA is provided by the City of Marysville. The City's Trunk A, at this point an 18- and 21-inch sewer main, conveys wastewater south on 51st Avenue for treatment at the City's Waste Water Treatment Plant located in the southern part of the City. The City's Sewer Comprehensive Plan, dated May 2005, includes a hydraulic model that evaluated the City's sewer collection system's capacity based on current and future conditions. The Comprehensive Plan proposes several improvements to Trunk A to correct capacity deficiencies to ensure that the sewer meets future demands. New sewer and service laterals will be required to be constructed to serve the light industrial area as development occurs in the Smokey Point MPA. The smaller laterals would convey wastewater to Trunk A. Existing sewer infrastructure within the Smokey Point MPA is presented in Figure 8.

Figure 8:
Existing Sewer System



City of Marysville

Smokey Point Master Plan

Existing Sewer System

June 2, 2008

0 1,000 2,000 Feet

N

Sewer Lines
Railroads
Marysville Sewer Service Area
Smokey Point MP Area

Source: City of Marysville Sewer System Plan Update, February 2005

6.5 ELECTRICITY

The Snohomish County Public Utilities District No. 1 (PUD) provides electrical power to the Smokey Point MPA. Power to the PUD is supplied mainly by the Bonneville Power Administration (BPA), whose main source of power is hydroelectric dams. The PUD recently completed the purchase of land for a new substation to be located on 51st Avenue NE, between 172nd Street NE and 152nd Street NE. The new substation is needed to provide adequate electric system capacity and reliable service to the surrounding Smokey Point area. The new substation will be designed by the PUD to accommodate additional equipment upgrades that may be required at the substation to serve the future light industrial zone development within the Smokey Point MPA. The PUD is committed to providing electric service to meet the needs of any light industrial development.

6.6 NATURAL GAS

Puget Sound Energy (PSE) is the primary provider of natural gas to the City of Marysville. Two stations, the Granite Falls and Everett Delta Gate Stations, provide service to the City of Marysville and the Smokey Point MPA. PSE currently provides natural gas service to several residential plats adjacent to the MPA as well as to two residences within the MPA. The sizing and implementation of new gas service lines will be based on new customer requirements. PSE does not have any active plans to provide additional service to the MPA though the utility is committed to extending service as demanded by future development.

6.7 TELECOMMUNICATIONS

6.7.1 Telephone

Telephone service in the Smokey Point MPA is provided by Verizon. Telephone service is currently provided by standard copper service only and is capable of providing DSL network service. When the area is further developed, Verizon will need to update their telephone service to meet the increased demand of a light industrial area in the MPA.

6.7.2 Fiber Optic

Fiber optic service is not currently available in the Smokey Point MPA. Verizon is currently planning an upgrade to their Marysville central office so that it can provide fiber optic network services to residences and businesses with the City of Marysville and the Smokey Point MPA within the next two to three years.

6.7.3 Cable Services

Digital cable service is currently provided by Comcast, the sole provider of digital cable service in the Smokey Point MPA. Their digital services include high-speed internet, cable TV and digital voice. Not all points within the MPA are currently served by Comcast and the utility does not have any current plans to extend service. When future development does occur, Comcast does have the capability to complete their service to the area. The costs of

extending the service may be shared with the proposed development with the terms of the service extensions assessed on a case-by-case basis.

6.7.4 Wireless Providers

Wireless communication services differ from traditional telecommunications services in that cellular communication systems use wireless phones and other wireless communication devices that transmit and receive radio signals on bands reserved solely for such activity. Signals are transmitted and received by low power antennae. The demand for service and new facilities for telecommunications is difficult to assess because of the changing technologies and the consumer demand for new services. Known service providers with facilities in the Smokey Point MPA area include Verizon Wireless, AT&T, T-Mobile, Sprint, and Nextel.

6.8 BP OLYMPIC PIPELINE

Beyond Petroleum (BP), formerly known as British Petroleum, owns and operates the Olympic Pipeline, which conveys approximately 4.9 billion gallons of refined fuel a year. The pipeline dissects the proposed planning area, running from the northwest edge to the southeast corner. The corridor consists of two separate lines of 16- and 20-inches in diameter with an average depth below the existing grade of 3 to 4 feet. Developers within the Smokey Point MPA will be required to coordinate with both the City and BP Pipelines Land and Right-of-Way department to ensure that the pipeline remains intact and undisturbed or is relocated with approval from BP.

Chapter 7 DRAINAGE

The purpose of this Chapter of the Smokey Point MPA is to establish a conceptual drainage plan for the area which the City and future developers can use to build a functioning drainage system in the planning area. In this Chapter, the basins are identified; the local and state methodology for the review and basis of design is applied, regional and on-site systems. Potential Low Impact Development (LID) standards are identified and basin exchange concepts are explored as well.

This conceptual drainage plan is designed to conform to the requirements of the 2005 Department of Ecology Stormwater Management Manual for Western Washington as well as the unique characteristics of the planning area. As part of a future master drainage plan, the City will need to continue with this baseline modeling to prepare more detailed modeling to demonstrate flow peak and duration conformance at key points along the stream systems for more accurately sized and located facilities.

The Smokey Point MPA is comprised of two drainage basins: the Hayho Creek Basin and the Edgecomb Creek Basin. Of the 675 total acres within the MPA, approximately 190 acres (28 percent) are located in the Hayho Creek drainage basin and 485 acres (72 percent) are located in the Edgecomb Creek basin. The complete analysis and figures are located in ***Appendix B – City of Marysville Smokey Point Master Plan – Drainage Element, February 9, 2007, by Otak Inc.***

The Master Plan area encompasses portions of the Hayho Creek and Edgecomb Creek drainage basins. Agriculture, commercial, and urban development are the principle land uses in both basins. The topography is flat with a slope of about 0.3 percent. Both basins are subject to planning constraints that are posed by high winter ground water levels, water quality treatment requirements of local fish-bearing waters, subtle changes in slope and topography, and the objective of minimizing pumping and optimizing the use of gravity for conveyance, storage and treatment of the region's stormwater.

7.1 PREFERRED MASTER PLAN LAND USE PLAN AND ASSUMPTIONS

The proposed land use, provided by the City for evaluation in this Master Plan is defined by the following criteria:

- 25 percent of the land within the planning area is assumed to be wetlands and not available for development. (This is a very broad assumption and will most likely be lower upon submittal of critical areas/wetland delineation reports.)
- Lot coverage of the developed land area by buildings / structures will be 50 percent.
- 60 percent of the developed land area will be in Light Industrial; the other 40 percent will be in office space.
- 85 percent of developed areas will be in impervious surfaces; the remaining 15 percent will be in landscaped surfaces or open space.

7.2 PRELIMINARY HYDROLOGIC MODELING RESULTS

The results of recent hydrologic modeling for the City in north Marysville (128th Street Regional Pond Feasibility Technical Memorandum, September 25, 2006) were used to provide preliminary sizing of water quality, rate control, and conveyance facilities. Uniformity of soils in the area and comparable developed impervious areas (85 percent) allowed the use of these results for preliminary planning within the Master Plan area. For hydrologic modeling, the USEPA Hydrologic Simulation Program-Fortran (HSPF) continuous rainfall-runoff model for computing runoff from rainfall was used. A one-hour time step was used to predict flow rates. Existing land cover for modeling was assumed to be forest to reflect pre-European settlement conditions, as required by Ecology's 2005 Stormwater Management Manual for Western Washington (2005 Ecology Manual).

For the purpose of this analysis, the North Marysville results (September 25, 2006) were converted to volume per developed area for water quality treatment and detention. Un-detained runoff rates and detained release rates were also estimated on a developed acre basis for use in sizing preliminary conveyance facilities. The estimated unit area values are as shown below:

- Water quality volume: 4,200 cubic feet per developed acre
- Detention volume: 17,000 cubic feet per developed acre
- Un-detained runoff rate: 0.5 cubic feet per developed acre
- Detained runoff rate: 0.04 cubic feet per developed acre

Note that more detailed modeling will need to be performed as a part of the future master drainage plan work to demonstrate flow peak and duration conformance at stream system points of compliance and to more accurately size and locate needed facilities.

7.3 DRAINAGE PLAN ALTERNATIVE ANALYSIS

Drainage planning considers alternatives that include regional facilities approaches, on-site systems, LID elements, and basin exchange concepts. Each basin area is addressed separately. Rate control criteria have been developed based on the results of continuous runoff simulation modeling for the City's State Avenue project.

Presented in sections 7.4 through 7.9 are the results of the analysis of various conceptual alternatives considered for stormwater management in the planning area. Alternatives have been created to conform to the requirements of the 2005 Ecology Manual, as well as to the unique characteristics of the planning area.

7.4 WATER QUALITY TREATMENT ALTERNATIVES

Discharge from developed areas will be to Type F stream, which is classified as a fish inhabited streams that drain into the Middle Fork of Quilceda Creek. This creek system contains Chinook spawning habitat and is regulated by the Endangered Species Act. Maintaining base flows, managing peak flows, and reducing pollutant loadings are key to the preservation of these critical habitat spawning areas. Industrial/commercial development discharges to Type F streams are required to have stormwater treated to an "enhanced treatment" level to reduce potential pollutant loadings, especially the discharge of dissolved metals. Acceptable enhanced treatment methods described in the 2005 Ecology Manual include the following:

- Large sand filter
- Amended sand filter
- Stormwater treatment wetland
- Compost-amended filter strip
- Ecology embankment
- Two facility treatment trains (as described in Table 3.2 of the 2005 Ecology Manual, provided as Table 7 below)

Table 7: Treatment Trains for Dissolved Metals Removal

First Basic Treatment	Second Treatment Facility
Biofiltration Swale	Basic Sand Filter or Sand Filter Vault or Media Filter[1]
Filter Strip	Linear Sand Filter with no pre-settling cell needed
Linear Sand Filter	Filter Strip
Basic Wetpond	Basic Sand Filter or Sand Filter Vault or Media Filter[1]
Wetvault	Basic Sand Filter or Sand Filter Vault or Media Filter[1]
Basic Combined Detention/Wetpool	Basic Combined Detention/Wetpool
Basic Sand Filter or Sand Filter Vault with a pre-settling cell if the filter isn't preceded by a detention facility	Media Filter[1]

1 The media must be of a nature that has the capability to remove dissolved metals effectively based on at least limited data. Ecology includes Stormfilter's ™ leaf compost and zeolite media in this category

7.5 RATE CONTROL (DETENTION) ALTERNATIVES – OVERVIEW

7.5.1 Overview

Detention options include above-grade open water surface facilities and below-grade buried facilities as listed below:

Above grade options:

- Open ponds with earth embankments*
- Off-channel detention for high flows
- Open vertical wall ponds
- Parking lot ponds
- Rooftop detention
- Roof runoff pressure downspout system to above grade pond
- Elevated sub-floor onsite detention
- Porous pavement with aggregate storage section or "Infiltrator" chamber storage systems

Below grade options:

- Buried precast or cast-in-place concrete vaults
- Buried pipe or "Infiltrator" chamber storage systems
- Porous pavement with aggregate storage section or "Infiltrator" chamber storage systems

(*Note that open ponds within the 10,000-foot FAA wildlife hazard zone would have to include approved mitigation measures, as discussed below.)

If adequate parcels of land are available downstream at a reasonable price, the use of regional detention ponds within earth berms can be an affordable and effective approach for providing detention for a large area, such as the Master Plan area. All of the above options are applicable for either development-specific onsite approach or a regional approach. Onsite options would be privately constructed, while regional facilities would likely be constructed by the City with capacity in the facility being available for purchase by future developers. This is similar to Pond #1 in the adjacent Hayho Creek drainage basin.

Least desirable for the planning area are the buried vault and pipe systems. This is because of the high seasonal ground water levels and the higher construction and maintenance costs. High ground water levels require that the vaults or pipes be designed to resist flotation when the systems are empty. The anti-flotation design can add considerable expense to vault or pipe system costs.

Future stormwater collection will be accomplished on each of the parcels by private developers. Conveyance systems will be needed in both the Hayho Creek and Edgecomb Creek basins to convey new flows to:

- Points of discharge within the creek systems where detention and stormwater treatment are provided onsite;
- To regional treatment and detention facilities where a regional approach is taken; and
- To points of discharge from regional facilities.

Conveyance alternatives include:

- Gravity pipelines
- Gravity open channels
- Combination of gravity open channels with pipelines
- Pumping and pressure pipelines

Gravity open channels are preferred, where feasible, because of lower construction costs (assuming City right-of-way locations vs. land purchase) and the added water quality treatment that the vegetated channels provide. Gravity pipelines are preferred next, followed by the least desirable pumping and pressure pipeline systems. These are least desirable because of higher costs, energy consumption, and reduced reliability during power outages.

Gravity pipelines can be designed to operate under a slight pressure (surcharge) in order to discharge from a higher elevation to a lower elevation bermed pond with an above grade detention water level. The Pond 1 conveyance system in the Hayho Creek drainage system is designed in this manner. This design method is applicable to both basins within the planning area.

Preliminary conveyance corridors identified for the planning areas are shown in ***Appendix B – Figure 2 – Technical Memorandum No. 3***. The alignments are based in part on the proposed road system for the planning area. The conveyance system will need to maintain current land use drainage provisions. During the early years of development in the Master Plan area, roadside ditches may be appropriate. As development continues and road improvements are made, piped systems will likely need to be installed in order to convey the increased flows. The lower portions of the proposed ditch / pipe conveyance systems to downstream regional detention facilities will operate under piped surcharge conditions.

7.5.2 Onsite and Regional Alternatives

Both onsite and regional stormwater management alternatives have been considered for the planning area. Onsite facilities would be planned, designed and constructed by the developer of the property. Regional facilities would likely be planned, designed and constructed by the City. The combination of onsite and regional facilities also has potential because of the flatness of the area and the desirability of avoiding pumped stormwater systems. Water quality treatment could occur onsite with excess flows being conveyed downstream to a regional facility.

The development of conceptual onsite and regional approaches for stormwater management in the Master Planning area has emphasized the use of:

- Multi-functional approaches (involving stormwater detention and treatment, as well as wetland mitigation, stream/habitat enhancement, parks/recreational uses, and aesthetics).
- Integration with open space opportunities.
- The use of off-channel storage as land availability and drainage opportunities allow.

Consideration of these potential opportunities can lead to improved environmental design, reduced permitting/mitigation, lower land costs, improved aesthetics, and enhanced economic incentives for development of this Master Plan area.

7.5.3. Consideration of FAA Hazardous Wildlife Separation Criteria and Stormwater Facilities

The Arlington Municipal Airport is located just north of the planning area, on the north side of 172nd Street NE (SR 531). Open bodies of water within 10,000 feet of air operations area are considered by the Federal Aviation Administration (FAA) to be hazardous wildlife attractants (FAA Advisory Circular No. 150/5200-33A, July 27, 2004). The portion of the planning area considered to be hazardous by the FAA criterion is shown in ***Figure 2, Appendix B***, as the area within the semi-circle drawn from the most southern part of the airport.

Nearly all of the planning area is located within 10,000 feet of air operations areas at the Arlington airport. The FAA Advisory Circular No. 150/5200-33A titled "*Hazardous Wildlife Attractants on or Near Airports*", states that no permanent standing water is allowed and that a management plan for the safe operation of stormwater facilities should be developed to assure airport safety.

> *"2-3. Water Management Facilities. Drinking water intake and treatment facilities, stormwater and wastewater treatment facilities, associated retention and settling ponds, ponds built for recreational use, and ponds that result from mining activities often attract large numbers of potentially hazardous wildlife. To prevent wildlife hazards, land-use developers and airport operators may need to develop management plans, in compliance with local and state regulations, to support the operation of stormwater management facilities on or near all public-use airports to ensure a safe airport environment…*
>
> *b. New stormwater management facilities. The FAA strongly recommends that off-airport stormwater management systems located within the separations identified in Sections 1-2 through 1-4 be designed and operated so as not to create above-ground standing water. On-airport stormwater detention ponds should be designed, engineered, constructed, and maintained for a maximum 48-hour detention period for the design storm and remain completely dry between storms. To facilitate the control of hazardous wildlife, the FAA recommends the use of steep-sided, narrow, linearly shaped water detention basins. When it is not possible to place these ponds away from an airport's AOA, airport*

operators should use physical barriers, such as bird balls, wires grids, pillows, or netting, to prevent access of hazardous wildlife to open water and minimize aircraft-wildlife interactions. When physical barriers are used, airport operators must evaluate their use and ensure they will not adversely affect water rescue. Before installing any physical barriers over detention ponds on Part 139 airports, airport operators must get approval from the appropriate FAA Regional Airports Division Office. All vegetation in or around detention basins that may provide food or cover for hazardous wildlife should be eliminated. If soil conditions and other requirements allow, the FAA encourages the use of underground stormwater infiltration systems, such as French drains or buried rock fields, because they are less attractive to wildlife."

Several design concepts to accommodate the FAA criteria have been developed and are outlined below:

- Detention and water quality treatment in an open pond, with constructed wetland, outside of the FAA 10,000-foot wildlife hazard zone.
- Onsite or regional water quality and low flow detention (bankfull) and stream enhancement with flood storage for higher flows which would need to drain out within 48 hours (if inside FAA 10,000-foot wildlife hazard zone).
- Detention and water quality treatment in open pond with constructed wetland inside of FAA 10,000-foot wildlife hazard zone, with FAA-approved mitigation devices (bird balls, wire grids, netting, etc.) to prevent access of hazardous wildlife.
- Detention and water quality treatment inside of FAA 10,000-foot wildlife hazard zone with open pond designed to drain the design storm within 48 hours. Flows present in excess of 48 hours would be detained below pavement grade in "Infiltrator" and rock void system with impervious liner, conveyed to an open pond with FAA approved mitigation devices, or conveyed to an open pond beyond the 10,000-foot zone.

7.6 POTENTIAL REGIONAL TREATMENT AND DETENTION SITES

To minimize the pumping of stormwater, regional detention facilities have been located at the lower elevation locations in the southerly part of the planning area. Potential sites for regional facilities in the Hayho Creek and Edgecomb Creek basins are shown in ***Appendix B - Figure 3***. These sites, located in lower elevation areas to the south, have been selected on the basis of location and land availability. The availability, cost and wetland constraints of the parcels, which make up individual sites, have not yet been fully assessed.

7.6.1 Hayho Creek Basin

In the Hayho Creek basin, the existing City Regional Pond 1 facility and adjacent future Regional Pond 2, on city-owned property, offer convenient sites to serve this western part of the planning area, as illustrated in Figure 3. Both of these regional sites are outside the FAA 10,000-foot hazard zone. Pond 1, as constructed, and Pond 2, as proposed in 2006, have a combined detention capacity of 67.2 acre-feet (2,930,000 cubic feet). This volume has the capacity to serve about 172 acres of development at 17,000 cubic feet of detention per acre. This capacity, plus high flow off channel detention in Hayho Creek, will likely satisfy both existing and ultimate development of the upper basin. Approximately 105 acres of the

northern area (about 79 acres net after wetland reductions) could be conveyed by gravity to the Pond 1 and 2 sites, using surcharged large diameter pipe(s). The remaining 85 acres of the more southern area (63 acres net) would need to be pumped into the conveyance system or handled onsite. One option to be considered is over-detaining runoff from the northern area to allow for direct discharge (i.e. without detention) of new runoff flows from the more southern parcels.

In order to convey stormwater to either of these two City owned pond sites, flow would need to be conveyed under Hayho Creek on the north side of 152nd Street NE. To accomplish this, flows would need to be conveyed via a shallow cover pipe under the streambed, pumped, or conveyed using an inverted siphon (depressed sewer) installed under the creek. The inverted siphon would need to be a multiple barrel design in order to convey the full range of design flows at self-cleaning velocities. All of these alternatives would connect to a new trunk storm line in 152nd Street NE, running from the west side of Hayho Creek to the existing Regional Pond 1 trunk system using a 48-inch pipe.

7.6.2 Edgecomb Creek Basin

Within the Edgecomb Creek Basin, four potential sites for regional facilities were identified and evaluated, both within and south of the Master Planning area. The sites are shown in ***Appendix B - Figure 3***. The FAA 10,000-foot hazard zone boundary is also shown in ***Appendix B - Figure 3***. The entire planning area is within the FAA 10,000-foot hazard zone.

The Edgecomb Creek portion of the planning area is about 485 acres. After adjusting this area for wetland areas (assumed to be 25 percent due to limited on-site verification), the maximum net developable area is about 364 acres. Open pond detention and water quality facility land requirements have been estimated to be 10 percent of the developed service area. For development of 364 acres, a pond area of 37 acres can be expected.

The regional sites located south of the planning area (Sites #3 and #4) would likely receive flow entirely by gravity conveyance. The sites within the planning area (Sites #1 and #2) will receive only a portion of the flow by gravity. If a pond design elevation (detention peak) of 109 feet is assumed, about 52 percent of the area (or 190 acres of developable land) could drain to the facility by gravity. At a design elevation of 105 feet, about 73 percent of the area (266 acres developable) could drain by gravity to the facility. The remaining non-gravity area would be addressed by one of the methods described for the Hayho Creek pumping service area or, alternatively, by over detaining additional flows to allow runoff from the lower areas to discharge to the stream without detention.

Sites #2 and #3, east of the BNSF railroad right-of-way, would likely have a lower property acquisition cost than the properties on the west side. Site #2 on the east side of the railroad right-of-way is also part of an "add-on area" being evaluated as a part of its Edgecomb Creek Relocation Alternatives Analysis. The key elements of that analysis are discussed in Chapter 5 – Critical Areas. The use of the add-on area as a regional detention site provides an opportunity to explore a multi-function project (stormwater, environmental mitigation and parks/recreation) and improved environmental designs, as previously discussed.

7.7 BASIN EXCHANGE CONCEPTS

With the flatness of the planning area, it is possible to consider the exchange of basin areas, where runoff from the land area within one basin is diverted to an adjacent basin in exchange for an equal amount of flow (or area) being permanently diverted from the second basin to the first basin. This concept could offer the benefit of using an existing regional facility, such as Pond 1, which is currently not fully used in terms of basin subscribers. If a development proposal in the Edgecomb Creek Basin has a proposed implementation schedule that is earlier than a development within the Hayho Creek Basin, then a basin exchange could be mutually beneficial for both the City and the Edgecomb Creek Basin developer. The Hayho Creek Basin exchange area could be incorporated into the Edgecomb Creek Basin at a later date. The technical feasibility of an exchange would need to be determined in a more detailed drainage master plan, with the ability to maintain gravity conveyance being one of the key criteria.

7.8 LOW IMPACT DEVELOPMENT ELEMENTS

Low Impact Development (LID) is a stormwater strategy that emphasizes conservation and use or natural site features integrated with distributed, small-scale stormwater controls to more closely mimic natural hydrologic patterns in residential, commercial, and industrial settings. Those concepts are explored in ***Appendix B - Technical Memoranda #1 and #3***. LID techniques may be utilized alone or in combination with other drainage control methods.

Development Guidelines Low impact Development Techniques

Twenty three different Low Impact Development (LID) techniques were reviewed for the MPA. Technical Memorandum #3 details those and the complete findings. LID water quality treatment techniques, such as filter strips and media filtration, could be used to provide a portion of the enhanced treatment requirement for developed areas.

LID techniques will be most useful to maintain existing hydration.

Limitations on LID techniques may be presented by:
- High seasonal ground water levels
- Low infiltration rates of the surficial soils

Recommend and viable LID techniques are:
- Filter strips and media filtration
- Vegetated roofs
- Tree box filters
- Roof stormwater harvesting (for irrigation of landscaped areas)
- Pervious concrete sidewalks

The LITD techniques explored in Technical Memorandum #1 and #3 may be utilized as appropriate for the site.

Examples of LID:

Example of Vegetated Roofs for an industrial one-story building.

Example of Pervious Drainage Swales with landscaping and parking areas.

Example of Tree box filters which can add to the overall urban design while fulfilling stormwater quality elements.

Example of Pervious pavement for parking areas

Example of porous pavement material

7.9 DRAINAGE PLAN CONCEPT SELECTION

The requirements and components for the conceptual alternatives and options for stormwater management have been described above. Based on identified constraints and opportunities, along with guidance from the City's planning and public works staff, the following Development Guidelines are the selected, preferred conceptual drainage plans for each basin.

Development Guidelines - Drainage Plan Concept

Hayho Creek Basin

A menu of alternatives is needed to address drainage in the Hayho Creek Basin. The use of alternatives alone or in combination with other alternatives will depend on the phasing of development within the basin, the availability of pond facilities at the time of development and the selection and implementation of creek, stream and ditch relocation projects. The Preferred Conceptual Alternatives:

LID, On-Site, and/or Construct Pond 2 (detention and water quality pond) which will operate parallel with existing Pond 1 by a connection between the two ponds.

- Extend the storm trunk sewer system in 152nd Street NE to the east side of Hayho Creek to receive flow from new development within the basin.
- For the portion of the basin that cannot gravity drain to Pond 1 and Pond 2 facilities, the following options will be considered:

    1. Over-detention in the gravity flow service area to allow direct discharge of the lower portion of the planning area into Hayho Creek.
    2. Onsite detention and water quality treatment, with discharge to Hayho Creek.
    3. High flow off-channel detention storage (on the Pond 2 site).
    4. Pumping of un-detained discharges to the trunk storm sewer system, which will operate under a surcharged condition.
    5. Detention in stream channel using additional capacity by creating additional floodplain capacity above the normal high water mark.

Edgecomb Creek Basin

The Preferred Conceptual Alternative:

Construct regional pond and water quality treatment in the southern portions of the Planning area. The Add-On triangular parcel east of the BNSF Railroad right-of-way (Site #2) and the parcel southeast of the planning area (Site #3) are the candidate sites preferred by the City for construction of the regional water quality and pond facilities.

- The Add-On parcel will serve as much of the gravity service area of the basin as practicable, with the FAA criteria needing to be addressed in the design (i.e., no water ponded over 48 hours after a rainfall event).
- The southeast off-site parcel will serve as much of the area that cannot be drained by gravity to the Add-On parcel, as practicable, assuming topography allows conveyance without pumping.
- Open-channel conveyance will be used where feasible, with the lower / southern portions of the backbone conveyance systems being surcharged using piped systems where flat slopes do not allow normal gravity flow.
- For areas that cannot drain by gravity to either of the two southern regional ponds, the options listed above for the Hayho Creek Basin would be considered for Edgecomb Creek Basin, including:

    1. Over-detention in the gravity service area to allow for direct discharge of a portion of the pumped service area to Edgecomb Creek
    2. On-site detention and water quality treatment discharge to Edgecomb Creek
    3. High flow off-channel detention storage
    4. Pumping of un-detained discharges to the trunk storm sewer system, which operates under a surcharge condition
    5. Detention in streams, utilizing additional floodplain storage created by modifying the stream channel and adjacent buffer area.

Chapter 8 AIRPORT COMPATIBILITY

The City of Arlington adopted an Airport Master Plan which documents the importance of land use compatibility within the airport influence area and illustrates the additional planning requirements necessary to minimize the potential impact of the airport on surrounding land uses. It is the intent of this Master Plan to further promote land use compatibility adjacent to the Arlington Municipal Airport.

As projects within the Master Plan boundaries are submitted to the City of Marysville, the City will take the lead on reviewing these projects. However coordination with the City of Arlington will be required. Projects will be circulated to the City of Arlington, in conjunction with their agreement of site plan reviews under the Airport Master Plan for comment and review to ensure compatibility with the Airport Master Plan and the Marysville / Arlington inter-local agreement which limits residential development south of the airport. This includes providing the Airport with the opportunity to:

- Purchase or negotiate aviation easements
- Ensure buildings do not penetrate the 100:1 airspace restrictions
- Ensure an FAA airspace form has been approved (Form 7460-1)
- Ensure that projects meet the airport compatibility requirements

8.1 EXISTING CONDITIONS

The Arlington Municipal Airport is located north of the Smokey Point MPA in the City of Arlington. The airport is classified as a General Aviation Airport and is designated as Airport Industrial (AI) zoning within the *Land Use Code* of the City of Arlington. The AI Zone encompasses all of the existing airport property.

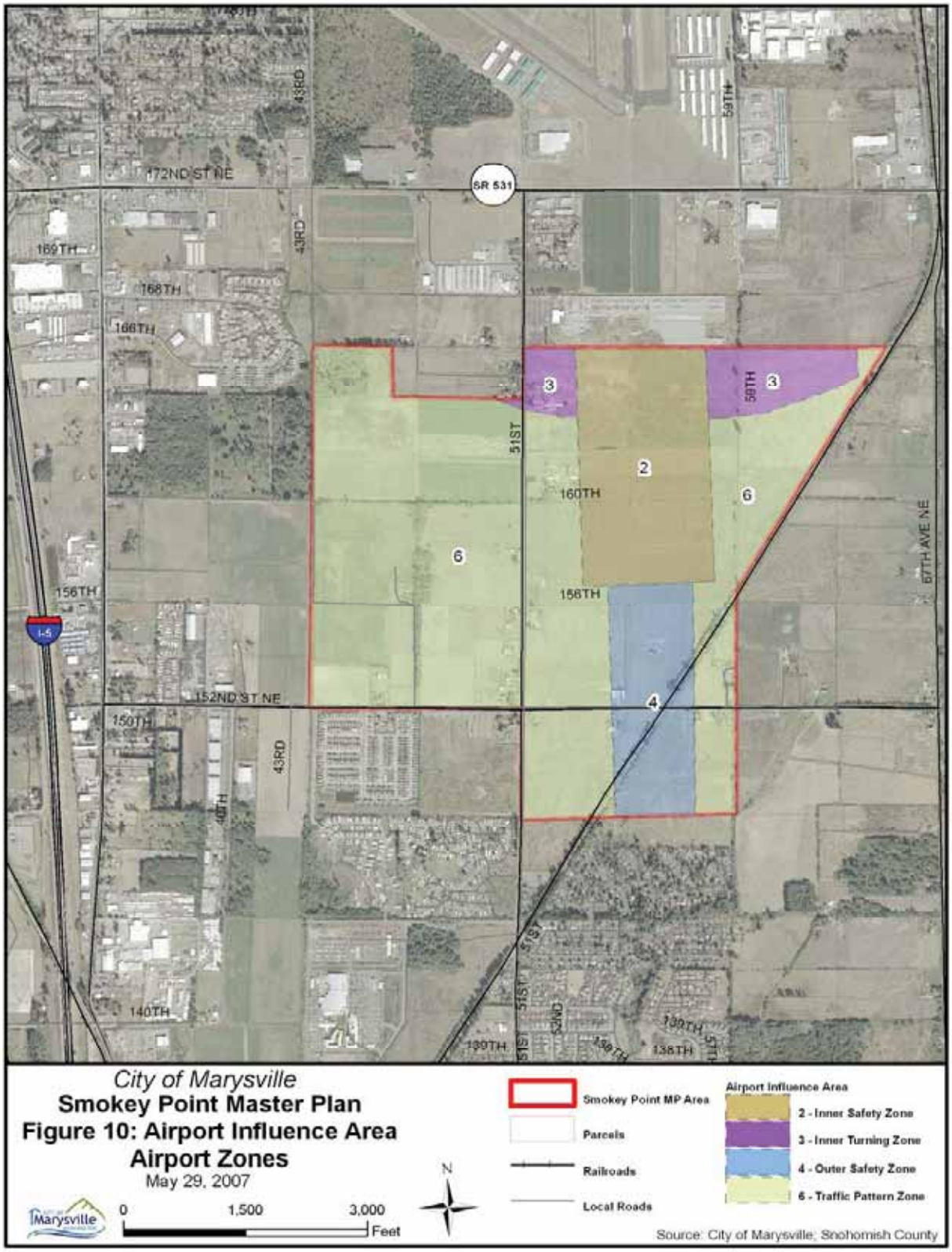
The airport encompasses approximately 1,189 acres and consists of two runways and several taxiways. A large area of industrial zoning is located directly east of the airport between 59th Avenue and 67th Avenue NE, east of 67th Avenue NE.

8.2 LAND USE COMPATIBILITY

An "*airport influence area*" (AIA) is an area near the airport where particular land uses are either influenced by or will influence the operation of the airport in either a positive or negative manner. The Arlington airport is divided into six individual zones each with their own land use regulations and guidelines. Four of these zones, as illustrated in Figure 9, overlay the Smokey Point MPA. They include:

- Inner Safety Zone (ISZ)/Zone 2
- Inner Turning Zone (ITZ)/Zone 3
- Outer Safety Zone (OSZ)/Zone 4
- Traffic Pattern Zone (ITZ)/Zone 6

Figure 9:
Airport Influence Area – Airport Zones



To ensure compliance with the Arlington Municipal Airport Master Plan, uses within the Smokey Point MPA boundaries are limited. To determine if a use is allowed within the Smokey Point MPA, the proposed use must be allowed by both the Marysville Municipal Code Permitted Use Matrix and the airport's Master Plan standard (see Table 8) below. If either regulation prohibits the use, then the use will not be allowed. The allowable industrial and warehouse uses, defined in the City of Marysville - LI zone classification, are generally allowed and do not generate a large gathering of people.

Table 8: Allowed Land Uses within the Arlington Airport AIA Zones

Land Use(1)	Inner Safety Zone (ISZ)/Zone 2	Inner Turning Zone (ITZ)/Zone 3	Outer Safety Zone (OSZ)/Zone 4	Traffic Pattern Zone (ITZ)/Zone 6
Residential	Prohibited	Allowed	Allowed	Allowed
Commercial	Allowed	Allowed	Allowed	Allowed
Industrial	Allowed	Allowed	Allowed	Allowed
Recreational	Prohibited	Allowed	Allowed	Allowed
Public(2)	Prohibited	Prohibited	Prohibited	Allowed

1. These development guidelines are not retroactive and will not be construed to require a change or alteration in the use of any property not conforming to these regulations, or otherwise interfere with the continuance of a nonconforming use. Nothing contained herein will require any change in the use of any property, the platting, construction, or alteration of which was begun prior to the effective date of the Arlington Airport Master Plan, and is diligently prosecuted.
2. Restrictions would apply to congregations of people and noise sensitive uses (i.e., schools, hospitals, nursing homes, churches, auditoriums, and concert halls).

8.3 NOISE CONTOURS

Noise levels around airports are generally broken down into three categories:

- 60-65 DNL noise level is compatible with all land uses;
- 65-70 DNL noise level is compatible with land use restrictions such and limiting residential uses and requiring noise abatement construction techniques in buildings; and
- 70-75 DNL noise level suggests significant noise levels that are not compatible with residential uses.

The Arlington Airport Master Plan shows that the a range of noise contours are contained within the existing airport boundary with a portion of the 60 DNL noise contour extending off the airport property into the Smokey Point MPA boundaries. As the Master Plan Area is only impacted by the 60 DNL noise contour, no additional land use restrictions are required other than those listed in the Airport Master Plan.

Chapter 9 DESIGN GUIDELINES

9.1 PURPOSE

As discussed in Chapter 2 – Purpose and Intent, there are two levels of guidelines for the Master Plan. First, the range of infrastructure needed are identified and defined through **Development Guidelines**, specifically road networks, street designs, utilities, critical area mitigations, storm drainage systems, and airport compatibility. The **Design Guidelines** apply to all new construction and provide guidance on building and parking lot orientations, landscaping standards, architectural features, pedestrian facilities, pedestrian amenities, and signage.

The purpose of these design guidelines is to diverge from the traditional industrial building concepts to create a master planned commercial/light-industrial/technology park that takes an unrelated collection of sites and builds a business district with complementary landscape, streetscape and architectural treatments.

9.2 ZONING AND SITE PLAN REQUIREMENTS

The Smokey Point MPA, has a zoning designation of Light Industrial (LI), except for a parcel zoned retail and where noted on the official zoning map. The underlying zoning Light Industrial will apply for permitted uses, lot coverage, building, setbacks, base landscaping requirements, required parking, and signage code standards. The following are applicable code sections, but applications are not limited exclusively to these sections. They are: *Marysville Municipal Code Chapter(s) 19.08*, *19.12, 19.14, 19.16, 19.18, 19.20, and 19.42*.

9.2.1 Site Plan Approval Process

A binding site plan is required that will demonstrate how the project meets the intent of the zoning code, the development guidelines, and the design guidelines. The means of pedestrian and vehicular parking lot circulation and building and entry orientation, must be approved by the City in accordance with the design guidelines as applied to the entire area of applicability as stated in this authority section.

9.3 RELATIONSHIP TO CONTEXT

Design guidelines that contribute to cohesiveness within an area are: landscape and streetscape treatments, vehicular circulation patterns, pedestrian circulation patterns, and architectural styles, forms, materials or colors. Physical continuity is also an important aspect. In the following sections, ways to achieve continuity in site design elements are discussed.

The Design Guidelines influence the cohesiveness of the business park internally by establishing the relationship to adjacent land uses, and to the City of Marysville through the following elements:

- Site Layout and Building Orientation
- External and internal road networks
- Parking lot and building placement
- Pedestrian and bike corridors
- Building architectural elements
- Landscaping

9.4 SITE LAYOUT AND BUILDING ORIENTATION

There are a number of ways in which architectural and site design can avoid the traditional approach and support a cohesive business park with the following primary guidelines.

All buildings should present a "face" to the street, providing visual interest and a pedestrian scale to the building(s). On corner lots, if the code does not stipulate, the developer may negotiate with the City which street to "face."

- Visitor and customer parking should be provided along the street, or in front of building entrances, while employee and vendor parking should be located behind or alongside the building.
- Service and storage areas will be located behind the buildings and screened from view from public streets.
- Where sites are adjacent, vehicular circulation should be coordinated to minimize curb cuts and access points to public streets.
- The internal pedestrian networks within the master planned development should provide pedestrian linkages between the transit service points, pedestrian facilities and services.
- Views of and into the development from neighboring public streets should be considered, with the goal of making the development an attractive destination.
- Landscaping for new development should consider the existing landscaping of adjacent sites to provide continuity along the street fronts and augment the perimeter treatment.

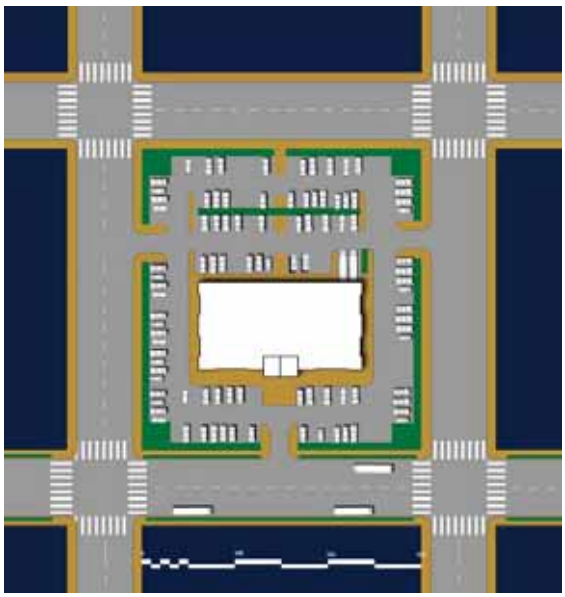
The following two graphics illustrate how industrial building and retail building layouts relate to the surrounding streets.

This generic site diagram illustrates the overall relationship between the building location and the parking layout within a site anticipated for office / light industrial / warehousing uses in the Smokey Point MPA.

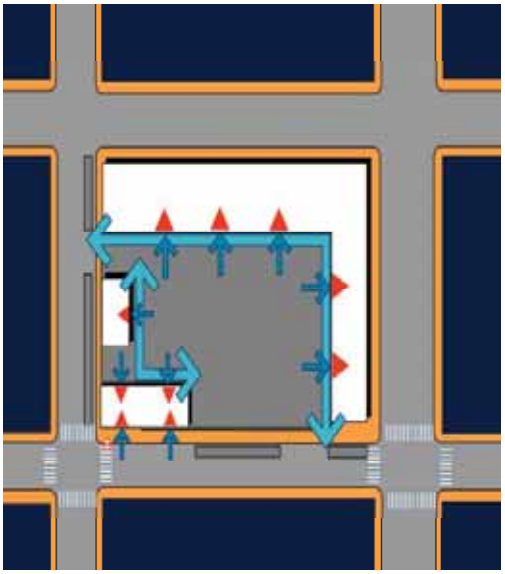
The building faces the street, with the greatest architectural detail along the front façade. A minimum of parking is provided for guests and visitors immediately in front of the building, with clear access from the address street.

The majority of parking is behind the building, as is the loading and service area.

The site is encompassed by perimeter landscaping, while the landscaping along the address street is a continuation of the streetscape on adjoining sites and blocks.



Applicable Site Layout for limited Retail Development
Store entrances are the destination of customers leaving their vehicles. The example at right supplied a "ladder" style paint stripping to alert drivers of the pedestrian concentration at the store entrance. The example at the right provides parking immediately in front of the building, which lowers the number of pedestrians crossing busy access drives and provides a buffer between pedestrians on the sidewalk in front of the building and moving cars. When parking is provided in front of buildings, it is important to clearly designate "no parking"' areas in front of building entrances to provide clear pedestrian access from the parking lot



9.5 SERVICE AND LOADING AREAS

Service areas for businesses consume a significant amount of land because of the high percentage of manufacturing and light industrial activities that require truck maneuvering and loading areas. While these areas are essential to the function of the facility, they can be located or screened to enhance the appearance of each site and the Smokey Point MPA in general. The type of manufacturing and light industrial facility and its orientation affects the visual appearance of commercial areas because of the design of the loading docks.

Design Guidelines – Service Areas

1. Service areas will be located behind buildings.
2. Service areas should be screened by landscaping, fences, or walls that obscure the operations from adjacent streets. "Screening" includes distance from street, location of on-site parking and other site landscaping.
3. Service courts are encouraged when the development includes multiple buildings.
4. Service courts are encouraged as shared facilities between sites or where they can be accessed for shared driveways.

Example of screening of service areas with landscaping

Example of screening service area with building layout

9.6 VEHICLE CIRCULATION AND PARKING LOTS

Vehicle circulation and parking lots in the Smokey Point MPA will influence roadway design and layout, site configuration, and building locations. The circulation needs of maneuvering trucks and trailers will be an important influence in the overall look and feel of the individual site and the overall district. While the dimensions and characteristics of truck traffic will be a strong influence, the passenger automobile that delivers customers to the site, store, and employment in the office will be another significant portion of the experience in the area.

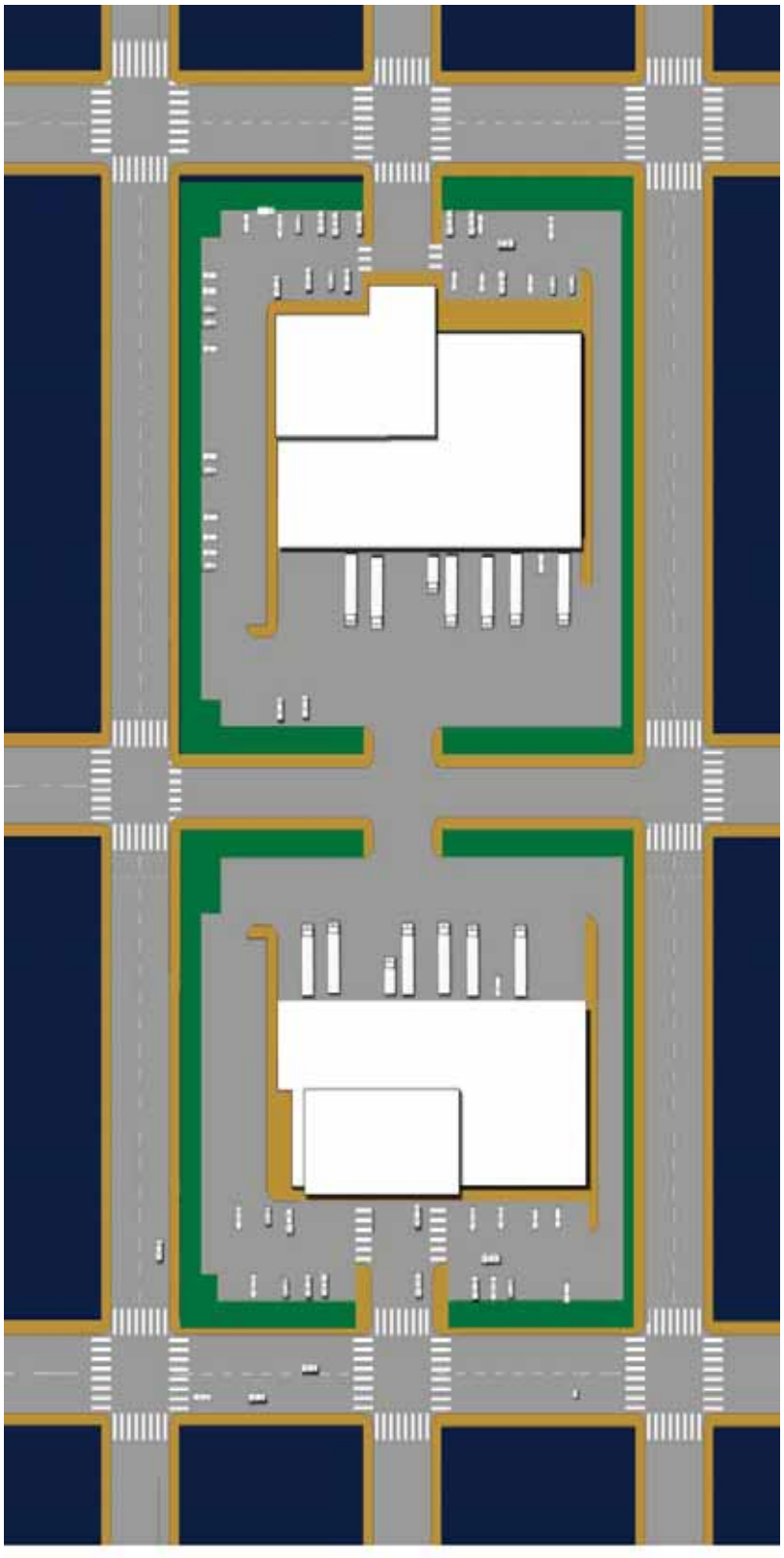
Design Guidelines - Access points

1. A designated truck and service vehicle access entrance/exit will be established with expanded turning radii. Access points will be subject to sight distance review.
2. A designated visitor and employee access entrance will be established that is not in close proximity to the truck and service vehicle entrance.
3. Access points between major development pads should be combined to minimized curb cuts, while recognizing the need to provide adequate emergency access to each building. Left turns should be restricted to turn pockets on the following roads:
   - 152nd Street NE
   - 51st Avenue

Design Guidelines – Parking Lots

1. Visitor parking should be located in front of the building, near the building entrance.
2. Employee parking behind the building is encouraged.
3. Parking lots should be integrated with the landscape concept and pedestrian circulation.

This is an example of blending parking lot landscaping, pedestrian open space, and building entrances.



Example of Building and Parking Layouts with Service areas in the interior of the lot.

These site plans show a basic approach to site planning for light industrial / freight forwarding operations.

The truck maneuvering and loading docks are located behind the building, while visitor parking is directly off the address street. Employee parking is along the side of the building. Where possible, especially in multi-site developments, some streets should be dedicated to truck access (behind both buildings in this example).

Landscape buffers around the site should be used to screen the parking and trucks and create an "address" street where the businesses can benefit from a quality streetscape.

9.7 PEDESTRIAN CIRCULATION AND CORRIDORS

Pedestrians need an origin, a destination and a continuous network to move from one point to another or from the automobile to their destination. Pedestrians have three origins: the building where they work or shop, transit drop off or, more likely, their parked automobile. To allow pedestrians to move between buildings and the street, a complete and continuous pedestrian network must be provided that has pedestrian amenities and visual interest.

Pedestrian flows from the public street to private building entrances and between neighboring properties has been overshadowed in suburban areas by the volume of pedestrians walking from private parking areas to building entrances. Connections to the public pedestrian network will become more important as pedestrian densities increase due to changing land uses and increases in transit ridership.

Design Guidelines - Pedestrian

1. The public sidewalk network will be completed with each development and roadway improvement to connect all the destinations in the Smokey Point MPA.
2. Clear, convenient, and safe pedestrian circulation should be provided between public sidewalks and building entrances.
3. Parking lot pedestrian crossings will be denoted by either stamped concrete or colored pavement within the first 500 feet of the building entrance. Painted pedestrian stripping may be used outside of the 500-foot perimeter around the building.
4. Pedestrian circulation through parking lots will be well marked.
5. Pedestrian circulation to the building entrances will be adequately sized and be provided with landscaping and weather protection where appropriate.
6. Where pedestrian routes cross parking lots or vehicle routes, they will be clearly identifiable with raised paving pathways. Pervious pavers to support infiltration are encouraged.
7. Buildings should clearly show the pedestrian entrance from the street and from the parking lot.

Creation of a pedestrian circle in the parking lot with integrated landscaping softens the building and provides a safe area and connects the businesses to the public sidewalk.

A complete network of public sidewalks will encourage pedestrians to walk rather than drive. As the employment density increases in the area, more transit services will be warranted. Within the parking lots, clear paths for pedestrians should be installed to provide a safe, clear means to access the businesses.

This new development provides positive pedestrian connections between the public sidewalk and walkways in front of the building. The pedestrian link through the parking area features pedestrian lighting, landscaping and a slightly elevated, crowned surface within the parking area.

9.8 PEDESTRIAN AMENITIES

The extent and type of pedestrian facilities appropriate for a given development will depend on the nature of the development, the number of users and its proximity to other recreational features. Design review should consider area recreational features and development scale in determining location and extent of pedestrian amenities on the site. As employee recruitment becomes more competitive in emerging northwest businesses ranging from manufacturing to light industrial, investments in pedestrian facilities can provide great benefits to employees. Changing uses in leased spaces is the dilemma for developers in providing fixed pedestrian amenities. Fixed pedestrian facilities constructed in anticipation of tenants may go unused if the use changes at the end of the lease. Providing space for pedestrian amenities in optimal locations and supplying non-fixed seating, landscaping, and other features, may prove more successful.

Design Guidelines – Pedestrian/Employee Amenities

1. In addition to safe and durable walking surfaces, pedestrians should be provided with amenities such as benches, weather protected seating areas, covered walkways, and other features.
2. Accessible open space, maintained grass areas, and mini sports courts are encouraged.
3. Pedestrian amenities should be integrated into the site design.

This high tech industrial business in Bothell provides benches and tables and integrating the landscape planters with seating.

Pedestrian amenities such as these benches are most important in the retails areas. Pedestrian amenities can range from a landscaped plaza to something as simple as a picnic table or bench. They are most attractive to pedestrians when designed in conjunction with businesses and activities that generate pedestrian activity, such as espresso stands and public trails, and provide features such as protection from, weather, noise and traffic.

Building arcades and colonnades are a good response to the Northwest rainy climate. In addition to providing shelter, they clearly define an area that is safe from vehicles.

Investments in pedestrian facilities or open space gathering area can provide great benefits. This modest facility is well used since It is important to provide a place for rest and relaxation for employees and visitors

9.9 ARCHITECTURAL CONCEPT

A strong architectural concept has both an aesthetic and an organizational component. The concept should convey the statement or image that the designer wants the building to communicate, and also provide clues as to how the building is to be used; for example, how pedestrians can reach their desired destination. In order to convey a clear message, sites with multiple buildings should also display design unity; individual buildings should reinforce the image of the complex as a whole.

Architectural composition is the design and arrangement of building elements. The composition conveys the architectural concept. In addition to function, the design, proportions and placement of elements should be visually pleasing. Typical components of the composition include the design, proportions, and placement of windows, doors and other openings, the building base and cornice line, and the roof form(s) and its relationship to other elements within the overall composition.

The Costco Headquarters was built within the Pickering Park Business Park in Issaquah.

The building at right shows a unity of architectural composition, symmetry, a clear entrance and a formal design approach that fits well with its corporate headquarters image.

"Speculative" office development is developed to serve multiple tenants, where smaller spaces are needed. In the building at right, the architectural approach was to provide a less specific image.

This office building was developed without a specific tenant. In a speculative venture like this, convenient parking is necessary to attract tenants.

A strong architectural concept should convey clear organization. For the user and the observer, the clarity of building organization is important to understanding where uses are located in the building and how to reach them. The exterior design gives cues as to where different uses are located.

Design Guidelines – Façades

1. The front façade of buildings should be designed to utilize elements such as massing, materials, windows, canopies, and pitched or terraced roof forms to create both a visually distinct "base" as well as a "cap."
2. The building façade that faces the public street will be articulated to reduce the apparent scale of buildings. Strong vertical and horizontal reveals, off-sets, and three-dimensional detail can be incorporated into building design to create shadow lines and break up flat surfaces.

This building exhibits façade with architectural features and definition for the primary entrance.

This building includes many elements that give the observer clues about scale. The doors, windows, and canopy all indicate how a human would "size up" when near this building. Modulating of the building plane and cornice and providing a variety of materials are effective techniques for providing interest to blank walls to the public, particularly when integrated with landscaping treatments.

9.10 SCALE IN DESIGN

There are multiple scales in building design. One aspect of scale refers to the size of a building relative to another building, or building element relative to other building parts. For example, it might be said of a multi-story building in a one-story retail area that the tall building is "out of scale" with its neighbors.

Another important scale consideration in building design is human scale. Human scale is the size of a building element or space relative to the dimensions and proportions of the human body. Achieving human scale in building design is particularly important in the Smokey Point MPA because of the large size of the anticipated buildings.

Light industrial buildings in the Smokey Point MPA could be large, rectangular structures with flat wall surfaces. These buildings could work well for their primary purposes, but several design issues need to be addressed to provide a quality visual and pedestrian environment. Buildings, especially large buildings, need to relate to pedestrians. This can be accomplished by breaking down, or modulating, larger building forms (massing) providing building elements and landscaping that mediates between the scale of the structure and 'human' scale. A way to reach that relationship is the incorporation of building elements that are typically designated with pedestrians in mind - entries, canopies and arcades.

Design Guidelines Scale

1. The side façade of buildings should be designed to utilize elements such as color, materials, and / or landscaping to break up the size and scale of large side walls.
2. Integrate pedestrian scale concepts into the front façade of the building. Elements such as arcades, canopies, balconies, or extending smaller structures out from the main façade.
3. Design the building massing so the taller or bulkier portions are less visible from public streets and sidewalks.

Example of how a large building façade can be a positive combed with the landscaping.

9.11 WALL MODULATIONS

The internal functions of buildings often require walls without penetrations or breaks in the plane of the façade. If appropriate, these blank walls should be placed in areas of the site not visible to the public (public streets and private land adjacent to public right-of-way). However, when walls of large structures are visible to the public, the impact of large expanses of blank walls can be minimized by modulation.

Modulation involves recessing and/or projecting portions of the façade of a building within specified intervals of building width and depth, as a means of breaking up the apparent bulk of a structure's continuous exterior walls.

Design Guidelines Walls

1. Walls should be provided with bends, recesses or projections to reduce long un-modulated planes.
2. Long planes of flat walls should be enhanced with patterns, changes in colors and breaks in materials or an alternative proposal may be approved by the Planning Director if the design meets the intent of these design guidelines.

The effect of the modulation may be enhanced with a change of materials or color, texture, or windows.

Modulation to break up long horizontal surfaces can be achieved with bay windows, recessed or projected entry features, structural bays that are accented on the exterior of the structure, or repeated 'storefronts' along the ground floor of the façade.

Modulation of the façade from the cornice to the ground to can be achieved by incorporating balconies, horizontally-oriented recessed windows, added emphasis on spandrel panels, long landscape planters or other features that project or recess from the main plane of the façade.

9.12 ROOFLINE

The horizon line, where the sky meets the ground, is one of the most important features in the visual environment. The horizon in the Pacific Northwest, with skylines of hills, mountains and water, is much more interesting than that of a flatter horizon. In the same way, the horizontal rooflines of light industrial structures, with simple flat horizons, are less interesting than other, more complex rooflines in the Smokey Point MPA.

Design Guidelines Roofline

1. The roofline of the main façade in large buildings should be broken into several planes.
2. Building elements that protrude above a long horizontal façade can be used to interrupt the cornice.

9.13 BUILDING ELEMENTS, DETAILS AND MATERIALS

Architectural elements are the "pieces" that make up an architectural composition, or the building form, of a building. The elements can include such features as the roof form, entries, an arcade, porch, columns, windows, doors and other openings. The architectural "parts" of a building must be related to the "whole." Architectural elements such as roof forms, entrances, arcades, porches, columns, dormers, doors and windows must be appropriately scaled and well-proportioned in relationship to the whole building.

Design Guidelines Architectural elements

1. The forms of the architectural elements of a building should be consistent with the overall architectural approach or theme.
2. The architectural elements should maintain balance and proportion between themselves and within the overall composition.

9.14 DETAILS

Architectural or building details refer to the minor building elements that contribute to the character, or architectural style of the structure, and may include moldings, mullions, rooftop features, the style of the windows and doors, and other decorative features. Architectural details that are used to articulate the structure may also include reveals, battens, material joint lines, and other three dimensional details that create shadow lines and break up the flat surfaces of a façade.

Design Guidelines Architectural Detail

1. Buildings should be designed with an appropriate scale of detailing to match how the building is experienced.
2. The architectural details of industrial elements (loading area, generators, exhaust vents or pipes, etc.) should match the materials and forms of the overall architectural approach.

Example of industrial venting system integrated into a positive architectural detail.

9.15 MECHANICAL SCREENING

Roof mounted mechanical equipment for heating, ventilating, and air conditioning can be a significant feature of the building design. Unscreened air handling equipment can detract from the architectural design if visually prominent. To avoid the visually detrimental appearance of this equipment, as well as antennas, satellite dishes and other equipment, several techniques should be employed to obscure their presence.

Design Guideline – Mechanical Screening

1. Structures should be provided to screen the equipment.
2. Roof forms should enclose the equipment.
3. The equipment should be placed so that it is not visible from public areas and neighboring sites.

9.16 UTILITIES

Treated similarly to service and loading areas, above grade utility boxes and trash receptacles in business areas will be screened.

Design Guidelines – Utilities Standard

1. Utilities should be located behind buildings except where prohibited by purveyors.
2. Utilities should be screened by landscaping, fences, or walls that obscure the operations from adjacent streets.
3. Utilities, such as meters and switch boxes, should be placed behind walls or screened by landscaping.

These trees serve two purposes, screening a loading area and screening utility vaults.

9.17 SURFACE STORMWATER DETENTION FACILITIES

As discussed in Chapter 7 – Drainage, site planning considerations to accommodate rainfall and runoff in the Pacific Northwest must include site features such as drainage, detention, and water quality treatment facilities. In developing site plans for new development, the volumes and flows of surface storm water determine the size of detention and water quality treatment facilities. Good site planning integrates these facilities into the overall site concept.

Design Guidelines Stormwater Facilities

1. Stormwater facilities and Low Impact Development concepts will be integrated and support the preferred basin concepts adopted by the City of Marysville.
2. Stormwater facilities should be integrated into the site concept to provide visual amenity. Facilities may include surface ponds, underground vaults or LID techniques, as appropriate.
3. Stormwater infiltration facilities (paved pedestrian pathways) and other Low Impact Development concepts are encouraged and may be integrated within the landscaping concept for parking lots and site perimeters
4. Rain gardens, vegetated roofs, and use of roof water for irrigation are encouraged for Low Impact Development techniques.

Chapter 10 LANDSCAPING

10.1 PURPOSE AND INTENT

The purpose and intent of this chapter is to encourage healthy, attractive landscapes in the Smokey Point MPA and to assist property owners in developing their property in a manner which is consistent with its natural condition. Design standard and guidelines are provided that will be based on the underlying Zoning Code Landscape Standards. The intent is to promote safety, provide screening between uses, promote wise and efficient use of water resources, protect the aesthetic assets of the community, and to reduce the impact of development on the environment. It is expected that good landscaping design principles will be applied at all times, including:

- Spacing vegetation for proper growth and root development.
- Safety precautions for pedestrian and vehicular traffic.
- Proper access and patrol for Fire and Police Departments.
- Wise and efficient use of water resources.

10.2 PLANTING DESIGN

Planting design is the selection of appropriate plant species to create a desired effect. Using a palette of plant types the designer selects for types of trees, shrubs and groundcover to achieve the desired green goal which is the screening of service areas, establishing an entry experience, or providing a field of ground cover.

This example provides an example of how the tree plantings can serve two purposes: screening a loading area and screening utility vaults.

Design Guidelines

1. Planting design will include seasonal color changes for the tree foliage and the blossoming flowers.
2. The three dimensional, sculptural result of planting design will reflect the specific landscape goal: screening, accent, and/or feature planting.
3. Plant design will provide for a variety of leaf texture, plant forms and branch pattern.
4. Planting design will include a selection of plants with the goal of reducing water consumption.

10.3 STREETSCAPE LANDSCAPING

51st Avenue is the main north-south roadway connecting the Smokey Point MPA with the City of Arlington to the north and a Marysville residential community to the south. 152nd is the east–west roadway connecting the Master Plan area to Smokey Point Boulevard. These roadways set the tone for the type of development the City envisions for this area as well as transitioning between residential uses south of 152nd Street and industrial development within the MPA. Therefore, the streetscape on all of the MPA roads should reflect the image of a high-tech industrial center which supports living wage businesses. To accomplish this objective, the streetscape will include a combination of ornamental landscaping consisting of street trees and shrubs/ground cover or lawn so as to improve the appearance of the future development but not necessarily to obscure it.

The purpose of the streetscape landscape improvements is to provide aesthetic landscape improvements and some visual separation between developments and the adjacent roadway. Landscaping will be located on right-of-way, private property, or any combination thereof.

Design Guidelines – Streetscape Landscaping

1. Landscape design should support, accent and enhance entryways without blocking signage and obscuring vehicle sight lines.
2. Landscape design should provide an edge to pedestrian walkways or separate pedestrians from vehicular zones.
3. The street trees will be a mix of Evergreen Trees, Flowering Crabapple, Japanese Flowering Cherry and/or Golden Rain Trees.
4. 2 1/2" caliper deciduous street trees will be planted twenty (20) feet on center within the right-of-way planting strip. Street tree varieties to include a mix of recommended street trees.
5. Street landscaping and median landscaping widths may be reduced during the design review phase. Within the ten foot landscape strip between the sidewalk and parking lot, a mix of 50% deciduous and 50% evergreen trees will be planted with the total quantity averaging 15' on center for the lineal frontage of streetscape area. Tree sizes required: deciduous – 1.5" caliper; evergreen - 50% 6-8' height, 25% 8-10' height, 25% 10-12' height.
6. Root barriers will be installed.
7. Evergreen groundcovers will be planted to achieve 90% coverage within 3 years of the time of planting. Lawn may be used for up to 75% of the area.
8. Shrubs will be planted to have a three (3) foot minimum height differential from the parking lot and be spaced to form a continuous shrub to shield parking and pedestrian areas.

Golden Rain Tree

Japanese Flowering Cherry

Within the Smokey Point MPA, a variety of streets are provided serve the overall development, groups of buildings and individual businesses as well.

The major streets and entry ways of this development were planned with a median that provided for a landscaped strip or for left turn pockets at the intersections.

Streetscape design standards are particularly important in developments that include large buildings. The scale of "big box" retail, warehousing, distribution or freight forwarding facilities can be imposing, so that the softening effect of street landscaping is imperative.

The blank side of this large store reflects the interior functions that orient merchandise to the customer. Without windows, the exterior facades can be very uninteresting for the pedestrian, necessitating the need for landscape screening and façade modulation.

The anticipated uses in the Smokey Point MPA include a significant amount of truck traffic and loading areas. Many streets along the sides of the facilities can be screened to mitigate the visual impact of the loading areas.

This streetscape design provides visual screening for the parked cars as well as truck operations for the freight forwarding facility in the background.

10.4 PARKING LOT LANDSCAPING AND SCREENING

The purpose of parking lot landscaping is to soften the visual appearance of the building, screen public views of parking lots, add shade, limit the amount of impervious surface and reinforce safe pedestrian access to buildings and connecting sidewalks. Parking lots will be setback a minimum of ten (10) feet from any property line.

Design Guidelines – Parking Lot and Screening

1. Parking lots will include one (1) tree for every six (6) parking stalls. Trees to consist of shade canopy will be deciduous trees sized at a minimum of 1.5" in caliper.
2. Truck bay and delivery areas will not be required to provide internal landscaping or trees; however, landscape trees will be provided along the perimeter of these areas every thirty (30) feet on center and at a minimum of 1.5" in caliper.
3. Five (5) shrubs will be provided for every 150 square feet of parking island.
4. Evergreen ground covers will be planted to achieve 90% coverage within 3 years of the time of planting. Lawn may be used in lieu of shrubs and ground covers for parking islands exceeding 200 square feet in area.
5. A landscape island will be provided at the end of each parking aisle.
6. The total of all interior landscaped areas will be equal to or greater than 10% of the total parking lot area (including parking, maneuvering, and loading areas). The perimeter parking lot landscaping may be reduced when abutting a public right of way streetscape area.
7. No parking will be more than forty-five (45) feet from a landscape area.
8. If grass pave, rainstore, or an equivalent alternative is proposed for the parking lot design, an alternative landscape plan may be approved by the City provided that the intent of this agreement has been met.
9. A berm is encouraged in the landscape area next to the sidewalk to promote interest and variety in the streetscape. If berms are used, they should be irregular and natural in layout ranging from 12" to 24" in height as measured from the sidewalk with no grades exceeding a 4:1 slope (4' horizontal/1' vertical).

A mix of evergreen and deciduous shrubs and / or hedge type plants will be planned adjacent to any parking lots to help break up visibility of large areas of asphalt. Native and drought tolerant species are encouraged.

Contemporary parking lot standards typically require a greater amount of parking lot landscaping than has been provided in the past. The turning radius at the end of the aisle provides locations for large planting beds and can delineate drive aisle from parking areas. In addition, concentrating the landscaping into clusters at the ends of parking rows can provide a good landscape edge to the pedestrian walkways.

Landscape treatment adds visual relief to large pavement areas. Current design trends lean toward providing larger planting beds that convey an image of more substantial planting mass, while reducing water consumption. Larger planting beds can support deciduous and / or evergreen plant material to provide year-round interest and diversity. Mature trees can provide shade from the summer sun and cool both the pavement and parked cars.

This landscape concept provides a continuous planting strip between two double loaded parking aisles. This technique provides a spatial definition within the parking lot that differentiates the parking area and avoids the wide pavement expanses found in older designs. Continuous planting strips also provide spoil area for tree roots to expand, encouraging healthy and disease resistant trees.

10.5 LANDSCAPING FOR AVIATION USES ONLY

If, in meeting the purpose and intent of these requirements, it causes the development to intrude into the 7:1 restricted airspace, the owner/users may propose an alternative landscaping plan that technically demonstrates and visually illustrates that the alternative proposal provides the desired effect of the purpose and intent of this Master Plan.

10.5.1 Service Area Standards

The intent of this section is to provide guidance on the location and shielding of services area such as trash recycling, outside storage, and loading docks.

Design Guidelines – Trash, Recycling and Storage areas

All dumpsters, individual refuse containers, trash compactors and permanent storage areas, herein referred to as "Containers" will meet the following conditions:

1. An architectural screen a minimum of one (1) foot in height greater than the tallest portion of the Container will surround all sides except the access entry. Building walls of adjacent structures may be used to partially satisfy this requirement. Walls will be a solid visual screen constructed out of metal, concrete, and / or masonry units, and other materials similar to structures on the site. Wood may be used for doors, gates, trellises, and other architectural screening elements that complement the surrounding buildings.
2. Container door(s) will provide a solid visual screen and be constructed out of metal and/or wood materials.
3. A concrete slab will be installed as the base material within the Container.
4. Landscape plant materials will be used to soften the appearance of the Container. The three sides of the Container that are not used for access will be landscaped.
5. Recycling areas will be conveniently located near central trash areas. They will be large enough to contain the separate recycling of newspapers/print, glass (clear and mixed), plastic, and aluminum.
6. Trash enclosures will be landscaped and not visible from the street.

Design Guidelines - Fences

Fences will meet the following conditions:

1. Fence materials between the front property line and the front façade of the building will consist of metal, wood, and/or masonry units, and will be consistent with the architectural character of adjacent structures.
2. Chain link fences will only be allowed around rear and side yard storage areas and then, only black vinyl coat or black painted chain link is allowed.
3. The maximum allowable height for fences is eight (8) feet.
4. Adjoining, adjacent, and connecting fences will be similar in design and constructed from like materials.

10.6 SIGNAGE

Signs are significant elements in the visual environment and are important to way finding businesses. The signage locations and design needs to be flexible to take into account landscaping and visibility for the drivers, cyclist, and pedestrian. They provide information and direction and they vie for our attention to sell us products. They do this with a variety of forms: motifs, scales, and graphic styles. The signage environment can be a visual cacophony or part of an ordered system. Signs will have a strong design relationship to the architectural and site design elements of a project.

Sign integration should be used in new development wherever possible, which makes signage a part of the overall design approach. Creativity is encouraged in signage and graphic design. Signs can be expressive in form and lighting. Standard, back-lighted, metal frame and plastic signs are discouraged.

A signage plan will be developed for each new development application in the Smokey Point MPA.

Design Guidelines - Signage Coordination

Depending on the complexity of the project (either single users or multiple tenants) the development should provide a combination of:

1. Project signage (signs that identify the project to the public from public streets).
2. Building, tenant or retail signage (signs that identify the individual tenants).
3. Way finding signs (signs that assist customers, service vehicles or vendors to find their way within the development).
4. Wall signs will not exceed ten percent (10%) of the front façade and five percent (5%) of a side façade that faces a street. In multi-tenant buildings, the percentage will be based on the façade of the leased space.
5. Signage placement will be centered over tenant storefronts.
6. Signage placement will be reviewed by City Staff to determine if the sign is blocked by landscaping or other buildings. The signage placement may be shifted to avoid visual conflicts.

Design Guidelines - Monument Signs

Monument signs are encouraged and should meet the following standards:

1. They may be built up to a maximum height of ten (10) feet and must include a base of at least two feet in height.
2. The base can be made of wood, brick, rock, aggregate concrete, or metal having a unique architectural design consistent with the adjacent building's architecture.
3. Pylon/Pole signs are prohibited.
4. The setback from the street is recommended at five (5) feet.
5. The sign location can be shifted to ensure visibility from vehicles, if blocked by trees. Signage placement will be reviewed by City Staff to determine if the sign is blocked by the landscaping and/or other buildings.

This sign complements the architectural style, materials and colors of the office it addresses. Matching these characteristics provides consistency in image between the business and the building in which it is located.

This monument sign example provides the modern-high tech look for a business center.

Chapter 11 IMPLEMENTATION AND FUNDING

This Chapter sets forth policies for implementation and options for funding for projects described in this Smokey Point MPA.

11.1 IMPLEMENTATION POLICIES

The Development Guidelines contained in Chapters 4-7 of this Smokey Point MPA document recommend how the City, affected agencies and private developers, should develop and construct road networks, transit networks, wetlands, critical areas, drainage systems, and utility networks infrastructure within the Smokey Point MPA. This Section contains policies for implementation.

The basic short-term priories (1 to 5 years) priorities of the MPA and infrastructure are:

1. Construction of 156th East to West
2. Reconstruction of 51st into a Principal Arterial
3. Transit pullout pockets in new roadway areas
4. Development and construction of regional stormwater facility (if approved by City)
5. Extension and expansion of water, sewer, and electric facilities
6. Extension and expansion of sewer trunk lines for future developer extension
7. Approval and construction of a wetlands/stream mitigation program

The long term priorities (5 to 10 years) of the City for the MPA and infrastructure are:

1. Continuation of construction minor arterials and collector streets
2. Installation of traffic signals as the warrants are defined in the future
3. Completion of regional wetlands/stream mitigation program

11.1.1 Infrastructure for Wetlands, Drainage Systems, and Critical Areas

Including any ditches and streams, will be addressed in one of two scenarios:

Scenario (1). The City shall utilize a coordinated permitting process in which impact analysis, mitigation planning, and project permitting are conducted on a regional basis in coordination with state and federal agencies. Under this Scenario (1), new development will participate in and receive property-specific benefits from regional mitigation projects through:

(a) Construction of regional mitigation projects with capacity in the facility available for purchase by developers; or
(b) Funding of regional mitigation projects to be constructed through one of the funding options identified in Section 11.2; or
(c) A combination of (a) and (b).

If capacity permits and with appropriate funding, regional mitigation projects may also serve property outside the Smokey Point MPA. Coordinated permitting process under Scenario (1) may require two to four years for planning and approvals.

Scenario (2). Under this Scenario (2), as new development occurs, analysis of impacts, mitigation planning, and project permitting will be conducted on a development-by-development basis.

11.1.2 Road and Transit Networks and Utility Networks

The City should consider the following transportation projects within its overall capital plan and develop timing and priorities for construction of road segments:

- The east-west corridor on 156th Street/152 Street from Smokey Point east to 51st Avenue NE.
- The I-5 Overpass at 156th Street.
- The north-south corridor on 51st Avenue NE from 152nd Street to 172nd Street.
- The I-5 Interchange at 156th Street.
- The north-south corridor on 43rd Street from 156th Street to 172nd Street.
- The expansion of 156th Street/152 Street corridor to SR 9.
- The transit network as needed to support development.
- The remaining elements to be completed as the region and development demand.

Scenario A. Planning and construction of road and transit networks and utility networks listed above will require many years for planning, funding and construction of the ultimate roadway plan. Under Scenario A, as new development occurs, the applicant will proceed with construction of the road and transit networks necessary to support the development. Under this Scenario A, the applicant could potentially receive (if applicable under City code) credit for fees or costs. Funding options for develop projects are identified in Section 11.2.

Scenario B. Under this Scenario (B), the City would require regional strategies such as Road Improvement Districts (RID), Local Improvement Districts, Transportation Benefit Districts (TBD) or other area-wide funding strategies be in place to complete the needed improvements. With an approved funding mechanism to complete needed roads, area development could proceed concurrent with or in advance of completion of the area improvements. Specific funding options and descriptions are identified in Section 11.2.

11.2 FUNDING OPTIONS / DEFINITIONS

This section includes financing tools that may be used to fund the planning and construction of infrastructure and mitigation addressed in this Smokey Point MPA. The tools range from those providing a general benefit, to those that provide a benefit only to specific users. While not exhaustive, this list provides a starting point for the City to examine applicable alternatives to achieve the goals set forth herein. The City shall consider these guidelines in choosing and implementing any funding option.

Local improvements benefit the area-wide network. It is critical that responsibility for the road network construction be equitable and roughly proportional to the benefits derived by those land owners developing in the area and broader City, County and regional needs.

1. **Finance through current budget.** The City will periodically review the budget for the current and upcoming fiscal years to determine whether the proposed capital improvement project may be funded through the current revenue stream.

2. **Assess an excess levy.** If a proposed capital improvement project provides a benefit to the municipality as a whole and meets certain criteria, the City may examine the possibility of assessing a one-time excess levy, in accordance with applicable law.

3. **Issuance of bonds.** The City may examine the possibility of issuing general obligation bonds, revenue bonds or assessment bonds to fund certain projects. If choosing this alternative, the City will discuss and coordinate with the City's bond counsel.

4. **Obtain state or federal grants.** The City may investigate various state and federal grant options, including, but not limited to the Job Development Fund administered by the Community Economic Revitalization Board, federal Community Development Block Grant, and federal Section 108 Housing and Urban Development money. Such funds may be available to assist with public infrastructure projects that directly stimulate economic development by creating and supporting local jobs. If the capital improvement project relates to critical areas or safety issues, there may be other state, federal or private grants available to provide funding.

5. **Form special purpose district.** For diking and drainage projects and flood control projects, the City may work with the County to establish a Special Purpose District (SPD) that acts separately and apart from the City and County to perform a limited function. The SPD would derive revenues from assessments on property owners within its boundaries. An SPD would be formed after either a petition or resolution, and typically after an election by the owners within the proposed SPD boundaries. The SPD may impose general tax levies and excess tax levies, in compliance with applicable law.

6. **Form Transportation Benefit District (TBD). Under RCW 36.73 a** TBD is a quasi-municipal corporation and independent taxing district created for the sole purpose of acquiring, constructing, improving, providing, and funding transportation improvements within the district. A TBD can fund any transportation improvement contained in any existing state or regional transportation plan. Under state statute, the boundary of the TBD can be less than city-wide; however, if the TBD utilizes taxing authority that does not require a public vote (e.g. impact fees) the boundaries of the TBD must be city-wide.

7. **Form a Local Improvement District or Utility Local Improvement District.** Depending upon the project, the City may consider establishing a Local Improvement District (LID) or Utility Improvement District (ULID) to finance improvements over a period of time. Under both scenarios, the City would sell bonds to investors, and retire those bonds with annual payments that are generated from assessments on property owners within the LID or ULID. With respect to ULID's, utility revenues are also pledged to the repayment of the ULID debt, in addition to the assessments on the benefitted properties. Since property owners within a LID or ULID will recognize a significant increase in their property values as a result of the project that is being financed, all costs associated with creation, formation, construction and related financing costs for the LID or ULID will be included in the assessment. Though not an exhaustive list, the City may also include the following costs in the assessment: construction, engineering and design, legal fees, right of way acquisition, appraisal fees, administration, and issuance of bonds.

8. **Form a Parking and Business Improvement Area.** Upon receipt of a petition submitted by affected owners, or upon resolution adopted by the City Council, the City may utilize RCW 35.87A to establish a Parking and Business Improvement Area (PBIA). This would allow businesses and property owners within a defined area to establish a special assessment district to provide additional funding for management, services, facilities, and programs benefitting that defined area. Such assessments may be levied against businesses, multifamily developments and mixed-use developments located within the PBIA. Funds may be used to construct and maintain parking facilities, promotion of public events, provision of security, and management and promotion of the PBIA.

9. **Utilize "sidewalk statute."** The City may utilize RCW Chapters 35.68, **[**35.69 and 35.70**]** to require property owners abutting a public street to construct sidewalk improvements, curbs and gutters. In the alternative, the City may construct such improvements itself and assess the costs to the affected property owners.

10. **Enter into a latecomer's reimbursement agreement or recovery contract.** If a property owner has installed certain types of street or utility improvements, the City may explore entering into a reimbursement agreement with the property owner pursuant to the requirements of the City Code. Such reimbursement agreement would allow the property owner to recover a portion of the construction and design costs of the street or utility improvements from other

property owners who later develop property and derive benefit from such improvements. Per the requirements of the Code, such reimbursement obligations would be triggered upon development of each benefited property.

11. **Encourage multiple property owners to enter into a private cost sharing agreement.** Similar to the City's reimbursement agreement, the City will always encourage property owners to enter into private cost-sharing agreements to finance needed capital improvement projects. These types of private arrangements are often preferred by property owners so that they may freely negotiate the design and construction planning, cost allocation and timing of payment.

12. **Assess impact fees/user fees/connection charges/system development charges. Under RCW 36.70B.170, t**he City, through its current budget, issuance of bonds, or certain other types of revenue sources, may construct certain types of improvements and assess impact fees and connection charges against new development projects. This allows the City to recover the costs incurred by the City in providing new or extended services to new developments. Such fees may be used by the City for such projects as public streets and roads; publicly owned parks, open space, and recreation facilities; and school facilities. These fees will be assessed per the requirements of the City Code. A property owner may receive credit against impact fees for costs incurred by the property owner. If any property is acquired by the City for improvements, then in addition to compensation for the property acquired, the property owner may also receive credit for a percentage of the value of acquired property assigned to a regional benefit or local benefit to other property.

13. **Increment Area Financing – Chapter 39.89 RCW.** This approach allows cities to designate an increment area, finance public improvements expected to encourage private development within the increment area and repay this financing with the additional regular property taxes generated by such private development.

Appendix A

Stream Relocation Evaluation – Shaw Group

EDGECOMB CREEK RELOCATION ALTERNATIVES ANALYSIS
Smokey Point Master Plan

Shaw Project Number 123768

June 2008

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Table of Contents

List of Figures

List of Tables

List of Attachments

1.0 Introduction

1.1 Background

The City of Marysville (City) annexed 675 acres of the Smokey Point Neighborhood, now designated as the Smokey Point Master Planning Area (MPA), north of the city limits (Figure 1 – Vicinity Map). To facilitate the future development of this area, the City intends has developed and will have adopted a Master Plan that will ensure that development occurs consistent with the City's vision of a high-tech industrial corridor. Part of the Smokey Point MPA includes the relocation of Edgecomb Creek, which runs northeast to southwest across the eastern edge of the MPA.

Edgecomb Creek is a tributary to Quilceda Creek, which discharges to Ebey Slough, a side channel of the Snohomish River. The geography of the Quilceda basin is dominated by the Marysville Trough, an expansive, nearly flat, alluvial plain stretching between the cities of Arlington to the north and Marysville to the south.

This plain is bordered by moderate to steep slopes rising to the gently sloping Tulalip and Getchell Hill plateaus to the east and west, respectively. The headwaters of Edgecomb Creek originate on the hillsides east of 67th Avenue NE and are fed by seeps and springs. This headwater channel provides good salmon spawning habitat, but is being degraded by impacts from adjacent land uses. Downstream of the steep slopes, Edgecomb Creek has been diverted from its historical path into a series of ditches to accommodate a railroad bed and agriculture.

The Smokey Point sub basin currently experiences flooding issues, primarily caused by the high groundwater levels. The plains contained extensive wetlands, but these were by and large eliminated about 100 years ago, when a system of ditches was created to drain fields, relocate channels, and lower the water table so lands could be used for agriculture. Groundwater contributes a significant portion of the summer baseflow, but also contributes to flooding and drainage problems. Due to the high groundwater table, many of the drainage issues are related to difficulties in providing adequate stormwater detention storage and infiltration. These problems are then exacerbated by the lack of slope to convey runoff from the ditches into the stream system.

Relocating the stream away from the ditches and into a more naturally-sinuous channel with a riparian corridor would benefit wildlife and stream habitat and provide an opportunity to integrate the stream with a regional approach to stormwater management.

1.2 Project Objectives

The purpose of this project is to identify alternative channel alignments for Edgecomb Creek and to develop conceptual-level plans for each alternative. Shaw Environmental, Inc. (Shaw) has developed two alternative channel alignments to fulfill project objectives. Both alternatives have similar channel designs. The first, or West Alignment, brings Edgecomb Creek to the west of the Burlington Northern Santa Fe Railway (BNSF), whereas the second, or East Alignment moves Edgecomb Creek to the east side of the BNSF right-of-way (ROW).

The relocation of Edgecomb Creek provides an opportunity to create habitat within a protected riparian corridor where none previously existed within the network of ditched stream channels. Flooding problems identified along the creek (Snohomish County, 2002) will be addressed by incorporating both a low-flow channel for year-round stream flow and a high-flow channel to convey the 100-year flood at future land use (i.e. built-out conditions). All existing and/or new crossings will be designed to convey flood waters and be passable by fish. Off-stream rearing habitat will be provided throughout the length of the restoration.

2.0 Existing Data

Existing hydrologic and hydraulic data were reviewed by Shaw. Snohomish County developed detailed hydrologic and hydraulic models to help quantify existing and future surface water conditions within the Quilceda Creek Basin, as well as to evaluate potential solutions to those identified problems (Snohomish County, 2002). Two sources of stream flow data were used in model development (Table 2-1). The hydrologic model determined the long-term flood frequency, flow duration, and runoff characteristics of the Quilceda Creek basin for existing and future developed conditions. The flood frequency results were used as input to the hydraulic model to estimate water surface elevations corresponding to specific return period flows (2-, 10-, 25-, and 100-year recurrence intervals) for existing and future land use conditions. The hydraulic models were also used to evaluate flooding issues resulting from insufficient conveyance capacity, evaluate fish passage conditions through culverts, and develop stage-storage-discharge tables for use in hydrologic modeling.

The outputs of these models allowed Shaw to determine channel and culvert design criteria. The 100-year flow event guided the high-flow channel size, whereas baseflow conditions determined the low-flow channel size. Predicted flooding and backwater problems from undersized or poorly-configured culverts identified appropriate size and locations where the culverts need to be upgraded.

Table 2-1
Stream Flow Data for Quilceda Creek Model

Station Name/Location	Source	Period of Record	Temporal Resolution
Middle Fork Quilceda	Snohomish County	Jan. 2000 to present (at time of report publication), report completed 2002, not known if data collection continued	15 minute
West Fork Quilceda	Snohomish County	April 1994 to present (at time of report publication), report completed 2002, not known if data collection continued	15 minute

3.0 Edgecomb Creek Relocation Alternatives

As stated previously, two conceptual alternative channel alignments have been identified and developed for Edgecomb Creek: the West Alternative and the East Alternative. Each alternative has several common concepts, including:

- Creation of 100-year flood capacity in the high-flow channel at anticipated built-out conditions
- Construction of a low-flow channel for year-round stream flow
- Placement of in-stream large woody debris (LWD) for habitat
- Installation of native vegetation throughout the channel and buffer
- Retention of 100 to 150 foot buffers on each side of the Creek along the entire project length
- Construction of off-channel rearing habitats
- Creation of connection to some of the hillside streams north of 162nd Street NE

In addition to the two alternatives, an add-on component is proposed that could be paired with either of the two alternatives: acquisition of land and/or easements on properties bounded to the east by the railroad, to the west and north by Olaf Strad Creek (existing location) and to the south by the housing development along Timberbrook Drive. The benefit of this component is creation of a regional detention/wetland mitigation/parkland area.

3.1 West Alternative – Alignment to the West of the Railroad Tracks

3.1.1 Description

The West Alternative would essentially emulate the preliminary design developed by Higa Burkholder[1] (HB) (see Attachment 1 for complete set of plans) where Edgecomb Creek would remain west of the railroad ROW (Figure 2-A). The HB design includes a 200-foot riparian buffer along the creek, whereas the City of Marysville Municipal Code (MMC 19.24.230) requires a 300-foot buffer (150 feet on each side) for a Type F stream. This alternative includes a 300-foot-wide riparian buffer corridor. The north end of the stream alignment flows from the City of Arlington, which requires only a 100-foot buffer on both sides of the stream; Snohomish County Code (SCC) would classify the Creek as a Type 3 stream [SCC 30.62.300 (1)] and SCC 30.62.310 (1) requires 100 foot buffers. The final width of the riparian corridor in this area would likely be negotiated during permitting. The existing ditch network would be filled or used

1 The HB designs are not at the 100 percent design phase, so some changes will be needed (e.g., such as buffer width, planting plans, railroad crossing.). Therefore, Shaw does not imply endorsement of the completeness of the design or its concepts.

for stormwater conveyance, and Edgecomb Creek would be realigned into a meandering stream channel and floodway with a riparian corridor buffer parallel to the railroad ROW. A new culvert crossing beneath 152nd Street NE would be constructed closer to the ROW to accommodate the new stream alignment and upstream and downstream migration of salmonids. Downstream of 152nd Street NE the Creek would continue to meander along the railroad ROW and cross under it at an upgraded culvert that is just north of the current creek railroad crossing. The result would be a total of four fish-passable crossings (two road crossings, two railroad crossings) for the reach of Edgecomb Creek within the project area.

Several hillside streams east of 67th Avenue NE are routed along 67th Avenue NE and merge with Olaf Strad Creek. Streams to the north of 162nd Street NE currently pass under 67th Avenue NE and flow into the northernmost east-west ditch, as identified during a Shaw site visit. The culvert at the 162nd Street NE/67th Avenue NE crossing was completely submerged on December 12, 2006. The drainage maps provided by the City of Marysville do not indicate a culvert/road crossing at this location, where water flows west through the ditch across open fields toward the railroad ROW before flowing south and merging with Olaf Strad Creek. Under the West Alternative, a new crossing beneath the ROW would bring the water from this ditch west of the railroad to combine with Edgecomb Creek.

Under the West Alternative, the existing ditch network east of the railroad would need to be plugged in some places and screened in other places to maintain drainage of the agricultural fields and restrict fish access to dead-end ditches. The existing ditch portion that parallels the railroad ROW would be plugged at the north end to prevent flow from heading south on the east side of the tracks and would be screened to prevent fish entry according to Washington Department of Fish and Wildlife (WDFW) Hydraulic Project Approval (HPA) guidelines on the south end. The tributary/stormwater ditch that parallels 144th Street NE would be screened to inhibit upstream movement of fish to the stormwater ditches along 51st Avenue NE, which will become disconnected from Edgecomb Creek's main channel. The ditches will continue to convey surface water to the Creek.

It is assumed that collected stormwater from the planned development to the west will be detained and treated and then released to Edgecomb Creek at several points along the new alignment. A combination of on-site detention and lateral drainage swales is expected, but has not been shown on Figure 2-A.

3.1.2 Analysis

The existing channel of Edgecomb Creek is ditched the entire length of its current alignment to the west of the railroad tracks and flows through agricultural fields and grazing areas. Habitat diversity is nominal, grazing animals have access, and the fields are often plowed to the Creek edges. Riparian buffers are nonexistent, provide no shade to the channel and there is no small or

large woody debris (LWD). Installation of LWD in the channel will provide instream cover and improve channel complexity. Riparian plantings will eventually increase the function of the riparian zone and provide overhead cover and a future source for woody debris recruitment. As the riparian plantings mature, the planted corridor would likely moderate summer water temperatures in Edgecomb Creek. Advantages and disadvantages are discussed below and summarized in Tables 5-1 and 5-2.

A significant advantage of this alternative is that HB has completed preliminary design work for the west alignment and affected property owners support the proposed design. This alternative would also result in the lowest loss of stream linear footage because the creek would not require Olaf Strad Creek to be realigned or combine with some its tributary ditch network (See Figure 2-A for specific tributaries affected). Connecting some hillside streams to Edgecomb Creek increases available spawning habitat and would likely augment summer low flows because these hillside streams are fed by seeps and springs (Snohomish County, 2002). Another benefit is that the stream mitigation area would be located entirely within the MPA.

Several limitations exist for the West Alternative.

- The resulting stream would be close to planned commercial development.
- Existing land where the Creek would be located has little wetland and no native vegetation; therefore, riparian habitat development would take many years.
- Significant construction costs include upgrading two crossings under the railroad ROW, creating a new railroad crossing for the hillside streams, and creating a new crossing at 152nd Street NE. It is expected that obtaining permission from BNSF to upgrade the existing crossings and to create a new crossing under the ROW would be difficult. Prior coordination with BNSF would be necessary before selecting this alternative.
- This alignment includes the greatest number of road crossings: one crossing under 67th Avenue NE, two railroad crossings for Edgecomb Creek, one railroad and one road crossing for the hillside streams, and an additional crossing at 152nd Street NE. Crossings are summarized and compared with the East Alternative in Table 5-1.
- Additional hydrologic modeling would be required to determine if the added flows from the hillside streams would cause flooding problems downstream of the railroad crossing south of 152nd Street NE. Connecting some hillside streams with Edgecomb Creek would reduce flows to the ditched portions of Olaf Strad Creek.

3.1.3 Estimated Costs

Conceptual level cost estimates have been developed for each alternative and are presented in detailed cost summary tables in Attachment 2. It is not yet clear who is responsible for land acquisition or easement costs as mitigation for the relocation of Edgecomb Creek: the landowners, the City of Marysville, or a combination of the two; furthermore, market changes may affect land cost. Although Shaw's research suggests that land west of railroad is more than nine times the value of land east of railroad, the cost element is not a part of this analysis. Additionally, HB has already completed the initial design for the new alignment; however, Shaw has included engineering costs in the total cost because further designs/analysis will be required (this cost is approximately the same between the two alternatives, and a significant amount of the HB design could be used in the eastern alignment). Other than land costs, the total estimated cost of the West Alternative is $423,000. The largest cost elements are identified below (prices rounded to the nearest $1,000):

- Land acquisition (60 acres) – TBD
- Earthwork (55,000 cubic yards) – $218,000
- Riparian buffer planting (60 acres) – $149,000
- Habitat structures – $56,000

The cost estimate does not include the costs associated with the project maintenance and monitoring or for erosion control during construction. However, this component is common to both alternatives and would not differ significantly between the two. Costs are summarized and compared with the East Alternative and Add-On Alternatives in Table 5-3.

3.1.4 Summary

The West Alternative meets the objectives of the project: to locate the stream away from anticipated development. It is the more expensive option of the alternatives developed and without land cost, is more than the East Alternative. The West Alternative would place the Creek closest to commercial development and does not easily lend itself to potential opportunities for increasing the riparian corridor by pairing it with the Add-On Alternative presented. However, it does have the advantages of already having preliminary designs prepared by HB and being supported by land owners in the mitigated area.

3.2 East Alternative – Alignment to the East of the Railroad Tracks

3.2.1 Description

The East Alternative would have a stream/floodplain configuration similar to its western counterpart, but would follow the railroad ROW on its east side (Figure 2-B). A 300-foot-wide riparian buffer corridor would be established east of the ROW and the stream channel would

meander through a riparian corridor, with a configuration similar to that shown on the HB plans (see Attachment 1 for complete set of plans).

The north end of the stream alignment enters the project area within the City of Arlington; Arlington and Snohomish County regulate Edgecomb Creek as a Type 3 stream and require a 100-foot buffer on both sides of the stream. The final width of the riparian corridor in this area will likely be negotiated during permitting. The creek would not maintain its current road crossing under 67th Avenue NE or the railroad crossing on the north end of the project area. Instead, Edgecomb Creek would be redirected to meander south through the existing palustrine emergent and seasonally flooded scrub-shrub wetland along the east side of 67th Avenue NE and cross under 67th Avenue NE at an existing 24-inch submerged culvert just north of 168th Street NE. This culvert would require upgrading to convey water from a 100-year flood event and be fish-passable. A drainage ditch, which is next to 67th Avenue NE, and two low-profile, unpaved driveways are located along this route. Eighteen-inch culverts pass under the driveways to convey surface water through the roadside ditch. The roadside ditch would remain, but a new channel would be excavated for Edgecomb Creek well east of the ditch. The two driveways would require new culverts farther east of the ditch to convey Edgecomb Creek. All new culverts would be designed to pass adult and juvenile salmonids. Since they are at a lower elevation than 67th Avenue NE, the driveways may need substantial improvement to allow for culvert placement (Figures 3 and 4).

After crossing under 67th Avenue NE just north of 168th Street NE, the relocated section of Edgecomb Creek would continue southward in a meandering pattern, with the general direction parallel to the railroad ROW, where it would intercept the flows from an Olaf Strad tributary ditch. The current tributary ditch that runs parallel to the ROW would be backfilled with material from the creek excavation. A new road culvert crossing would be constructed under 152nd Street NE. Edgecomb Creek would ultimately connect to its existing channel to the east of the railroad tracks, south of 152nd Street NE and just north of the housing development (at Timberbrook Drive). The result would be a total of four fish-passable road crossings for the reach of Edgecomb Creek within the project area; no railroad ROW crossings would be required for this alternative.

To prevent entry of fish into the stormwater ditches along 51st Avenue NE, the tributary/stormwater ditch that parallels 144th Street NE would be screened as per WDFW HPA guidelines. The stormwater ditches along 51st Avenue NE will become disconnected from Edgecomb Creek's main channel, but will continue to convey surface water to the creek.

Near the railroad tracks where Olaf Strad Creek is ditched and moves due south, away from the railroad, a short portion of Olaf Strad Creek would be moved to parallel the eastern edge of the Edgecomb Creek riparian buffer. This would prevent Olaf Strad and Edgecomb Creeks from

combining and reconnect Olaf Strad with its existing channel to the south; this is labeled as Olaf Strad ditch bypass on Figure 2-B.

Although approximately 100 linear feet of ditched creek would be eliminated, there is the opportunity to construct the thread of the relocated Creek in a sinuous fashion to increase linear feet to approximate that lost. Furthermore, new riparian zone plantings will markedly improve habitat compared to the existing condition; such plantings will be supported by underlying hydrology in addition to hydrologic influences of the Creek. The option is discussed in more detail in the analysis.

The Creek system would ultimately benefit from its association with an enhanced riparian corridor, which will provide shade to moderate stream temperatures and provide a future source for woody debris recruitment to the channel.

This alternative also constructs a system of water quality drainage swales to convey and treat stormwater from the proposed development to the west, in the MPA. The main water quality swale would be located in a linear corridor (30 feet wide) adjacent to and parallel with the west side of the railroad ROW. Secondary lateral swales would convey stormwater from detention vaults or ponds on developed sites east to the main water quality swale. After flowing through the water quality swale, the stormwater would be conveyed to the east side of the railroad through a currently-dry existing 30-inch culvert (located approximately 800 feet north of 152nd Street NE) into the newly created stream channel.

3.2.2 Analysis

Advantages and disadvantages are discussed below and summarized in the Tables 5-1 and 5-2. Relocating Edgecomb Creek to the east of the railroad ROW provides significant advantages:

- The benefits of woody debris installations and riparian plantings would be as described in the West Alternative.
- Keeping Edgecomb Creek relocation outside of the MPA would allow for the opportunity to develop an extra 54 acres of the high-value land within the MPA.
- Combining flows of Edgecomb Creek and the hillside creeks improves access to upstream spawning habitats and might result in higher summer baseflow conditions.
- The proposed alignment east of the railroad would take the stream through areas of existing wetlands and native vegetation, which would provide immediate shade and wildlife habitat benefits.

- Two railroad crossings would be eliminated;

- Improving fish migration and reducing BNSF coordination and infrastructure upgrade costs.

- The eastern alignment of Edgecomb Creek would be farther from planned commercial development, which would result in less potential disturbance to the stream corridor. Additionally, the potential exists for moving the creek farther east from the railroad if larger portions of properties are purchased.

- Future wetland mitigation projects could also be constructed in the open fields east of and adjacent to the riparian corridor, which could further enhance the wildlife habitat and water quality functions of the area.

The disadvantages of this alternative are fewer than those of the West Alternative. Land use issues are less clear, and up-front coordination and public outreach would be required to determine if this alignment is a politically-feasible option. Interception of the existing drainage ditch network to the north of Olaf Strad Creek could reduce flows in Olaf Strad/Middle Fork Quilceda (MFQ) Creeks. Combining the flow of Edgecomb with this ditch would also eliminate additional marginal fish habitat contained in the ditch running along the railroad. This ditch did not appear to have flow during a Shaw site visit on October 24, 2006. Construction of a new culvert crossing at 152nd Street NE would be necessary. A slight increase in costs would be associated with the realignment of Olaf Strad Creek, which contains habitat similar to Edgecomb Creek.

The existing ditched thread of Edgecomb Creek within the project area is approximately 10,870 lineal feet, with a maintained nominal width of 4 feet and nearly-vertical to 2:1 side slopes. The initially-proposed Creek relocation along the east side of the railroad ROW (based on the HB design: 4:1 slopes, 10 foot bottom 100-year flood channel width, 25 foot top channel width, with 100 foot buffers) is approximately 9,110 feet in length, but markedly increases the total channel area.

There is sufficient area to introduce a meander (based on the HB design) to a segment of the relocated Creek, starting at 67th Avenue NE and intersecting the originally-proposed East Alternative relocation thread just north of Olaf Strad Creek. The meander would add approximately 1550 lineal feet to the relocated Edgecomb Creek system, for a net gain of 265 lineal feet, compared to the original thread of the Creek. Additional analysis and design would be needed for this design element. The land in this area is currently used for farming and exhibits characteristics that indicate it may be degraded wetland, although this is based on field reconnaissance rather than a completion of a wetland delineations. Therefore it is likely that

developing a sinuous channel would involve some wetland impacts. Discussions with applicable regulatory agencies would be needed to balance interests in maintaining linear feet of stream channel versus avoiding wetland impacts.

Based on the functions presented in the HB design, and compared with the existing, maintained thread of the Creek, it is understood that a minimum of 9,110 lineal feet of the new channel provides significantly greater opportunities to promote more natural ecological and hydrologic processes. This increase in function would be achieved through riparian plantings for shading, installation of LWD for fish habitat, construction of off-channel rearing habitat and construction of a low flow channel for year-round stream flow, coupled with creation of 100-year flood capacity in a high flow channel. Addition of a 1,550 lineal foot meander to a segment of the Creek provides further area for increased functions.

Additional modeling would be required to determine if the added flows from the hillside streams and a portion of the Olaf Strad ditch network would cause flooding problems in Edgecomb Creek downstream of the railroad crossing south of 152nd Street NE.

Realigning Olaf Strad Creek (Olaf Strad ditch bypass on Figure 2-B) would result in a loss of approximately 230 linear feet of Olaf Strad Creek. It is unknown if regulating agencies would take issue with a nominal reduction in the lineal feet of stream channel length; the affected area is ditched and has minimal habitat value, and creation of a more structurally-complex riparian corridor would be a portion of the Alternative design in this area, similar to that envisioned for the relocation of Edgecomb Creek. As a result, it is possible that additional costs may be incurred due to potentially-increased mitigation planning and implementation; permitting negotiations, and slightly increased fish rescue efforts when the old Olaf Strad channel is abandoned.

The analysis does not include the additional mitigation related to relocation of the Edgecomb tributary adjacent to 51st Avenue NE. The East Alternative does have additional area identified for providing additional mitigation area and if selected, will be amended to address this component.

3.2.3 Estimated Costs

Conceptual-level cost estimates have been developed for each alternative and are presented in detailed cost summary tables in Attachment 2. Similar to the West Alternative, land acquisition/easement costs have not been factored into the analysis: Since both the western and eastern alignments are generally analogous, a majority of the HB design for the new alignment could be applied to the East Alternative, e.g. stream size, meander patterns, pipeline crossing. However, since further designs/analysis will be required, Shaw included engineering costs in the total cost. The total estimated cost of the East Alternative is $454,000. The largest cost elements are identified below (prices rounded to the nearest $1,000):

- Land acquisition (61 acres) – $TBD
- Earthwork (61,000 cubic yards) – $244,000
- Riparian buffer planting (60 acres) – $149,000
- Habitat structures – $61,000

The cost estimate does not include the costs associated with the project maintenance and monitoring or for erosion control during construction. However, this component is common to both alternatives and would not differ significantly between the two. Costs are summarized and compared with the West Alternative and Add-On Alternatives in Table 5-3.

3.2.4 Summary

The East Alternative meets the objectives of the project of locating the stream away from anticipated development. It has significant advantages over the West Alternative. Fewer road crossings are needed, and most importantly, none would involve the BNSF railroad. This would considerably reduce time and cost required for coordination with BNSF for upgrading and creating new railroad crossings. Because the new stream channel would be routed through an existing scrub-shrub wetland east of 67th Avenue NE and through existing scrub-shrub and emergent wetlands on the north end of the alignment west of 67th Avenue NE, the quality of habitat is expected to be higher with implementation of the East Alternative. The north end of the stream would have a riparian corridor consisting of shrubs and trees, and the shading and organic inputs would be available immediately. Additional habitat benefits would be expected because the new stream channel would encounter a decreased potential for disturbance since it will be farther from the planned commercial development west of the railroad.

3.3 Add-On Alternative – Acquire Land in Area Bounded by BNSF Railroad to the West and MPA Area to the East and Southward (outside of MPA area) to Housing Development at Timberbrook Drive

3.3.1 Description

The Add-On Alternative could be paired with either the West or East Alternative alignment options for Edgecomb Creek. The Add-On could be implemented either in the future, when more funding is available, or concurrently with the selected West or East Alternative. The conceptual plan is to build a regional stormwater detention facility to store stormwater and reduce peak flows. Wetlands would be restored and created to be used as mitigation for wetland impacts from the development in the MPA area, west of the railroad.

Edgecomb Creek would flow through this area and an expanded floodplain could be built to provide additional surface water storage during storm events. High flow diversion structures would be installed to direct floodwaters out of the stream channel and into the floodplain,

providing downstream protection outside of the project area. Off-channel habitats and riparian plantings would improve habitat conditions compared to the depressed existing condition. Existing wetlands in the southwest portion of the property could be enhanced by removing non-native, invasive vegetation and planting native shrubs and trees. The adjacent Strawberry Fields Park could be improved to include a wetland interpretation area and trail system. This portion of the MPA is somewhat isolated from adjacent areas due to the railroad ROW on the west and lack of road access to the east. Therefore, this area may have lower demand for future development than the area west of the railroad. Additional plans could include relocating MFQ to flow through the area to enhance stream habitat conditions and to provide increased floodplain storage.

3.3.2 Analysis

3.3.2.1 Add-On Paired with West Alternative

Significant uncertainties exist if the Add-On and West Alternatives are combined. One uncertainty is that of timing: implementation of the option during construction of the West Alternative or implementation at some time in the future. To take advantage of the available area it would be optimal to bring the creek to the east side of the railroad farther upstream than what is currently proposed in the HB plan. The existing, unused railroad culvert 800 feet north of 152nd Street NE could be used for this purpose, although it is likely the culvert would need to be resized or upgraded to accommodate future stormwater increases or to address fish passage requirements.

If Add-On implementation occurred after the Edgecomb Creek relocation/mitigation, then the newly-enhanced creek west of the railroad ROW would be effectively abandoned and a section of new creek channel would be created east of the ROW. It is not known if regulating agencies would allow the Creek to be moved out of a previously-mitigated area. Construction costs would be higher as well, because the affected portion of the creek would be relocated twice. It would also be necessary to create a new road crossing at 152nd Street NE on the east side of the ROW, thus eliminating the previously-constructed road crossing at 152nd Street NE on the west side of the ROW.

3.3.2.2 Add-On Paired with East Alternative

Combining the Add-On with the East Alternatives would be less costly than with the West Alternative, because the creek would already be located on the same side of the railroad ROW. The Add-On Alternative could be constructed in the future as a second phase of the overall creek relocation without abandoning any of the newly-created channel. The overall action area would be smaller because the Creek and riparian buffer land would have already been purchased. The connectivity of the Creek riparian corridor and created/enhanced wetlands would establish a

more vitally-functioning ecosystem which also has the dual purpose of stormwater storage and treatment.

3.3.3 Estimated Costs for Add-On

3.3.3.1 Add-On West – Implemented in conjunction with West Alternative Construction

Conceptual-level cost estimates have been developed for each Add-On alternative and are presented in detailed cost summary tables in Attachment 2. It is assumed that construction costs would be the same as for the West Alternative, because the total length of constructed stream channel would be the same and the same number of crossings would be built, just in different locations, i.e., BNSF crossing would be upgraded at an existing culvert, just farther upstream and the new crossing at 152nd would be on the east side of the railroad. Land costs would increase at an indeterminate level, compared to the stand-alone West Alternative, because it would be necessary to acquire additional land. The total estimated cost of the West Alternative combined in conjunction with the Add-on is $423,000. The largest cost elements are identified below (prices rounded to the nearest $1,000):

- Land acquisition TBD
- Earthwork (55,000 cubic yards) – $218,000
- Riparian buffer planting (60 acres) – $149,000
- Habitat structures – $56,000

Without considering land acquisition costs, combining the Add-On in conjunction with the West Alternative is unchanged compared to the stand alone West Alternative costs, but has the added value of acquiring 52 acres of land that incorporates all of the benefits as detailed above. Refer to Section 3.1.3 for complete discussion of land value assessment.

3.3.3.2 Add-On West – Implemented at a later date following West Alternative Construction

Conceptual level cost estimates have been developed for each Add-On alternative and are presented in detailed cost summary tables in Attachment 2. Implementing the Add-On with the West Alternative after the West Alternative has been constructed increases costs considerably because a number of features will be required to be constructed a second time, e.g., another railroad crossing upgrade, a new road crossing on the east side of 152nd, and new stream channel in the Add-On area. The total estimated cost of the Add-On, not including original construction or land costs for either the West Alternative or the Add-On is $92,000. The largest cost elements are identified below (prices rounded to the nearest $1,000):

- Land acquisition (52 acres on east side of railroad) – TBD
- Earthwork (10,000 cubic yards) – $39,000

- Riparian buffer planting (15.5 acres) – $39,000
- Habitat structures – $14,000

The total cost for the West Alternative combined with the Add-On at a later date is $515,000.

3.3.3.3 Add-On East

Conceptual level cost estimates have been developed for each Add-On alternative and are presented in detailed cost summary tables in Attachment 2. The only added cost is for acquiring an additional 31 acres of land, that would need to be annexed, on the east side of the railroad; land value has not been included in this evaluation, but it is understood that land cost east of the railroad ROW would be significantly less than that for the area to the west.

The total cost for the East Alternative combined with the Add-On at a later date is therefore limited to current land cost, and relative appreciation in land value based on market conditions.

3.3.4 Summary

The Add-On feature has several benefits that make it worthy for consideration. Lesser land costs outside of the MPA on the east side of the railroad provide a significant incentive for use of this area for locating a regional detention facility. Edgecomb Creek's floodplain could be enlarged to provide further stormwater storage opportunities and protect downstream properties. Existing wetlands could be enhanced and adjacent Strawberry Fields Park could be improved to include a wetland interpretation area and trail system. Furthermore, a large area of land would be protected from future development, preserving a unique ecological setting and wildlife habitat area within a growing city.

Ultimately, it is advisable to combine the Add-On with the East Alternative or in conjunction with the construction of the West Alternative. Including the Add-On with the East Alternative would simply require the acquisition of an additional 31 acres in the area identified on Figure 2-B. Joining the Add-On in conjunction with the West Alternative is a unique solution that takes advantage of existing property owner support of the West Alternative and results in the acquiring of an additional 52 acres of land for use as a regional detention facility. Combining the Add-On with the West Alternative at a later date is inadvisable from a financial perspective, and it would most likely be difficult to implement because regulating agencies could likely take issue with the abandonment of a portion of a previously-mitigated creek area. Costs are summarized for the Add-On Alternatives in Table 5-3.

4.0 Future Hydrology and Hydraulic Data Needs

The hydrology and hydraulics of both Edgecomb and Olaf Strad Creeks will be affected by the Alternatives presented. The hillside streams currently flow into Olaf Strad Creek. Changing their route to flow into Edgecomb Creek would increase flows in Edgecomb Creek and reduce flows in Olaf Strad Creek. This increase in flows in Edgecomb Creek could result in sufficiently large changes in baseflow and stormflow conditions to result in the need to enlarge the proposed size and geometry for Edgecomb Creek. Conversely, reducing the inputs into Olaf Strad Creek could potentially cause baseflow conditions to be too low during the dry season to support what fish populations now exist there. However, portions of Olaf Strad Creek already either appear to dry up or experience low dissolved oxygen conditions during the summer months, making this a moot point. Hydrologic modeling for these unknowns would be necessary prior to implementing either alternative. Hydraulic analysis at creek crossings downstream of these new inputs would also be required to determine if the proposed culvert sizes are still appropriate and if flooding problems would be created in the stream channel located in the housing development upstream of the Edgecomb-MFQ confluence. No hydrologic or hydraulic changes would occur downstream of this confluence.

5.0 Summary and Recommended Realignment Alternative

The two alternatives presented in this report would both result in significant improvements over the existing conditions of fish and wildlife habitat in Edgecomb Creek. Both alternatives are feasible and would move the stream out of the existing ditch network and away from planned development. The alternatives would create a meandering stream channel and adjacent floodplain that would add off-channel fish habitat, provide improved fish access to the upper reaches of Edgecomb Creek east of 67th Avenue NE, improve thermal and chemical water quality, and improve surface water conveyance.

Although both alternatives would improve conditions in Edgecomb Creek, the East Alternative has a number of advantages over the West Alternative (Table 5-1). The advantages are primarily associated with the quality of fish and wildlife habitat and the overall cost of the project. The quality of habitat is expected to be higher under the East Alternative because the new stream channel would be routed through an existing scrub-shrub wetland east of 67th Avenue NE and through existing scrub-shrub and emergent wetlands on the north end of the alignment west of 67th Avenue NE. The north end of the stream would have a riparian corridor consisting of shrubs and trees and the shade and organic inputs would be available immediately. Additional habitat benefits would be expected because the new stream channel would be farther from the planned commercial development west of the railroad, which would result in a decreased potential for disturbance.

Further wildlife benefits would be realized if the Add-On Alternative were to be constructed, because the new riparian corridor would be immediately adjacent to created and restored wetlands and ponds. The East Alternative's location would also keep open the possibility of future wildlife habitat improvements adjacent to the riparian corridor. The farmland east of the riparian corridor could potentially be used for wetland and stream mitigation and restoration needed to offset future development of the area. Locating future mitigation sites adjacent to the East Alternative riparian corridor would further enhance wildlife habitat and water quality functions and provide wildlife corridor connections between Edgecomb, Olaf Strad, and MFQ Creeks.

The construction costs for both alternatives are expected to be similar, but the overall project costs are expected to be lower for the East Alternative (Attachment 2). The expected lower costs for the East Alternative are associated with anticipated lower land values. If the Add-On Alternative under the East Alternative were selected, the difference in costs between the alternatives would be even greater because much of the land associated with the East Alternative Add-On would already be included in the new riparian corridor. The East Alternative would also retain 54 acres of the high-value land west of the railroad ROW for potential development.

For the reasons summarized above, the East Alternative would result in greater ecological benefits and would cost less than the other alternative. The increase in ecological benefits should facilitate obtaining agency approval for the project and the lower overall cost should help with securing necessary funds. The opportunity to retain more of the high value land for development within the MPA and the potential for ultimate sales of conservation easements on land east of the railroad should aid in receiving land owner approval of the project.

However, following initial meetings with the property owners, it was clear that they favored the West Alternative based largely on property ownership of this alignment. Additional features can be added to the West Alternative to make it comparable to the East Alternative from an environmental and freight mobility standpoint. The MPA mitigation approach identifies key features that must be a component of the selected alternative, which could be either the East or West Alternative.

Table 5-1
Summary of Conceptual Alternative Realignment Options

Option	West Alternative	East Alternative	West Add-On Alternative	East Add-On Alternative
Construction Cost	+			+
Land Cost	+			+
Design Cost	+			+
In-stream Habitat		+		+
Number of Road /Railroad Crossings on Edgecomb	6	5	2	0
Riparian Habitat Corridor		+		+
Regional Detention		+	+	+
Property Owner Support	+			
Potential For Riparian &/or Wetland expansion		+		
Maximize developed area in MPA area		+		

Note: + indicates relative advantage over other alternatives.

Table 5-2
Summary of Creek Crossings for Alternatives (includes main channel and headwater tributaries)

Option	West Alternative	East Alternative	West Add-On Alternative	East Add-On Alternative
Total number of crossings	6	5	2	0
Number of road crossing upgrades	1	2		0
Number of new road crossings	1	3	1	0
Number of railroad crossing upgrades	1	0		0
Number of new railroad crossings	1	0	1	0
Number of existing crossings with no upgrades needed	2	0		

Table 5-3
Summary of Alternative Implementation Costs

	West Alternative	East Alternative	Add-On West, in conjunction	Add-On West, at a later date (in addition to West Alt. costs)	Add-On East
Cost (rounded to nearest $1,000)	$423,000	$454,000	$423,000	$515,000	no-cost

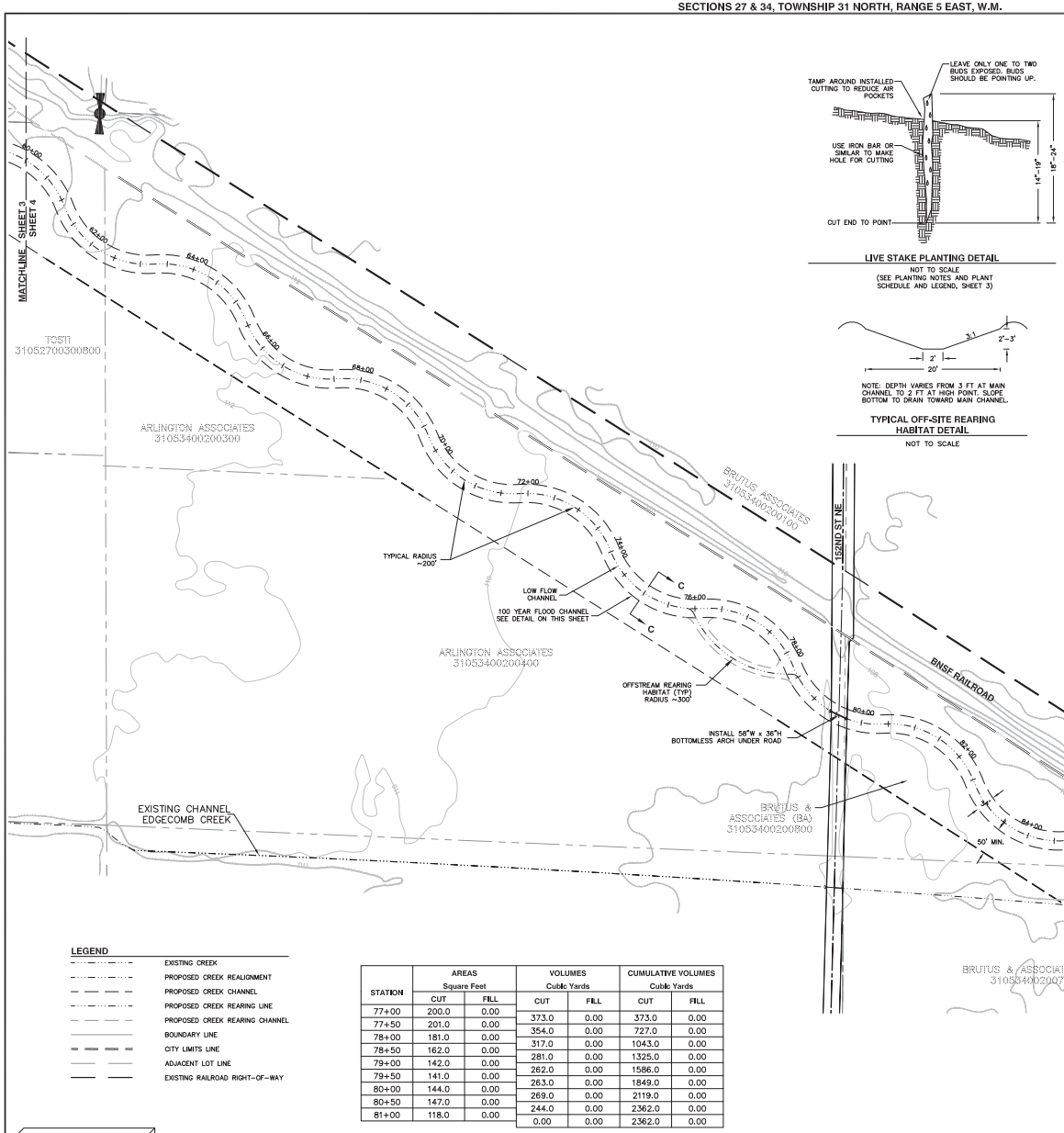
6.0 References

Snohomish County, 2007, Assessor's Office web site, <http://www1.co.snohomish.wa.us/Departments/Assessor/>, accessed 2007.

Snohomish County, 2002, "Quilceda Creek Drainage Needs Report (DNR #1)," Public Works Surface Water Management Division, Everett, WA.

Attachment 1
Higa Burkholder Preliminary Design Plan

SECTIONS 27 & 34, TOWNSHIP 31 NORTH, RANGE 5 EAST, W.M.



LIVE STAKE PLANTING DETAIL

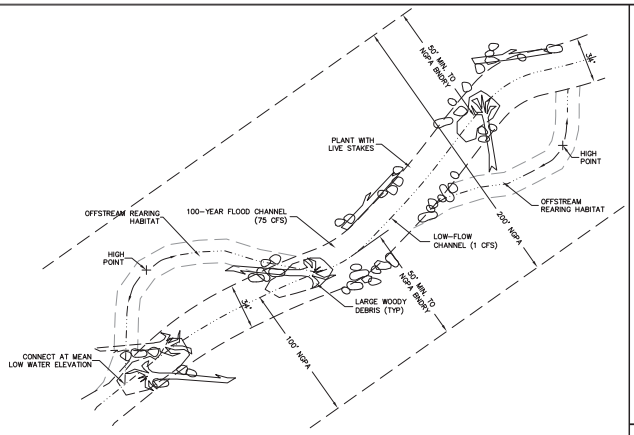
NOT TO SCALE

(SEE PLANTING NOTES AND PLANT SCHEDULE AND LEGEND, SHEET 3)

NOTE: DEPTH VARIES FROM 3 FT AT MAIN CHANNEL TO 2 FT AT HIGH POINT. SLOPE BOTTOM TO DRAIN TOWARD MAIN CHANNEL.

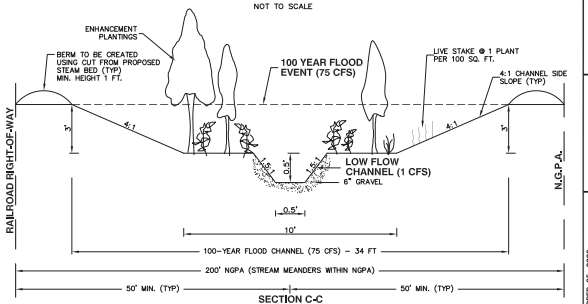
TYPICAL OFF-SITE REARING HABITAT DETAIL

NOT TO SCALE



TYPICAL CONCEPTUAL STREAM RESTORATION DETAIL

NOT TO SCALE



SECTION C-C

TYPICAL CONCEPTUAL STREAM RESTORATION DETAIL STATION 75+00

NOT TO SCALE

LEGEND

- EXISTING CREEK
- PROPOSED CREEK REALIGNMENT
- PROPOSED CREEK CHANNEL
- PROPOSED CREEK REARING LINE
- PROPOSED CREEK REARING CHANNEL
- BOUNDARY LINE
- CITY LIMITS LINE
- ADJACENT LOT LINE
- EXISTING RAILROAD RIGHT–OF–WAY

STATION	AREAS Square Feet		VOLUMES Cubic Yards		CUMULATIVE VOLUMES Cubic Yards	
	CUT	FILL	CUT	FILL	CUT	FILL
77+00	200.0	0.00	373.0	0.00	373.0	0.00
77+50	201.0	0.00	354.0	0.00	727.0	0.00
78+00	181.0	0.00	317.0	0.00	1043.0	0.00
78+50	162.0	0.00	281.0	0.00	1325.0	0.00
79+00	142.0	0.00	262.0	0.00	1586.0	0.00
79+50	141.0	0.00	263.0	0.00	1849.0	0.00
80+00	144.0	0.00	269.0	0.00	2119.0	0.00
80+50	147.0	0.00	244.0	0.00	2362.0	0.00
81+00	118.0	0.00	0.00	0.00	2362.0	0.00

SCALE: 1" = 100'

0 50' 100' 200'

CONTOUR INTERVAL = 2 FEET

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ISSUE DATE: OCTOBER 25, 2006
DESIGNED BY: JWC, JRM
DRAWN BY: AJE, DH
PLAN CHECK BY: JWC

DATE	REVISIONS	BY

CONSTRUCTION PLANS
EDGECOMB CREEK STREAM REALIGNMENT
EDGECOMB CREEK REALIGNMENT FROM STA. 60+00 TO 88+00

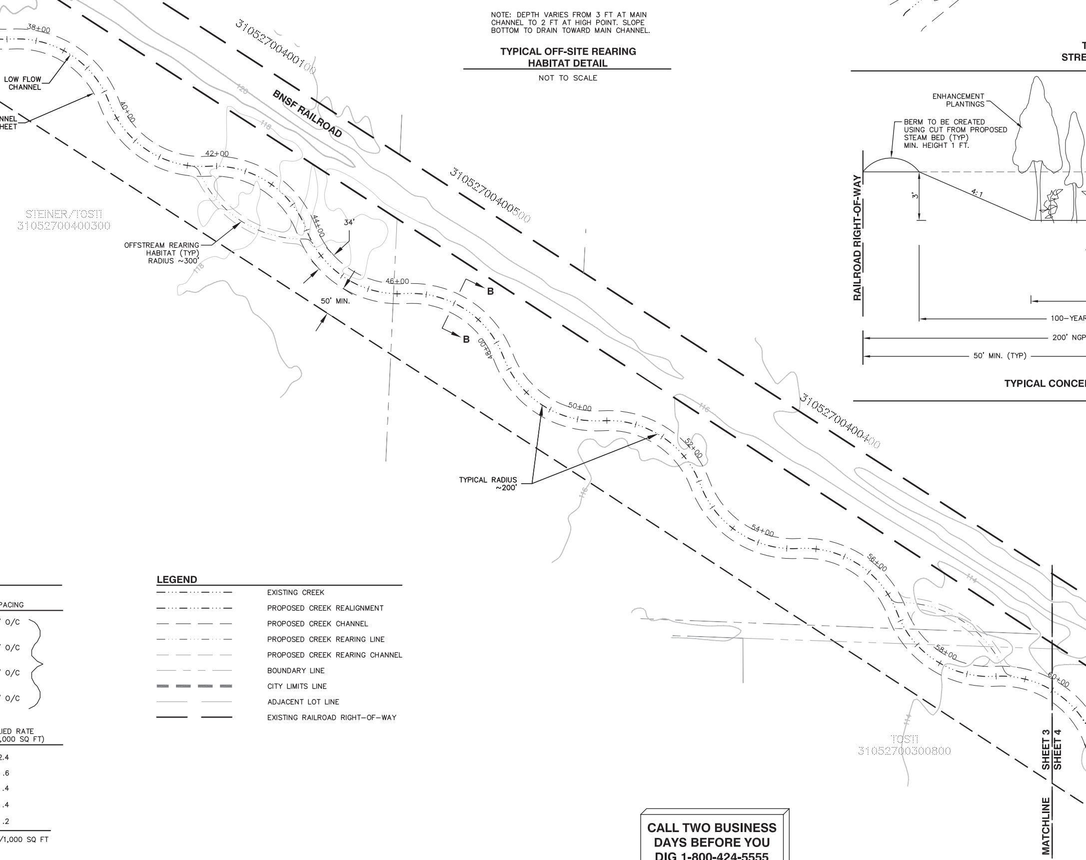
JOB NO. 1978

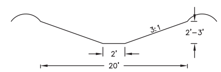
4/5

XREF: EDGECOMG, EDGECN-SURV2WG, EDGECN-TBK2WG

SECTIONS 27 & 34, TOWNSHIP 31 NORTH, RANGE 5 EAST, W.M.

STATION	AREAS Square Feet		VOLUMES Cubic Yards		CUMULATIVE VOLUMES Cubic Yards	
	CUT	FILL	CUT	FILL	CUT	FILL
45+00	179.0	0.00	338.0	0.00	338.0	0.00
45+50	186.0	0.00	351.0	0.00	689.0	0.00
46+00	193.0	0.00	364.0	0.00	1053.0	0.00
46+50	200.0	0.00	378.0	0.00	1431.0	0.00
47+00	207.0	0.00	376.0	0.00	1807.0	0.00
47+50	198.0	0.00	355.0	0.00	2162.0	0.00
48+00	185.0	0.00	331.0	0.00	2493.0	0.00
48+50	173.0	0.00	309.0	0.00	2802.0	0.00
49+00	160.0	0.00	0.00	0.00	2802.0	0.00

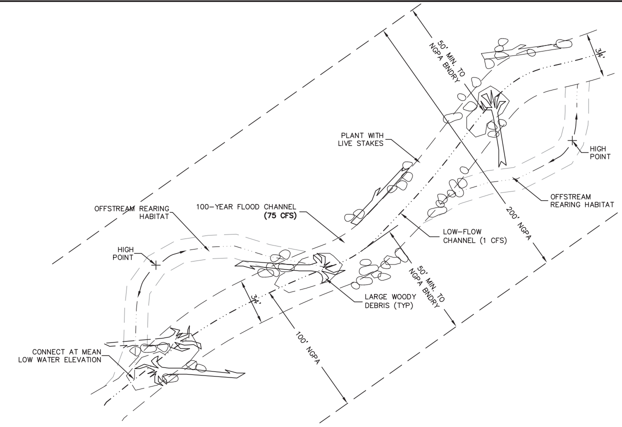




NOTE: DEPTH VARIES FROM 3 FT AT MAIN CHANNEL TO 2 FT AT HIGH POINT. SLOPE BOTTOM TO DRAIN TOWARD MAIN CHANNEL.

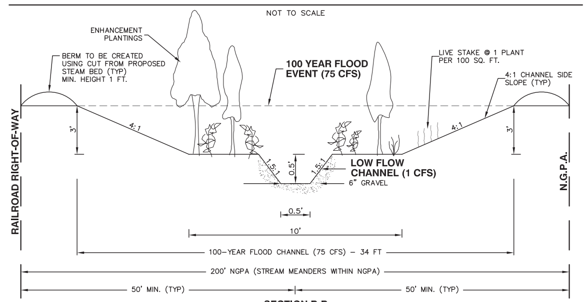
TYPICAL OFF-SITE REARING HABITAT DETAIL

NOT TO SCALE



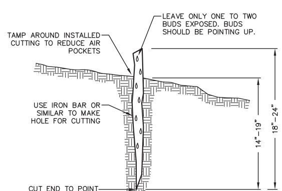
TYPICAL CONCEPTUAL STREAM RESTORATION DETAIL

NOT TO SCALE



SECTION B-B
TYPICAL CONCEPTUAL STREAM RESTORATION DETAIL
STATION 47+00

NOT TO SCALE



LIVE STAKE PLANTING DETAIL

NOT TO SCALE
(SEE PLANTING NOTES AND PLANT SCHEDULE AND LEGEND, THIS SHEET)

PLANT SCHEDULE AND LEGEND

LIVE STAKES	SCIENTIFIC/COMMON NAME	INSTALL SIZE	SPACING
	SALIX LASIANDRA (PACIFIC WILLOW)	18"–24"	6' O/C
	SALIX SITCHENSIS (SITKA WILLOW)	18"–24"	6' O/C
	CORNUS STOLONIFERA (RED OSIER DOGWOOD)	18"–24"	6' O/C
	POPULUS TRICHOCARPA (BLACK COTTONWOOD)	18"–24"	6' O/C

HYDROSEED MIX	COMMON NAME	PROPORTION	APPLIED RATE (LBS./1,000 SQ FT)
	TALL FESCUE	60%	2.4
	COLONIAL BENTGRASS	15%	.6
	MEADOW FOXTAIL	10%	.4
	ALSIKE CLOVER	10%	.4
	MARSHFIELD DIG TREFOIL	5%	.2
	TOTAL	100%	4 LBS./1,000 SQ FT

LEGEND

- EXISTING CREEK
- PROPOSED CREEK REALIGNMENT
- PROPOSED CREEK CHANNEL
- PROPOSED CREEK REARING LINE
- PROPOSED CREEK REARING CHANNEL
- BOUNDARY LINE
- CITY LIMITS LINE
- ADJACENT LOT LINE
- EXISTING RAILROAD RIGHT-OF-WAY

CALL TWO BUSINESS DAYS BEFORE YOU DIG 1-800-424-5555

hba DESIGN GROUP

WASHINGTON
425.252.2826 phone
425.252.9551 fax
1721 Hewitt Avenue
Fourth Floor
Everett, WA 98201

OREGON
541.988.1862 phone
541.988.1863 fax
150 North 7th Street
Springfield, OR 97477

ISSUE DATE: OCTOBER 25, 2006
DESIGNED BY: JWC, JRM
DRAWN BY: AJB, DIH
PLAN CHECK BY: JWC

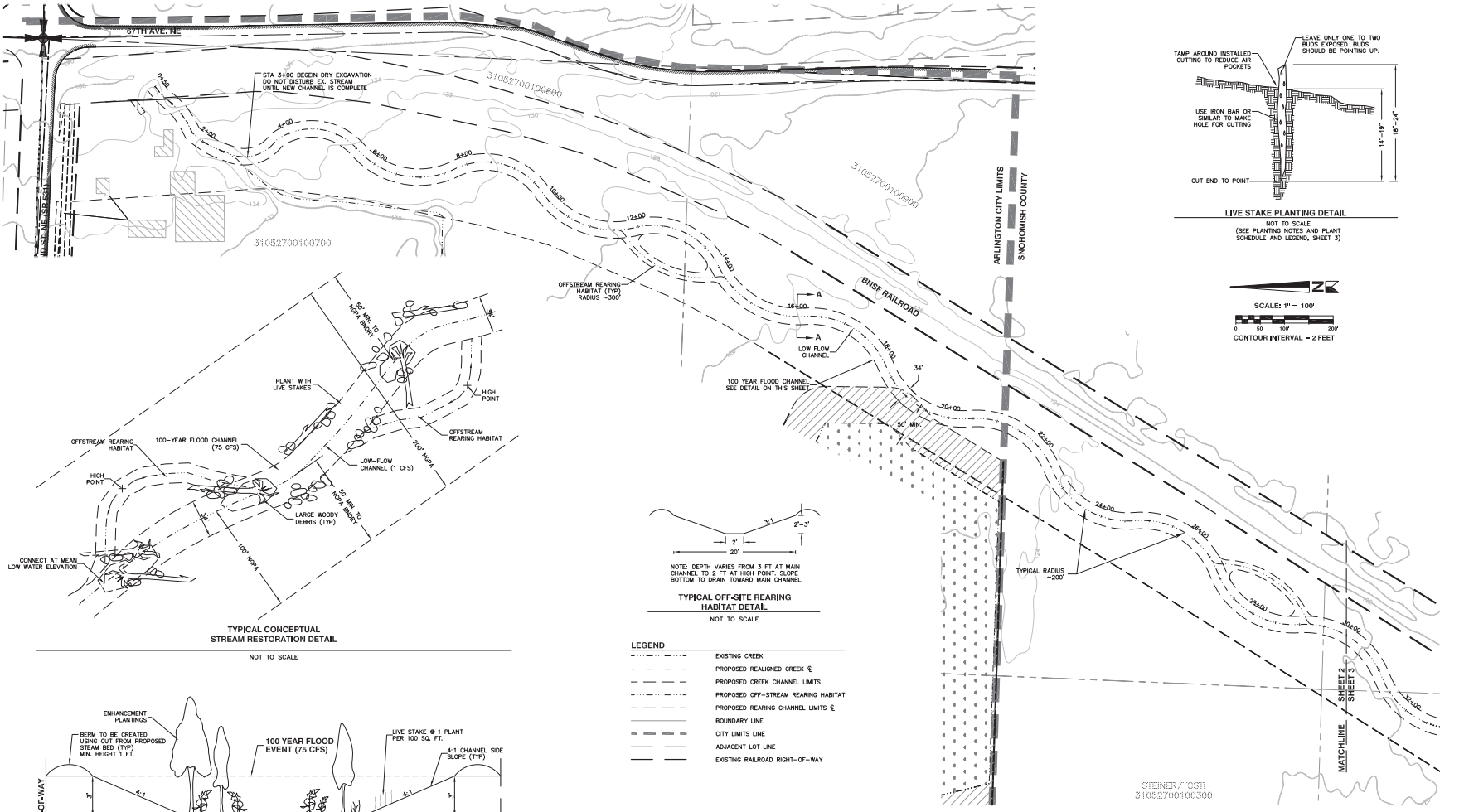
DATE	REVSIONS	BY

CONSTRUCTION PLANS
EDGECOMB CREEK STREAM REALIGNMENT
EDGECOMB CREEK REALIGNMENT FROM STA. 30+00 TO 60+00

JOB NO. 1978 — 3 / 5

XREF: EDGECR.DWG, EDGECR-SURV.DWG, EDGECR-TBK.DWG

SECTIONS 27 & 34, TOWNSHIP 31 NORTH, RANGE 5 EAST, W.M.



TYPICAL CONCEPTUAL
STREAM RESTORATION DETAIL

NOT TO SCALE

NOTE: DEPTH VARIES FROM 3 FT AT MAIN CHANNEL TO 2 FT AT HIGH POINT. SLOPE BOTTOM TO DRAIN TOWARD MAIN CHANNEL.

TYPICAL OFF-SITE REARING
HABITAT DETAIL

NOT TO SCALE

LIVE STAKE PLANTING DETAIL

NOT TO SCALE
(SEE PLANTING NOTES AND PLANT SCHEDULE AND LEGEND, SHEET 3)

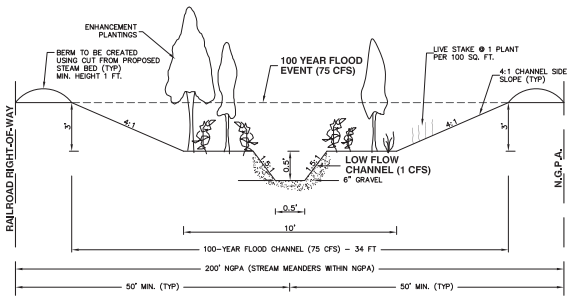
SCALE: 1" = 100'

0 50' 100' 200'

CONTOUR INTERVAL = 2 FEET

LEGEND

- EXISTING CREEK
- PROPOSED REALIGNED CREEK ℄
- PROPOSED CREEK CHANNEL LIMITS
- PROPOSED OFF-STREAM REARING HABITAT
- PROPOSED REARING CHANNEL LIMITS ℄
- BOUNDARY LINE
- CITY LIMITS LINE
- ADJACENT LOT LINE
- EXISTING RAILROAD RIGHT-OF-WAY



SECTION A-A

TYPICAL CONCEPTUAL STREAM
RESTORATION DETAIL
STATION 16+00

NOT TO SCALE

STATION	AREAS Square Feet		VOLUMES Cubic Yards		CUMULATIVE VOLUMES Cubic Yards	
	CUT	FILL	CUT	FILL	CUT	FILL
14+00	172.0	0.00				
14+50	163.0	0.00	310.0	0.00	310.0	0.00
15+00	153.0	0.00	292.0	0.00	602.0	0.00
15+50	140.0	0.00	271.0	0.00	873.0	0.00
16+00	152.0	0.00	271.0	0.00	1144.0	0.00
16+50	163.0	0.00	291.0	0.00	1435.0	0.00
17+00	171.0	0.00	309.42	0.00	1744.0	0.00
17+50	174.0	0.00	319.0	0.00	2064.0	0.00
18+00	175.0	0.00	324.0	0.00	2387.0	0.00
			0.00	0.00	2387.0	0.00

CALL TWO BUSINESS DAYS BEFORE YOU DIG 1-800-424-5555

DATUM — ELEVATION CONTOURS BASED ON CITY OF ARLINGTON LIDAR N.A.V.D. '88

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DESIGN GROUP
civil planning engineering

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DRAWN BY: AJE, DH
PLAN CHECK BY: AWC

DATE	REVISIONS	BY

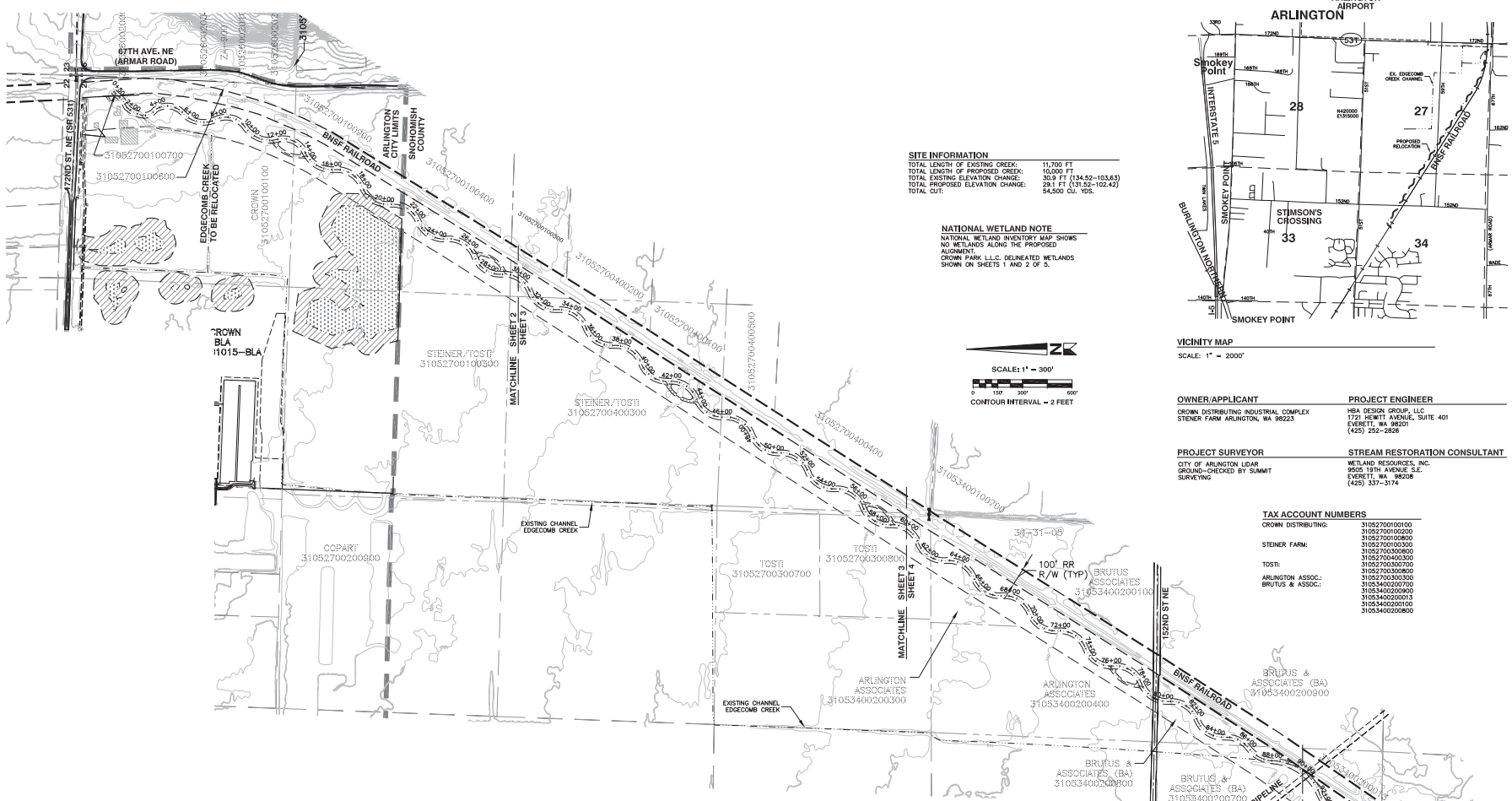
CONSTRUCTION PLANS
EDGECOMB CREEK STREAM REALIGNMENT
EDGECOMB CREEK REALIGNMENT FROM STA. 1+00 TO 33+00

JOB NO. 1978

SHEET 2 OF 5

XREF: EDGECOMG, EDGECN-SURV.DWG, EDGECN-TBK.DWG

SECTIONS 27 & 34, TOWNSHIP 31 NORTH, RANGE 5 EAST, W.M.



SITE INFORMATION

TOTAL LENGTH OF EXISTING CREEK:	11,700 FT
TOTAL LENGTH OF PROPOSED CREEK:	10,000 FT
TOTAL EXISTING ELEVATION CHANGE:	30.9 FT (134.52–103.63)
TOTAL PROPOSED ELEVATION CHANGE:	29.1 FT (131.52–102.42)
TOTAL CUT:	54,000 CU. YDS.

NATIONAL WETLAND NOTE

NATIONAL WETLAND INVENTORY MAP SHOWS NO WETLANDS ALONG THE PROPOSED ALIGNMENT.
CROWN PARK L.L.C. DELINEATED WETLANDS SHOWN ON SHEETS 1 AND 2 OF 5.

VICINITY MAP

SCALE: 1" = 2000'

OWNER/APPLICANT

CROWN DISTRIBUTING INDUSTRIAL COMPLEX
STEINER FARM ARLINGTON, WA 98223

PROJECT ENGINEER

HBA DESIGN GROUP, LLC
1721 HEWITT AVENUE, SUITE 401
EVERETT, WA 98201
(425) 252-2826

PROJECT SURVEYOR

CITY OF ARLINGTON LIDAR
GROUND-CHECKED BY SUMMIT SURVEYING

STREAM RESTORATION CONSULTANT

WETLAND RESOURCES, INC.
9505 19TH AVENUE S.E.
EVERETT, WA 98208
(425) 337-3174

TAX ACCOUNT NUMBERS

CROWN DISTRIBUTING:	31052700100100
	31052700100200
	31052700100800
STEINER FARM:	31052700100300
	31052700300800
	31052700400300
TOSTI:	31052700300700
	31052700300800
ARLINGTON ASSOC.:	31052700300300
BRUTUS & ASSOC.:	31053400200700
	31053400200900
	31053400200913
	31053400200100
	31053400200800

LEGEND

- EXISTING CREEK
- PROPOSED REALIGNED CREEK ℄
- PROPOSED CREEK CHANNEL LIMITS
- PROPOSED OFFSTREAM REARING HABITAT ℄
- PROPOSED REARING CHANNEL LIMITS
- BOUNDARY LINE
- CITY LIMITS LINE
- ADJACENT LOT LINE
- EXISTING RAILROAD RIGHT-OF-WAY
- EXISTING CULVERT
- PROPOSED CULVERT

OLYMPIC PIPE CROSSING GENERAL SAFETY REQUIREMENTS

1. WASHINGTON ONE-CALL AT 1-800-424-5555 MUST BE CONTACTED AT LEAST 48 HOURS (2 WORKING DAYS) BEFORE ANY CONSTRUCTION AND/OR EXCAVATION ACTIVITIES ARE INITIATED WITHIN THE PIPELINE RIGHT-OF-WAY SO THAT OPLC MAY HAVE A REPRESENTATIVE PRESENT TO ENSURE THAT THERE ARE NO CONFLICTS WITH THE PIPELINE. (THERE IS NO COST TO THE THIRD PARTY CONTRACTOR TO USE THE ONE-CALL NOTIFICATION SERVICE. HOWEVER, FAILURE TO UTILIZE THE ONE-CALL SERVICE CAN BE QUITE COSTLY IN TERMS OF UNNECESSARY RISK FOR THE CONTRACTOR/EXCAVATOR, THEIR EMPLOYEES, INNOCENT BYSTANDERS, PERSONAL PROPERTY OF OTHER AND THE ENVIRONMENT; AS WELL AS POTENTIAL CIVIL PENALTIES AND/OR FINES.)
2. TO HAVE THE PIPELINE PHYSICALLY LOCATED AND DEPTH VERIFIED, PLEASE CALL OPLC'S FIELD PROJECT OFFICE AT (425)235-7767 OR THE DAMAGE PREVENTION OFFICE AT (425)981-2517.
3. OPLC REQUIRES A REPRESENTATIVE/INSPECTOR ON SITE WHEN ANY WORK IS BEING PERFORMED WITHIN TEN FEET (10') OF THE PIPELINE(S). FORTY-EIGHT (48) HOURS PRIOR NOTICE TO OPLC IS HIGHLY RECOMMENDED FOR ANY WORK. NOTICE TO OPLC DOES NOT RELIEVE THE CONTRACTOR OF ANY NOTIFICATION RESPONSIBILITY TO THE APPROPRIATE STATE ONE-CALL SYSTEM.
4. OPLC REQUIRES DETAILED CONSTRUCTION PLANS AND OR DRAWINGS FOR ANY WORK WITHIN THE PIPELINE EASEMENT. OPLC REQUESTS AT LEAST 10 WORKING DAYS FOR REVIEW AND COMMENTS/APPROVAL OF PLANS. PLANS AND DRAWINGS SHOULD BE SUBMITTED TO OLYMPIC PIPELINE COMPANY, FIELD PROJECT OFFICE, 2319 LIND AVE, SW, RENTON, WA 98055.
5. THE CONTRACTOR IS RESPONSIBLE FOR HAVING THE PIPELINE LOCATION ADDED TO THE CONSTRUCTION DRAWINGS. THE CONTRACTOR IS ALSO RESPONSIBLE FOR TAKING ALL THE NECESSARY SAFETY PRECAUTIONS AND WILL BE HELD RESPONSIBLE FOR ANY DAMAGE CAUSED TO THE PIPELINE OR PROPERTY AS A RESULT OF THEIR WORK.
6. SEE ADDITIONAL NOTES ON SHEET 5.

LEGAL DESCRIPTION

STEINER FARM:
SEC 27 TWP 31 RGE 05 RT-5-6-) TH PT S1/2 S1/2 N1/4 LY W OF NP R/W OSA-76

SEC 27 TWP 31 RGE 05 RT-24-25-1-26B-) TH PT OF SE1/4 LY N & W OF NP R/W OSA-76

SEC 27 TWP 31 RGE 05 RT-22-) SE1/4 SE1/4 SW1/4 LESS MARYSVILLE & NORTHERN R/W LESS NP R/W OSA-79

SHEET INDEX

DATUM — ELEVATION CONTOURS BASED ON CITY OF ARLINGTON LIDAR N.A.V.D. 88

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DRAWN BY: AJE, DH
PLAN CHECK BY: JWC

DATE	REVISIONS	BY

CONSTRUCTION PLANS
EDGECOMB CREEK STREAM REALIGNMENT
EDGECOMB CREEK REALIGNMENT

JOB NO. 1978

1 / 5

XREF: EDGECOMB.DWG, EDGECOM-SURVEY.DWG, EDGECOM-TBK.DWG

OLYMPIC PIPELINE CROSSING NOTES

EXCAVATION SPECIFIC REQUIREMENTS:

NO EXCAVATION OR CONSTRUCTION ACTIVITY WILL BE PERMITTED IN THE VICINITY OF THE PIPELINE(S) UNTIL ALL APPROPRIATE COMMUNICATIONS HAVE BEEN MADE WITH OPLC'S FIELD PROJECTS AND ENGINEERING PERSONNEL.

THERE SHALL BE NO EXCAVATION OR BACKFILLING WITHIN THE PIPELINE RIGHT OF WAY FOR ANY REASON WITHOUT A REPRESENTATIVE FROM OPLC ON SITE STATING PERMISSION.

IN SOME INSTANCES, EXCAVATION AND OTHER CONSTRUCTION ACTIVITIES AROUND CERTAIN PIPELINES CAN BE CONDUCTED SAFELY ONLY WHEN THE PIPELINE OPERATING PRESSURE HAS BEEN REDUCED.

CONTRACTORS ARE THEREFORE CAUTIONED THAT EXCAVATION, WHICH EXPOSES OR SIGNIFICANTLY REDUCES THE COVER OVER A PIPELINE MAY HAVE TO BE DELAYED UNTIL THE REDUCED PRESSURE IS ACHIEVED.

GENERAL CONSTRUCTION ACTIVITIES:

THE CONTRACTOR SHALL NOT BE PERMITTED TO TRANSPORT CONSTRUCTION MATERIALS OR EQUIPMENT LONGITUDINALLY OVER THE PIPELINE.

ANY REQUIRED RELOCATION OR ENCASEMENT OF THE PIPELINE(S) WILL BE AT THE DEVELOPER'S EXPENSE.

DEVELOPMENT GRADING SHOULD NOT REMOVE ANY OF THE EXISTING GROUND COVER FROM; OR ADD EXCESSIVE FILL OVER THE PIPELINE(S). OPLC'S PRIOR APPROVAL TO ADD FILL IS REQUIRED.

WHERE IT IS NECESSARY FOR CONSTRUCTION EQUIPMENT (I.E. TRACTORS, BACKHOES, DUMP TRUCKS ETC.) OR EQUIPMENT TRANSPORTING CONSTRUCTION MATERIALS TO CROSS THE PIPELINE TO GAIN ACCESS TO THE JOB SITE, A CROSSING SHALL BE CONSTRUCTED AT A 90-DEGREE ANGLE TO THE PIPELINE. THE CONTRACTOR WILL BE RESPONSIBLE FOR PROTECTING THE PIPELINE DEPENDING ON DEPTH, SOIL CONDITIONS AND TYPE OF EQUIPMENT FOR TEMPORARY OR PERMANENT CROSSINGS USING EITHER FILL OR STEEL SHEETING. THESE METHODS MUST MEET OPLC'S REQUIREMENTS AND HAVE PRIOR APPROVAL FROM OUR ENGINEERING AND CONSTRUCTION DEPARTMENTS.

NO TRACK TYPE CONSTRUCTION EQUIPMENT SHALL BE PERMITTED TO PIVOT OR TURN DIRECTLY OVER THE TOP OF THE PIPELINE.

A SCRAPER OR PAN TYPE TRACTOR SHALL NOT BE USED FOR REMOVAL OF SOIL WITHIN TEN FEET (10') OF THE CENTERLINE OF THE PIPELINE. RUBBER TIRE OR SMALL TRACK TYPE EQUIPMENT IS AN ACCEPTABLE ALTERNATIVE.

A SHEEPSFOOT ROLLER SHALL NOT BE USED FOR COMPACTION PURPOSES WITHIN FIVE FEET (5') OF THE CENTERLINE OF THE PIPELINE.

NO VIBRATORY ROLLERS SHALL BE USED WITHIN THREE FEET (3') OF THE CENTERLINE OF THE PIPELINE UNTIL THE COMPACTED COVER OVER THE PIPELINE HAS REACHED A DEPTH OF THREE AND ONE-HALF FEET (3 ½).

PARKING LOTS, ROADS, DRIVEWAYS, FENCES AND STRUCTURES:

NO PERMANENT STRUCTURES MAY BE CONSTRUCTED ON THE PIPELINE RIGHT OF WAY.

NO ROADS OF FENCES SHALL RUN PARALLEL TO THE PIPELINE WITHIN THE PIPELINE RIGHT OF WAY. ROADS AND FENCES SHALL CROSS THE PIPELINE RIGHT OF WAY AT, OR AS NEAR TO, A 90-DEGREE ANGLE AS IS FEASIBLE. IN NO INSTANCE SHALL THE ANGLE OF THE CROSSING BE LESS THAN 45 DEGREES. FENCE POSTS MUST MAINTAIN A MINIMUM THREE FEET (3') CLEARANCE OFF THE PIPELINE(S) WHEN CROSSING THE EASEMENT.

THERE SHALL BE A MINIMUM VERTICAL SEPARATION OF TWO FEET (2') BETWEEN THE PIPELINE AND ANY UNDERGROUND STRUCTURE.

A MINIMUM OF FIVE FEET (5') OF COVER IS REQUIRED FOR ALL ROAD CROSSINGS, AND THREE FEET (3) FOR DRIVEWAYS. HOWEVER A STRESS FACTOR CALCULATION MAY BE NEEDED TO DETERMINE THE ACTUAL AMOUNT OF COVER REQUIRED DEPENDING ON SOIL CONDITIONS AND OTHER CIRCUMSTANCES.

PROPOSALS FOR PARKING ON THE PIPELINE RIGHT OF WAY ARE DISCOURAGED. ASPHALT PAVING MAY BE PERMITTED AS AN EXCEPTION UNDER CERTAIN CONDITIONS WITH AN AGREEMENT EXECUTED BY THE PROPERTY OWNER AND OPLC. THE AGREEMENT GRANTS OPLC THE RIGHT TO EXCAVATE WITHIN THE PAVEMENT AREA FOR ANY PIPELINE MAINTENANCE THAT MAY BE NECESSARY IN THE FUTURE AND ACKNOWLEDGES THE PROPERTY OWNER AS THE PARTY RESPONSIBLE FOR THE EXPENSE OF PAVEMENT REPLACEMENT. IF A PARKING LOT IS PERMITTED BY OPLC, A MINIMUM OF FOUR FEET (4') OF COVER WILL BE REQUIRED. HOWEVER OPLC WILL EVALUATE EACH PROPOSAL ON AN INDIVIDUAL BASIS, AND MAY IMPOSE ADDITIONAL REQUIREMENTS.

CONCRETE PAVEMENT IS DISCOURAGED; AND IN MOST INSTANCES WILL NOT BE ALLOWED.

A MINIMUM OF THREE FEET (3') OF COVER IS REQUIRED FOR ALL DRAINAGE DITCHES.

NO STRUCTURES SUCH AS MANHOLES, CATCH BASINS, THRUST BLOCKS OR FIRE HYDRANTS SHALL BE LOCATED OVER THE PIPELINE. A MINIMUM HORIZONTAL CLEARANCE OF TEN FEET (10') IS REQUIRED BETWEEN THE STRUCTURE AND PIPELINE.

FOREIGN LINE OR UTILITY CROSSINGS:

ALL FOREIGN LINES SHALL CROSS THE PIPELINE RIGHT-OF-WAY AT, OR AS NEAR TO, A 90-DEGREE ANGLE AS IS FEASIBLE.

IN NO INSTANCE SHALL THE ANGLE OF THE CROSSING BE LESS THAN 45 DEGREES.

IN NO INSTANCE SHALL THE FOREIGN LINE BE PLACED PARALLEL TO THE PIPELINE WITHIN THE PIPELINE RIGHT-OF-WAY.

THE FOREIGN LINE SHALL CROSS UNDER THE PIPELINE WITH AT LEAST TWO FEET (2') OF VERTICAL SEPARATION UNLESS THE PIPELINE IS AT A PROHIBITIVE DEPTH. IN SUCH CASES, OPLC PERSONNEL WILL REVIEW AND EVALUATE THE PROPOSED CROSSING LOCATION TO DETERMINE IF IT WILL BE ALLOWABLE FOR THE FOREIGN LINE TO CROSS ABOVE.

IF THE FOREIGN LINE IS A TELECOMMUNICATIONS CABLE, POWER CABLE OR SIMILAR IN NATURE, THE FOREIGN LINE SHALL BE PLACED IN SCHEDULE 40 PVC CONDUIT, OR GREATER, FOR A LINEAR DISTANCE EXTENDING TEN FEET (10') ON EITHER SIDE OF CENTERLINE OF THE PIPELINE. IN THE CASE OF A POWER CABLE IT SHALL BE ENCASED IN RED-DYED CONCRETE FOR A LINEAR DISTANCE OF TEN FEET (10') ON EITHER SIDE OF CENTERLINE OF PIPELINE.

A UTILITY WITH A CATHODICALLY PROTECTED FOREIGN LINE WHICH CROSSES OR IS PLACED ADJACENT TO OPLC'S PIPELINE(S) MUST INSTALL A TEST POINT AND PERFORM INTERFERENCE TESTING BETWEEN THE UTILITY AND OPLC. PLEASE CONTACT OPLC'S CORROSION TECHNICIAN BY CALLING OUR MAIN OFFICE AT (425) 226-8865.

BELOW GROUND WARNING TAPE SHALL BE PLACED IN THE DITCH LINE, ABOVE THE FOREIGN LINE. THE WARNING TAPE SHALL BE PLACED APPROXIMATELY ONE FOOT (1') BELOW THE FINAL SURFACE GRADE/ELEVATION. THE WARNING TAPE SHALL EXTEND FOR A LINEAR DISTANCE TO TEN FEET (10') ON EITHER SIDE OF THE CENTERLINE OF THE PIPELINE.

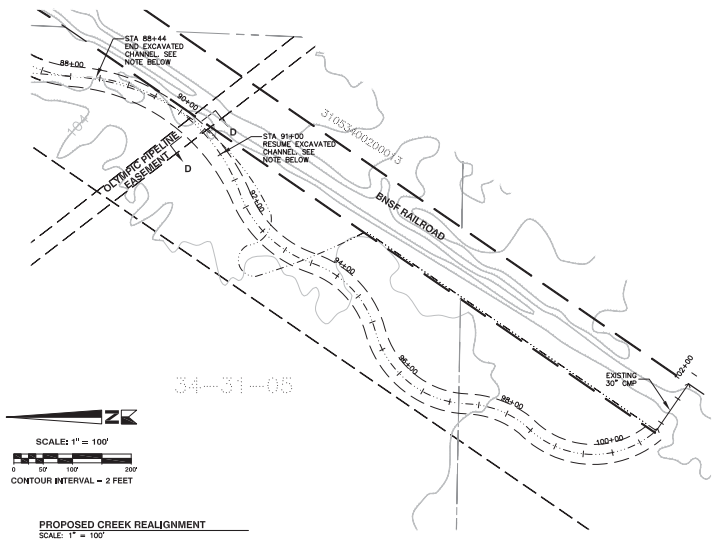
LANDSCAPE AND VEGETATION:

NO TREES ARE ALLOWED ON THE PIPELINE RIGHT OF WAY. OPLC MAY PERMIT THE INSTALLATION OF LIMITED LANDSCAPING AND MINOR SHRUBBERY PLANTINGS WITH A VERBAL COMMUNICATION. FOR MAJOR DEVELOPMENT, LANDSCAPING PLANS MUST FIRST BE SUBMITTED IN WRITING TO OPLC FOR REVIEW AND APPROVAL. ANY PLANTINGS THAT RESTRICT EFFICIENT AERIAL INSPECTION OR LIMIT ACCESS TO THE EASEMENT AREA WILL BE CONSIDERED AN INTERFERENCE AND MUST BE ADDRESSED ACCORDINGLY.

OPLC RESERVES THE RIGHT TO IMPOSE FURTHER STIPULATIONS OR REQUIREMENTS CONSISTENT WITH EACH INDIVIDUAL EASEMENT OR SITUATION. SHOULD YOU ANTICIPATE ANY PROBLEMS REGARDING THESE REQUIREMENTS PLEASE CONTACT OPLC'S FIELD PROJECT OFFICE AT (425)-235-7767.

NO-EXCAVATION AREA AT OLYMPIC PIPELINE CROSSING

FROM STA 88+40 TO 91+00, STREAM CHANNEL SHALL BE CONSTRUCTED ENTIRELY ABOVE EXISTING GRADE TO MAINTAIN MAXIMUM COVER OVER OLYMPIC PIPELINES. CONTRACTOR SHALL CREATE A COMPACTED EARTH BERM 4.5' DEEP & 50 FT. WIDE ALONG THE STREAM PATH. CHANNEL SHALL BE EXCAVATED INTO THE CONSTRUCTED BERM WITH MINIMUM SLOPE OF 0.1%. BERM SHALL BE TAPERED FOR SUFFICIENT DISTANCE BEYOND BOTH ENDS OF NO-EXCAVATION AREA TO ENSURE SMOOTH TRANSITION WITH MINIMUM CHANNEL SLOPE OF 0.1%.
STREAM CHANNEL SHALL BE LOCATED AS CLOSE AS POSSIBLE TO RAILROAD R/W BECAUSE PIPELINES ARE DEEPER AT RR CROSSING. RAILROAD EMBANKMENT SHALL BE ARMORED WITH LARGE RIPRAP AS SHOWN IN DETAIL ON THIS SHEET.

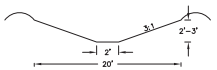


SCALE: 1" = 100'

0 50' 100' 200'

CONTOUR INTERVAL = 2 FEET

PROPOSED CREEK REALIGNMENT
SCALE: 1" = 100'

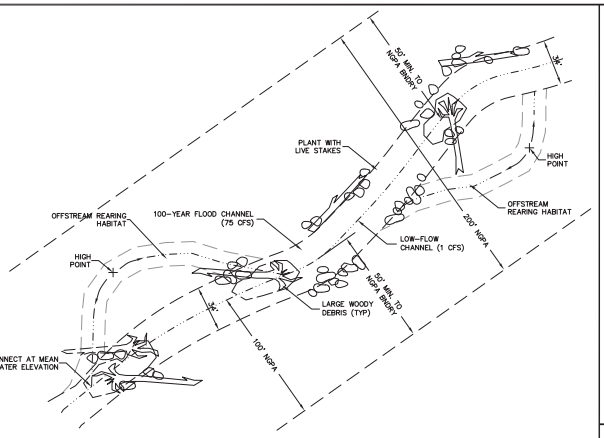


NOTE: DEPTH VARIES FROM 3 FT AT MAIN CHANNEL TO 2 FT AT HIGH POINT. SLOPE BOTTOM TO DRAIN TOWARD MAIN CHANNEL.

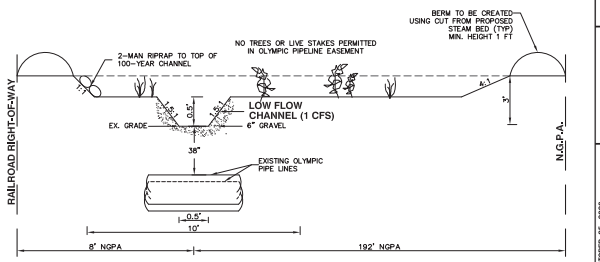
TYPICAL OFF-SITE REARING HABITAT DETAIL
NOT TO SCALE

LEGEND

- EXISTING CREEK
- PROPOSED CREEK REALIGNMENT
- PROPOSED CREEK CHANNEL
- PROPOSED CREEK REARING LINE
- PROPOSED CREEK REARING CHANNEL
- BOUNDARY LINE
- CITY LIMITS LINE
- ADJACENT LOT LINE
- EXISTING RAILROAD RIGHT-OF-WAY
- EXISTING CULVERT

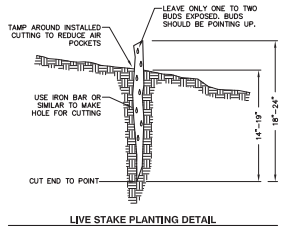


TYPICAL CONCEPTUAL STREAM RESTORATION DETAIL
NOT TO SCALE



SECTION D-D

TYPICAL CONCEPTUAL STREAM RESTORATION DETAIL AT OLYMPIC PIPELINE CROSSING STATION 90+36
NOT TO SCALE



LIVE STAKE PLANTING DETAIL
NOT TO SCALE
(SEE PLANTING NOTES AND PLANT SCHEDULE AND LEGEND, SHEET 3)

CALL TWO BUSINESS DAYS BEFORE YOU DIG 1-800-424-5555

DATUM — ELEVATION CONTOURS BASED ON CITY OF ARLINGTON LIDAR N.A.V.D. '88

hba
DESIGN GROUP
civil planning engineering

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425.252.9551 fax
1721 Hewitt Avenue
Fourth Floor
Everett, WA 98201

OREGON
541.988.1862 phone
541.988.1863 fax
150 North 7th Street
Springfield, OR 97477

ISSUE DATE: OCTOBER 25, 2006
DESIGNED BY: JWC, JMB
DRAWN BY: AJE
PLAN CHECK BY: JWC

DATE	REVISIONS	BY

CONSTRUCTION PLANS
EDGECOMB CREEK STREAM REALIGNMENT
CREEK REALIGNMENT PLAN
FROM STA 88+00 TO 101+00

JOB NO. 1978 — 5/5

XREF: EDGECOMG, EDGECR-SURV.DWG, EDGECR-TSK.DWG

Attachment 2
Estimated Construction Costs

Construction costs

Reference: Building Construction Cost Data, 65th edition, by RSMeans

Note: several costs given, depending on type equipment used and conditions encountered. Also a state inflation factor is provided, used 102.2% for Everett. To simplify costs, will provide a general average that takes into account these factors based on expected conditions

Type	Unit	Bare Cost (material, labor & equip)	Total Cost (overhead & profit)	Reference code, page #	Assumptions
Excavation	C.Y.	$4.75	$6.50	31 23 16.130050/60, 523	Baseline starts with total cut # provided by HBA, in drawings. Assume the E & W alternative Edgecomb Creek lengths are same to the west of 67th. Additonal excavation added for relocating Olaf Stradd and US of
Fill	L.C.Y.	$1.44	$1.77	31 23 23.170020, 533	Existing channel network, assume excavated soil will be used as fill
Culvert-30"	L.F.	$89.46	$105.27	33 42 16.53080, 577	Oval arch, galvanized or aluminum, coated & paved.
Culvert-36"	L.F.	$132.81	$154.32	33 42 16.53100, 577	Oval arch, galvanized or aluminum, coated & paved.
Culvert-48"	L.F.	$178.19	$206.44	33 42 16.53140, 577	Oval arch, galvanized or aluminum, coated & paved.
End section-36"	Ea.	$538.08	$638.75	33 42 16.533400, 577	Oval arch, galvanized or aluminum, coated & paved.

Acronyms:

C.Y.	cubic yard
L.C.Y.	linear cubic yard
L.F.	linear foot

Edgecomb Creek Relocation Costs

West Alternative - Alignment to the West of Railroad
Reference: **Building Construction Cost Data, 65th edition, by RSMeans
***costs derived from King County Bond Quantity Worksheet 1-2006

Item	Unit	Quantity	Unit cost	Total cost	Notes/assumptions, description
Engineering	Lump Sum	1	10% of Construction	$ 46,143	Design of new channel alignment, habitat structures, assume engineering costs are 10% of construction costs
Add-on at later date	Lump Sum	1	10% of Construction	$ 12,556	Design of new channel alignment, habitat structures, assume engineering costs are 10% of construction costs
Permitting	Lump Sum	1	$ 12,000	$ 12,000	Permitting for moving/regrading creek, document preparation, site visits with agencies, meetings, drafting (all inclusive conservative estimate)
Construction					
Structures					
Culvert-48" **	Linear feet	30	$ 206	$ 6,193	152nd St
Add-on at later date Culvert-48" **	Linear feet	30	$ 639	$ 19,163	Add-on AFTER West alternative constructed, 152nd St, east side of RR
Culvert-36" **	Linear feet	70	$ 154	$ 10,803	2 total: underneath 67th St (30') and RR for hillside tributaries (~40')
Habitat structures***	Each	47	$ 1,200	$ 56,160	Assume average channel width of 30', total length of 11,700', pool spacing every 7 channel widths, one log w/rootwad and one log w/o rootwad per structure. Approx. cost for wood is $500/log w/root, $300/log w/o root, & $400 construction cost to install.
Add on at later date a Habitat structures***	Each	12	$ 1,200	$ 14,112	Add-on AFTER West alternative constructed, same assumptions as above
Spawning gravel***	CY	433	$ 22.00	$ 9,526	Only in low-flow channel (per HB design) bottom and sides @ 6" depth
Add-on at later date Spawning gravel***	CY	110	$ 22.00	$ 2,420	Add-on AFTER West alternative constructed, same assumptions as above
Earthwork***	CY	54,500	$ 4.00	$ 218,000	Excavate ~ 11,700' of new channel, assuming channel dimensions provided by HB, material will be used for earthen berms or to fill existing ditches
Add-on at later date	CY	9,780	$ 4.00	$ 39,120	Add-on AFTER West alternative constructed, ~ 2,940' new channel on eastern side of RR
Planting	acre	59.5	$ 2,500	$ 148,750	Riparian planting, assuming no planting in low flow channel ~2' wide (0.5 acre)
Add-on at later date	acre	15.5	$ 2,500	$ 38,750	Add-on AFTER West alternative constructed, same assumptions as above
Land/easement acquisition	acre	60	$ 49,807	$ 2,988,420	Within Annexation area, from Snohomish County Assessor Website, average average assessed value range $11,741-$140,394
Add-on at later date	acre	52	$ 15,617	$ 812,084	For annexation area on east side of railroad, from Snohomish County Assessor Website, average assessed value range $11,800-$23,100
Add-On in conjunction with West-Alternative	acre	47.6 acre annexed W side of RR, 52 acre annexed E side of RR	$49,807, $15,617	$ 3,182,897	**Add-on for West alternative in conjunction, therefore, 12.4 acres of land on the west side of RR would not be acquired (more expensive annexed land)**, and additional land within annexation area on east side of railroad, from Snohomish County Assessor Website, average assessed value range $11,800-$23,100
Maintenance					no maintenance included

Total cost =	$ 3,495,995	West Alternative only
Total cost with Add-on if implemented in conjunction with West Alternative =	$ 3,690,472	Additional land acquisition cost
Additional cost if Add-on implemented AFTER relocation construction =	$938,205	Does not include original West Alt. costs. Includes Add-on land acquisition and creek relocation costs
Total cost with Add-on implemented after with West Alternative =	$ 4,434,200	West Alternative plus additional Add-On cost

NOTE: DOES NOT INCLUDE costs associated with erosion control, fencing, maintenance and monitoring
Cost are approximate and are provided for planning purposes only, actual costs may be higher or lower than presented

Edgecomb Creek Relocation Costs

East Alternative - Alignment to the East of Railroad
Reference: **Building Construction Cost Data, 65th edition, by RSMeans,
***costs derived from King County Bond Quantity Worksheet 1-2006

Item	Unit	Quantity	Unit cost	Total cost	Notes/assumptions, description
Engineering	Lump Sum	1	10% of Construction	$ 48,928	Design of new channel alignment, habitat structures, assume engineering costs are 10% of construction costs
Permitting	Lump Sum	1	$ 12,000	$ 12,000	Permitting for moving/regrading creek, document preparation, site visits with agencies, meetings, drafting (all inclusive conservative estimate).
Construction					
Structures					
Culvert-48" **	Linear feet	90	$ 206	$ 18,580	4 total: at 67th (30'), 152nd St (30'), and 2 driveways on the east side of 67th (15', each)
Culvert-36" **	Linear feet	30	$ 154	$ 4,630	underneath 67th St for hillside tributaries
Habitat structures***	Each	51	$ 1,200	$ 61,440	Assume avg. channel width of 30', total length of 12,800' (no habitat structures in Olaf relocation), pool spacing every 7 channel widths, one log w/rootwad and one log w/o rootwad per structure. Approx. cost for wood is $500/log w/root, $300/log w/o root, & $400 construction cost to install.
Spawning gravel, Type A***	CY	474	$ 22.00	$ 10,428	Only in low-flow channel (per HB design) bottom and sides @ 6" depth
Spawning gravel, Type A*** for Olaf Strad relocation	CY	78	$ 22.00	$ 1,716	For 700' and only on ditch bottom @ 6" depth
Earthwork**	CY	60,000	$ 4.00	$ 240,000	Excavate ~ 12,800' of new channel, assuming channel dimensions provided by HB, material will be used for earthen berms or to fill existing ditches.
Olaf Strad	CY	933	$ 4.00	$ 3,732	Excavate 700' of new ditch (6'x6', approximate) for Olaf Strad minor relocation paralleling Edgecomb Creek buffer
Planting	acre	59.5	$ 2,500	$ 148,750	Riparian planting, assuming no planting in low flow channel ~2' wide (0.5 acre)
Land/easement acquisition	acre	61	$ 6,379	$ 389,119	Area outside of annexation area, from Snohomish County Assessor Website, average assessed value range $1,000-$23,108
	acre	31	$ 15,617	$ 484,127	**Add on for East alternative**, annexation area on east side of railroad, from Snohomish County Assessor Website, average assessed value range $11,800-$23,100
Maintenance					no maintenance included
			Total cost =	$ 939,322	
			Total cost including Add-on=	$ 1,423,449	

NOTE: DOES NOT INCLUDE costs associated with erosion control, fencing, maintenance and monitoring
Cost are approximate and are provided for planning purposes only, actual costs may be higher or lower than presented

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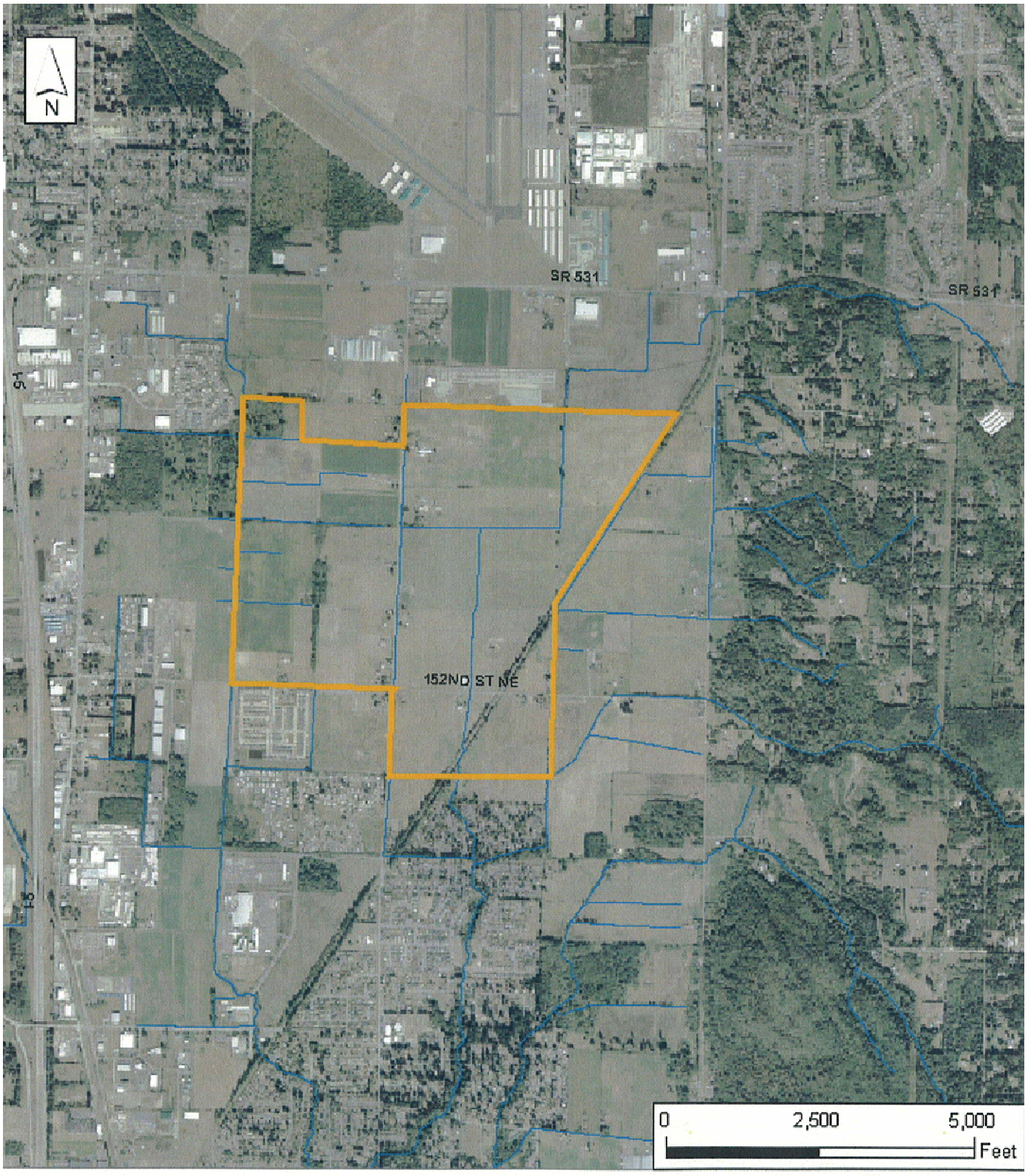


Legend:

Smokey Point Master Plan Annexation Area

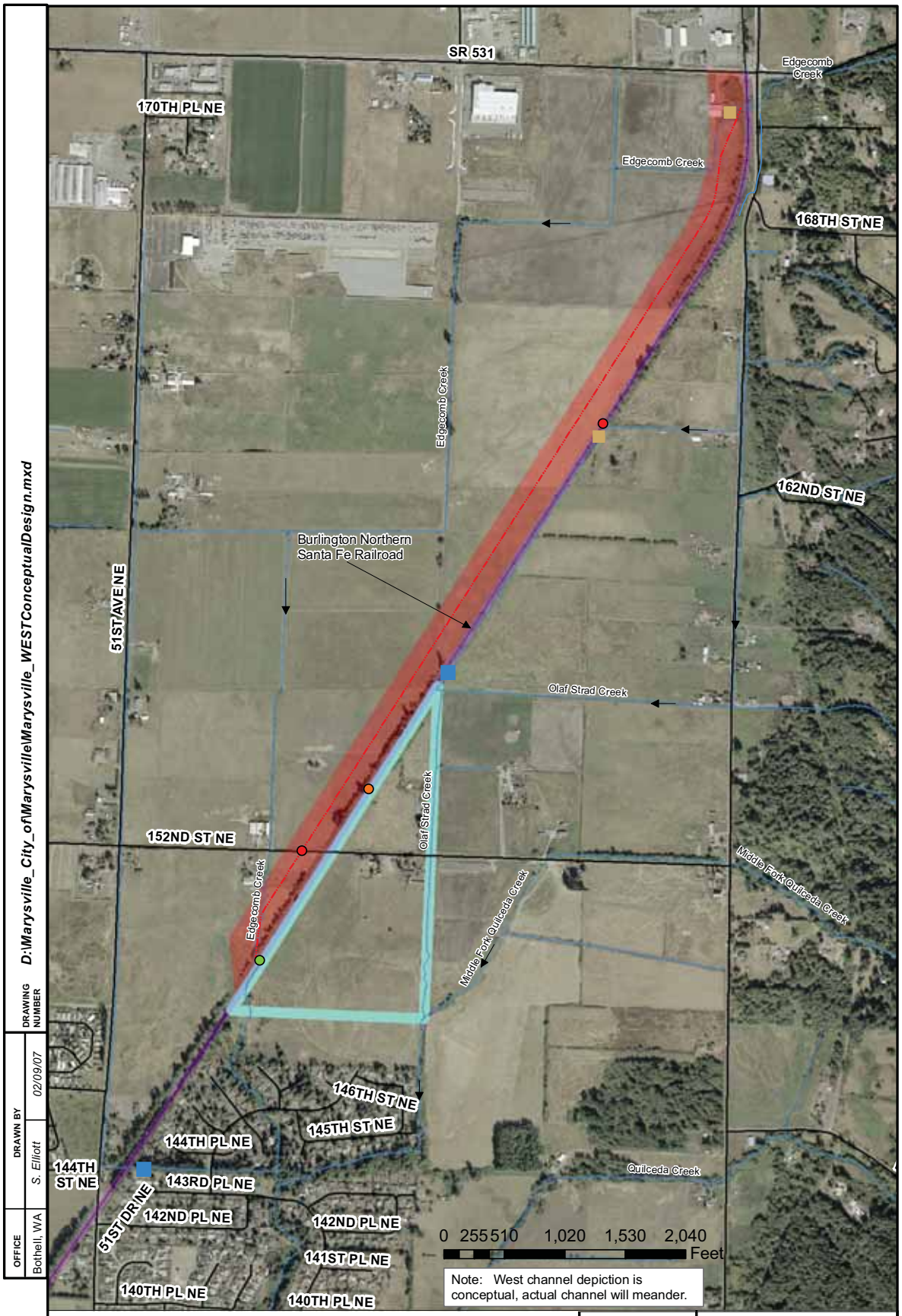
Streams

19909 120th Avenue N.E.
Suite 101
Bothell, Washington 98011
Phone (425) 485-5000
Fax. (425) 486-9766

FIGURE 1

VICINITY MAP

CITY OF MARYSVILLE
MARYSVILLE, WA



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Bothell, Washington 98011
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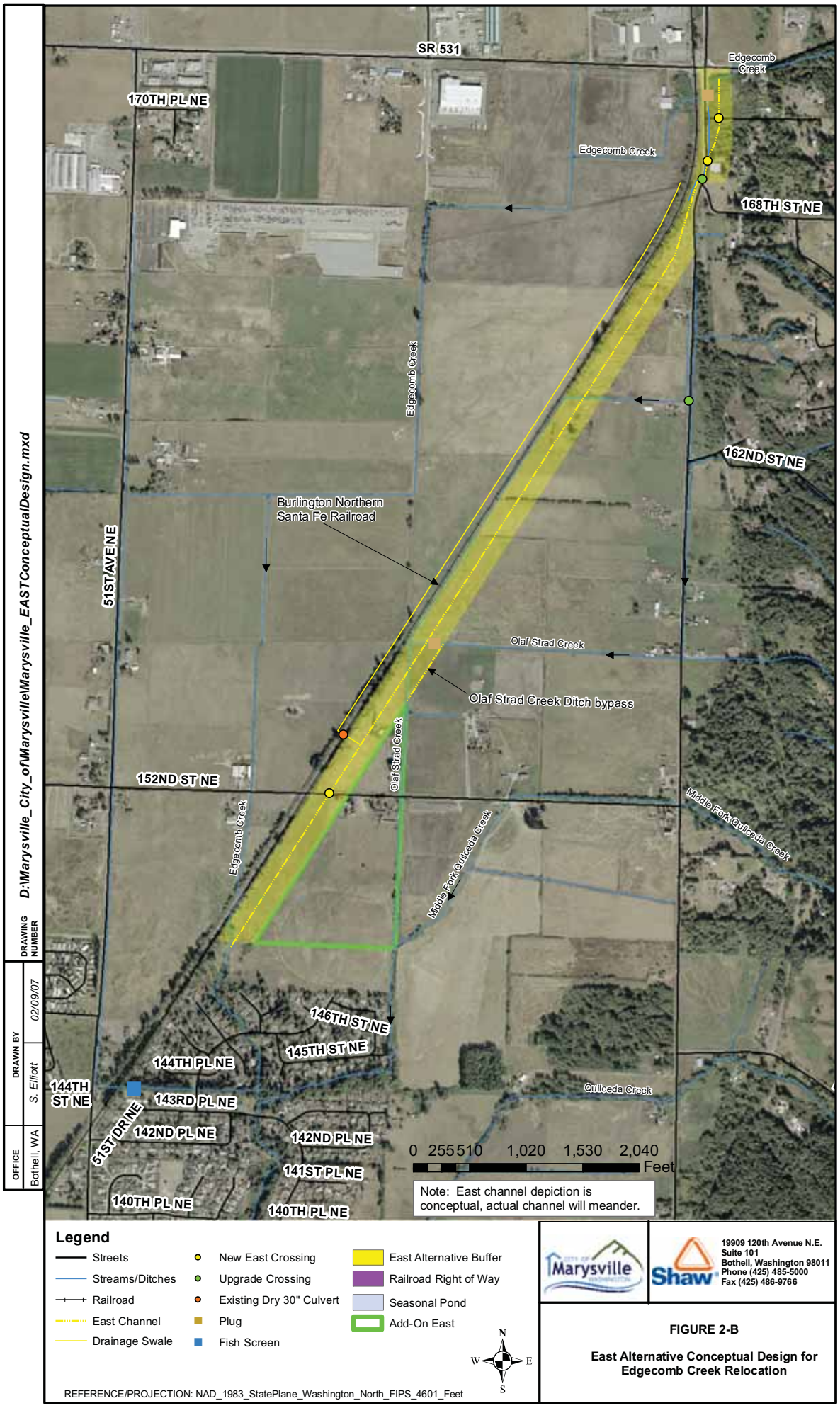
Fax (425) 486-9766

FIGURE 2-A

West Alternative Conceptual Design for Edgecomb Creek Relocation



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Bothell, Washington 98011
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Fax (425) 486-9766

FIGURE 2-B

East Alternative Conceptual Design for Edgecomb Creek Relocation

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File: N:\Project\draft\City of Marysville\Drawings\BT-MARYSV-F3-4.dwg Layout: Model User: maria.portacio Jan 10, 2007 - 11:00am

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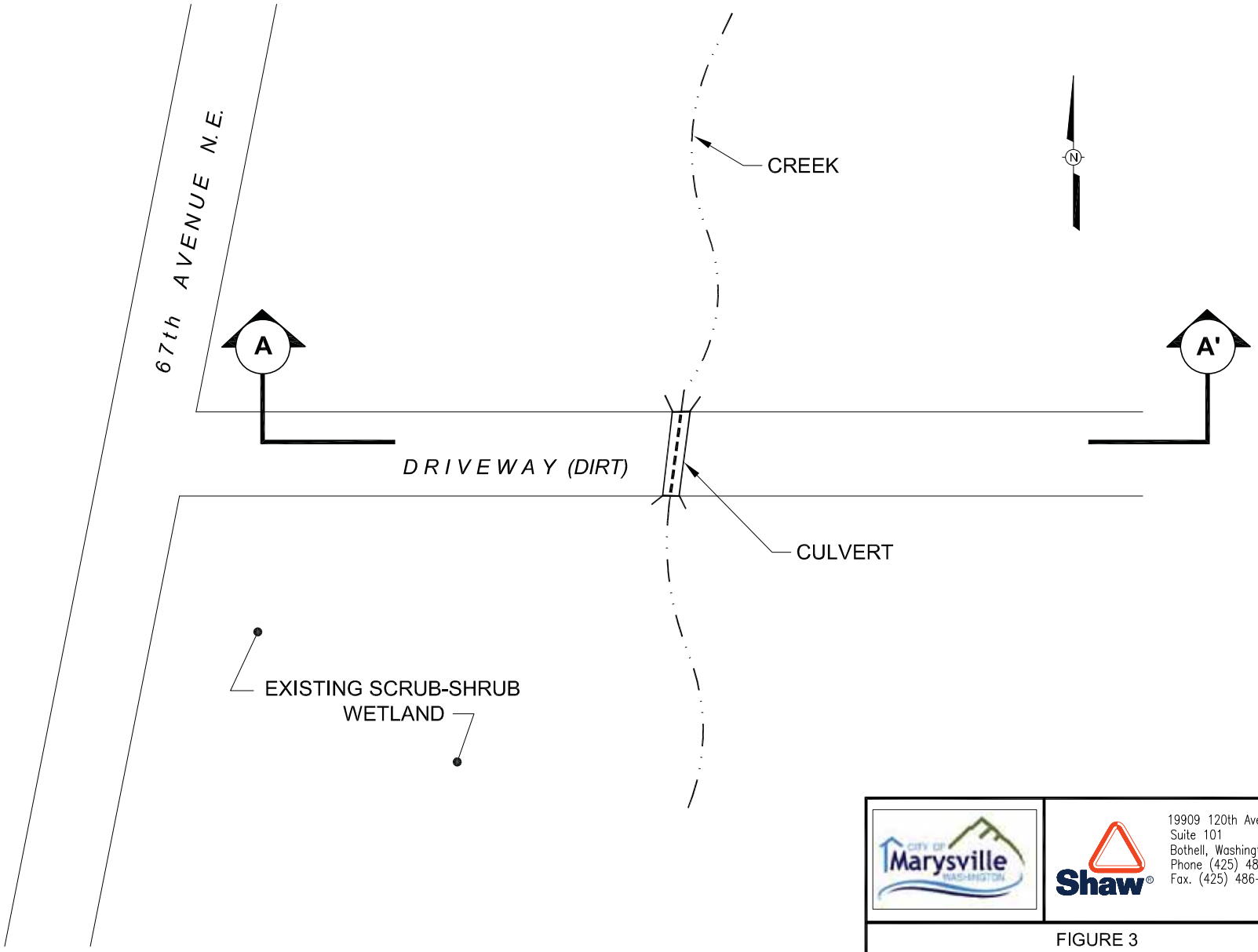
MPortacio	1/2007	SEM	1/07			BOTHELL		



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Suite 101
Bothell, Washington 98011
Phone (425) 485-5000
Fax. (425) 486-9766

FIGURE 3

PLAN VIEW

EDGECOMB CREEK EAST ALTERNATIVE
NEW CROSSING AT DRIVEWAYS EAST OF 67th
CITY OF MARYSVILLE
MARYSVILLE, WA

XREF Files: IMAGE Files: marysville-2006-logo.jpg
File: N:\Project\draft\City of Marysville\Drawings\BT-MARYSV-F3-4.dwg Layout: Model User: maria.portacio Jan 10, 2007 - 11:12am

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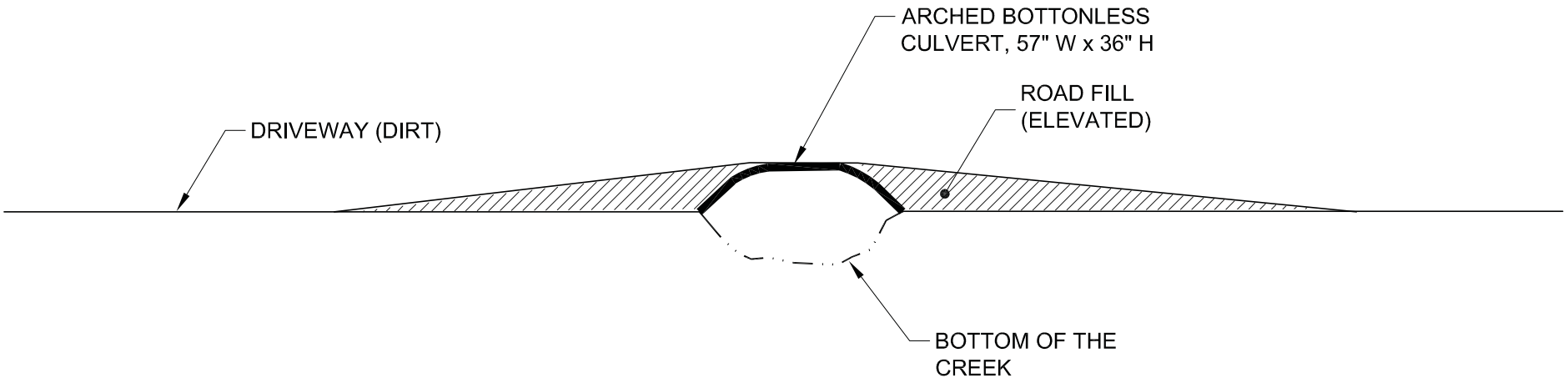
MPortacio	1/2007	SEM	1/07			BOTHELL		



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Bothell, Washington 98011
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FIGURE 4

SECTION A-A'

EDGECOMB CREEK EAST ALTERNATIVE
NEW CROSSING AT DRIVEWAYS EAST OF 67th
CITY OF MARYSVILLE
MARYSVILLE, WA

Appendix B

Storm Drainage Analysis – Technical Memorandums (3) by Otak

Technical Memorandum

10230 NE Points Drive
Suite 400
Kirkland, WA 98033
Phone (425) 822-4446
Fax (425) 827-9577

To: Perteet, Inc.
Patricia Love, Community Planning Manager,

From: Otak, Inc.
Joe Simmler, PhD, Larry Grimm, PE,

Copies:

Date: Draft January 22, 2007

Subject: Drainage Technical Memorandum #1—
Low Impact Development Evaluation
for Master Plan Area

Smokey Point Neighborhood Master Plan EIS
City of Marysville, WA

Project No.: 30813

Introduction

The results of the evaluation and selection of Low Impact Development (LID) techniques for stormwater management in the Smokey Point Neighborhood Master Plan area are presented in this memorandum. The Low Impact Development Technical Guidance Manual for the Puget Sound [1] (Guidance Manual) describes LID as follows: *Low impact development (LID) is a stormwater strategy that emphasizes conservation and use of natural site features integrated with distributed, small-scale stormwater controls to more closely mimic natural hydrologic patterns in residential, commercial, and industrial settings.* The full menu of LID techniques presented in the Guidance Manual has been considered in the following evaluations for the Smokey Point neighborhood.

This technical memorandum describes the objectives of the master planning effort, existing drainage-related conditions, and proposed land use alternatives in order to provide a framework and reference for the LID evaluations. Various LID techniques are then identified and described. An evaluation is presented of the techniques with respect to master plan objectives and site opportunities and constraints. The results of the LID review and technique selection process for the City of Marysville are described and conclusions and recommendations are made.

[1] Puget Sound Action Team, Washington State University Pierce County Extension, Low Impact Development Guidance Manual for Puget Sound, January 2005 (Revised May, 2005)

Master Plan Objectives

The Smokey Point Neighborhood Master Plan addresses a 675-acre area located south of the Arlington Airport, as shown in Figure 1. Concurrent with this master planning effort, this area is being annexed to the City of Marysville from Snohomish County. The proposed land use includes a future industrial center—the planning of which will need to be consistent with the City's vision of a high-tech commercial/industrial corridor for the area—with a minimum of residential development.

Specific objectives have been established for the master planning work. These include: (1) establishing land use and transportation standards; (2) preparing a critical areas analysis and preliminary mitigation plans; (3) developing conceptual stormwater management plans including regional and LID approaches; and (4) establishing land use regulations that will allow the expansion and growth of the Arlington Airport. This technical memorandum addresses the LID objectives of the master plan, as applicable to Objective 3—developing a conceptual stormwater management plan.

Existing Conditions Summary

The pre-project setting and conditions relating to drainage are described in this section. These include drainage basins and patterns, hydrologic characteristics, topography, geology and soils, existing land use, and wetlands. The salmonid habitat of streams within the study area is also described.

Site Streams and Hydrology

The study area is located within the Middle Fork Quilceda Creek drainage basin, as shown in Figure 2. The majority of the study area drains to the Edgecomb Creek, while a lesser area drains to Hayho Creek. Both of these creeks are tributary to Middle Fork Quilceda Creek. The subbasin boundaries for Edgecomb and Hayho Creeks are also shown in Figure 2. The Hayho Creek subbasin was referred to as the "Smokey Point Channel West" subbasin in the December 2002 *Quilceda Creek Drainage Needs Report* by Snohomish County.

The City of Marysville has classified the streams within the Quilceda-Allen watershed. The classifications are shown in Figure A-1, Appendix A. Both Edgecomb and Hayho Creeks are classified as Type F streams. Type F streams are defined as "Those stream segments within the ordinary high water mark that are not Type S streams, and which are demonstrated or provisionally assumed to be used by salmonid fish."

Mean annual rainfall at the site is about 36 inches, based on the HSPF precipitation data set for North Marysville. December is the wettest month with an average rainfall of 5.0 inches. Mean daily temperatures range from 38° F in January to 64° F in August.

Flooding problems currently exist and have been reported within both the Hayho Creek and Edgecomb subbasins. These are described in Snohomish County's *Quilceda Creek Drainage Needs Report DNR No. 1* (December 2002, Quilceda DNR). Specific projects are proposed in DNR No. 1 to correct identified problems.

Topography

The topography in the study area slopes gently downward in a northeast to southeast direction at a grade of approximately 0.3 percent (three feet fall in 1,000 feet). Existing contours for the study area along with stream systems are shown in Figure 3. The prominent slope direction is south-southwest. The elevation of the basin ranges from approximately 124 feet in the northeast, to about 104 feet in the southeast. The flat topography creates challenges for designing and constructing stormwater conveyance and detention facilities. Many of the parcels that have been developed previously in the North Marysville area have been constructed on fill to provide the vertical drop needed to build gravity stormwater management systems.

Existing Land Use

Existing land use within the project tributary area is predominantly agricultural with small areas of single family, low density residential.

Soils

The North Marysville area lies within a north-south valley known as the Marysville Trough. The National Resources Conservation Service (NRCS, formerly the SCS) Soil Survey of Snohomish County Area, Washington identifies soils in the study area as primarily a combination of Custer fine sandy loam and Norma loam soils. The NRCS delineation of soil types in the study area are defined in the City's 2005 Comprehensive Plan, and are shown in Figure A-2, Appendix A. These soils are relatively uniform, primarily consisting of glacially deposited sand and gravel to a depth well below the typical limits of excavation. These soils are known to be porous and have seasonally high groundwater tables that restrict infiltration, contribute to localized flooding, and increase the amount and rate of surface water runoff.

Two geotechnical reports for properties adjacent to the study area were made available to the consulting team by the City. These included the Nelson Geotechnical Associates report for Dujardin Development Corporation's 150-acre berry farm property in the southeast quadrant of the 152nd Street NE/43rd Avenue NE intersection; and the AGRA Earth & Environmental report for the City of Marysville 60-acre Strawberry Fields Athletic Complex in the southwest quadrant of the 152nd

Street NE/59th Avenue NE intersection. The Dujardin property is located immediately south of the southwest corner of the study area and was being planned for residential development. The Strawberry Fields complex is located immediately east of the southeast corner of the study area. Relevant information from those reports is provided as a general reference for the master planning work.

The reports indicate the soil conditions in the area to be characterized by recessional outwash sands and silty sands. The report for the Dujardin property indicated that a surfical layer of 1.0 to 1.5 feet of modified soil was found in all explorations. Below the modified soil, a 0.5 to 2.5-foot layer of loose to medium dense soil was encountered. This consisted of silty sand or sand with silt. The deepest unit encountered was outwash. It was found at depths from one to four feet and interpreted as medium dense. The outwash consisted of fine to medium gray sand with silt to medium to course sand with gravel. The report for the Strawberry Fields site indicated that somewhat variable near-surface soil conditions were found. These consisted of loose to medium dense, interlayered silty sand/sandy silt in the upper two to four feet, underlain by a medium dense, saturated, coarse sand deposit. It also indicated that a one to two-foot thick layer of clayey silt was encountered below a depth of about two feet in the northeastern, east-central and southeastern portions of the site. Topsoil and sod was observed to an average depth of roughly six inches across the site.

Explorations at the Dujardin property encountered groundwater at depth ranging from three to four feet, while at the Strawberry Fields groundwater was encounter at depths of two to four feet. Shallow ground water level monitoring points were installed on both properties. Depths from ground surface to ground water at the Dujardin property ranged from 12 inches to 32 inches in early February 1999. At the Strawberry Fields, depths from ground surface to ground water ranged from 0.5 feet to 3.5 feet in early February 1997. Winter water levels within the study area may be similar to those encountered for the two properties.

Wetlands

Wetlands exist within the study area, but have not been delineated for individual parcels. Potential wetland areas within the study area, and defined in the City's 2005 Comprehensive Plan, are shown in Figure A-3, Appendix A.

Selected Land Use Development Criteria

The selected land development criteria of the Master Plan includes the following:

- 25 percent of the land within planning area is assumed to be wetlands and not available for development
- Lot coverage by buildings will be 50 percent

- 60 percent of the developed land area will be manufacturing, the other 40 percent will be office space
- 85 percent of developed areas will be impervious surfaces, the remaining 15 percent will be landscaped surfaces or open space

LID Technique Evaluation

The study area, as characterized above, has several constraints with respect to use of LID techniques. These include:

- Seasonally high ground water levels
- Limited infiltration capacity of site soils because of high winter groundwater levels
- Lack of native vegetation resulting from agricultural use of the land
- Flat slopes
- Salmonid populations in the receiving waters

LID techniques from the Guidance Manual include the following:

- Site assessment
- Site planning and design
- Site phasing and fingerprinting
- Preserving native soils and vegetation
- Clearing and grading
- Bioretention cells
- Sloped bioretention
- Bioretention swales
- Tree box filters
- Maintenance
- Amending construction site soils
- Permeable pavement
- Vegetated roof
- Minimal excavation foundations
- Homeowner education
- Downspout dispersion
- Roof stormwater harvesting systems
- Filter strips
- Media filtration

The LID techniques have been evaluated with respect to the identified constraints and the proposed commercial/industrial park land use for the site. The results of this evaluation together with descriptions of the techniques are given in Table 1. As may be noted from Table 1, many of the LID techniques cannot be applied to the Study Area because of the limited infiltration capacity of the soils, the flatness of the site, and the proposed intensity of development.

Table 1
LID Technique Evaluation

LID Technique	Description	Applicability	Comments
Site assessment	The site assessment process evaluates the hydrology, topography, soils, vegetation, and water features of the site to identify how stormwater moves through the site prior to development. Wetlands, riparian management areas and floodplains are considered in the assessment process.	Applicable	
Site planning and design	Site planning and design addresses road, driveway, and parking layouts, road crossings, street trees, site layout, and building design. LID practices applicable to a given site influence the planning and design of these elements for the site.	Applicable	
Site phasing and fingerprinting	Site construction phase planning is performed to minimize impacts on LID elements. Site fingerprinting refers to placing development away from environmentally sensitive areas (wetlands, steep slopes, etc.), future open spaces, tree save areas, future restoration areas, and temporary and permanent vegetative buffer zones. It also confines ground disturbance to areas where structures, roads and rights-of-way will exist after construction is complete.	Partially applicable	- Development will be setback from sensitive area - Existing site soils are disturbed from agricultural uses of the land. - Industrial park design standard is for 85% impervious and 15% landscaping/open space
Preserving native soils and vegetation	This technique addresses preservation of native soils and vegetation as a primary LID objective to limit impacts on aquatic systems. This is done through reduction of total impervious surface coverage; providing areas for infiltration of project runoff; and maintaining or closely mimicking the natural hydrologic function of the site.	Not applicable	- Existing site soils are disturbed from agricultural uses of the land. - Industrial park design standard is for 85% impervious and 15% landscaping/open space

Clearing and grading	For project clearing and grading, the primary LID technique is to minimize site disturbance through reducing the extent of grading and retaining vegetative cover. This technique seeks to minimize hydrologic modifications and control sediment yield from the site.	Partially applicable	- Sediment yield from site will be controlled by BMPs - Existing site soils are disturbed from agricultural uses of the land. - Industrial park design standard is for 85% impervious and 15% landscaping/open space
Bioretention cells	Bioretention cells (also known as "rain gardens") provide for onsite retention of stormwater through the use of vegetated depressions engineered to collect, store and infiltrate runoff.	Not applicable	- Seasonally high ground water levels
Sloped biodetention	The sloped biodetention technique uses grassy vegetative barriers such as hedgerows on contours to detain stormwater and reduce pollutant loads.	Not applicable	- Site has flat slopes
Bioretention swales	Bioretention swales function to collect, store and infiltrate runoff on a linear basis such as in landscaped swales in roadway medians.	Not applicable	- Seasonally high ground water levels
Tree box filters	Tree box filters are a mini bioretention area installed beneath trees. With this technique, runoff is directed to the tree box where it is cleaned by vegetation and soil before being discharged to a catch basin. The runoff also helps to irrigate the tree.	Applicable	
Maintenance	On-going maintenance and long term protection of native vegetation and soils associated with LID stormwater facilities are necessary to their successful performance. Clearly written maintenance procedures and LID area protection plans are important to this element.	Applicable	

Amending construction site soils	With this technique, disturbed site soils are amended to enhance their hydrologic attributes and environmental benefits in landscaped areas. Soil amendment specifications include organic matter content, pH, depth of amendment and subsoil preparation.	Applicable	
Permeable pavement	Permeable pavement surfaces accommodate pedestrian, bicycle and vehicular traffic while allowing the infiltration, treatment and storage of stormwater. The general categories of this technique relate to the pavement wearing material and include: • Permeable asphalt concrete • Permeable concrete • Permeable gravel • Permeable pavers Permeable pavement sections consist of: (1) a permeable wearing course or surface area designed to provide the strength needed for traffic loads; (2) an aggregate base below the surface section for support, vertical and lateral dispersion of water, and temporary storage of runoff; (3) and separation layer using non-woven geotextile fabric below the aggregate base to prevent upward migration of fine soil particles; and (4) where required, a water quality treatment layer to filter pollutants and protect the ground water.	Partially applicable	- The City of Marysville require a minimum of one foot separation from seasonally high ground water levels - Infiltration limited - If the aggregate base section is used for detention storage, an impervious liner will be needed below and on the sides of the section. - Permeable concrete sidewalk most feasible application for permeable pavement technique.

Vegetated roof	Vegetated roofs are also known as green roofs and eco-roofs. They are categorized as either intensive (deeper soil layer, intensive plantings, higher maintenance) or extensive (shallower soil layer, lower cost, lower maintenance). Benefits identified for vegetated roofs include energy efficiency and air quality, temperature and noise reduction in urban areas, improved aesthetics, extended roof life, and reduction in stormwater flows. The typical vegetated roof section includes from top to bottom: vegetation layer; growth medium (soil) layer; separation layer; drainage, aeration, water storage and root barrier layer; water proof membrane; and roof structure section.	Applicable	- Extensive category most appropriate for proposed industrial park
Minimal excavation foundations	This LID technique seeks to limit soil disturbance during construction by the use of minimal excavation systems. The objective is to limit compaction of site soils from heavy equipment operations which would result in degradation of the infiltration and storage capacities of the site soils.	Not applicable	- Industrial park design standard is for 85% impervious and 15% landscaping/open space
Property Owner/Homeowner education	Property Owner/Homeowner education is an important component of a successful LID maintenance program and LID area protection plan. Clearly written operations and maintenance procedures and protection management plans should be a part of any homeowner education program.	Applicable	
Downspout dispersion	Downspout dispersion provides for the dispersion and infiltration of roof runoff onsite. Several dispersion methods are available including splash blocks, gravel trenches and sheet flow.	Not applicable	- Large roofs - Seasonally high ground water levels - Infiltration limited

Roof stormwater harvesting systems	Roof stormwater harvesting (also know as "rainwater harvesting") is the collection and storage of roof runoff for domestic or irrigation purposes. Harvesting systems include a collection (roof) area, a filter, a storage device (tank or vault) and an outflow device.	Applicable	
Filter strips	Filter strips are grassy slopes located adjacent to an impervious area subject to vehicular traffic. Pollutants are removed by the action of grass blades which enhance sedimentation and trapping and adhesion of pollutants to the grass. Filter strips are graded to provide for sheet flow over the entire filter area.	Possibly applicable	- Flat site
Media filtration	Media filtration includes sand filter units or patented units using leaf compost material or other media such as perlite, zeolite and others. Pollutants are removed through filtration in sand filters and filtration, adsorption, ion exchange and microbial degradation in the patented units.	Applicable	

Recommended LID Components

From the results of the evaluations presented in Table 1, the following LID techniques are considered applicable to the master planning area:

- Vegetated (Green) roofs—Runoff in excess of the vegetated roof demand would be subject to detention.
- Site planning and design—This could be encouraged by the City during the pre-application process.
- Tree box filters—Promotes pre-treatment of runoff and tree irrigation.
- Property owner education—Promotes awareness of LID operation and maintenance needs.
- Roof stormwater harvesting (for irrigation of landscaped area)—Runoff in excess of storage capacity would be subject to detention.
- Permeable concrete sidewalks—This technique is being considered elsewhere by the City.

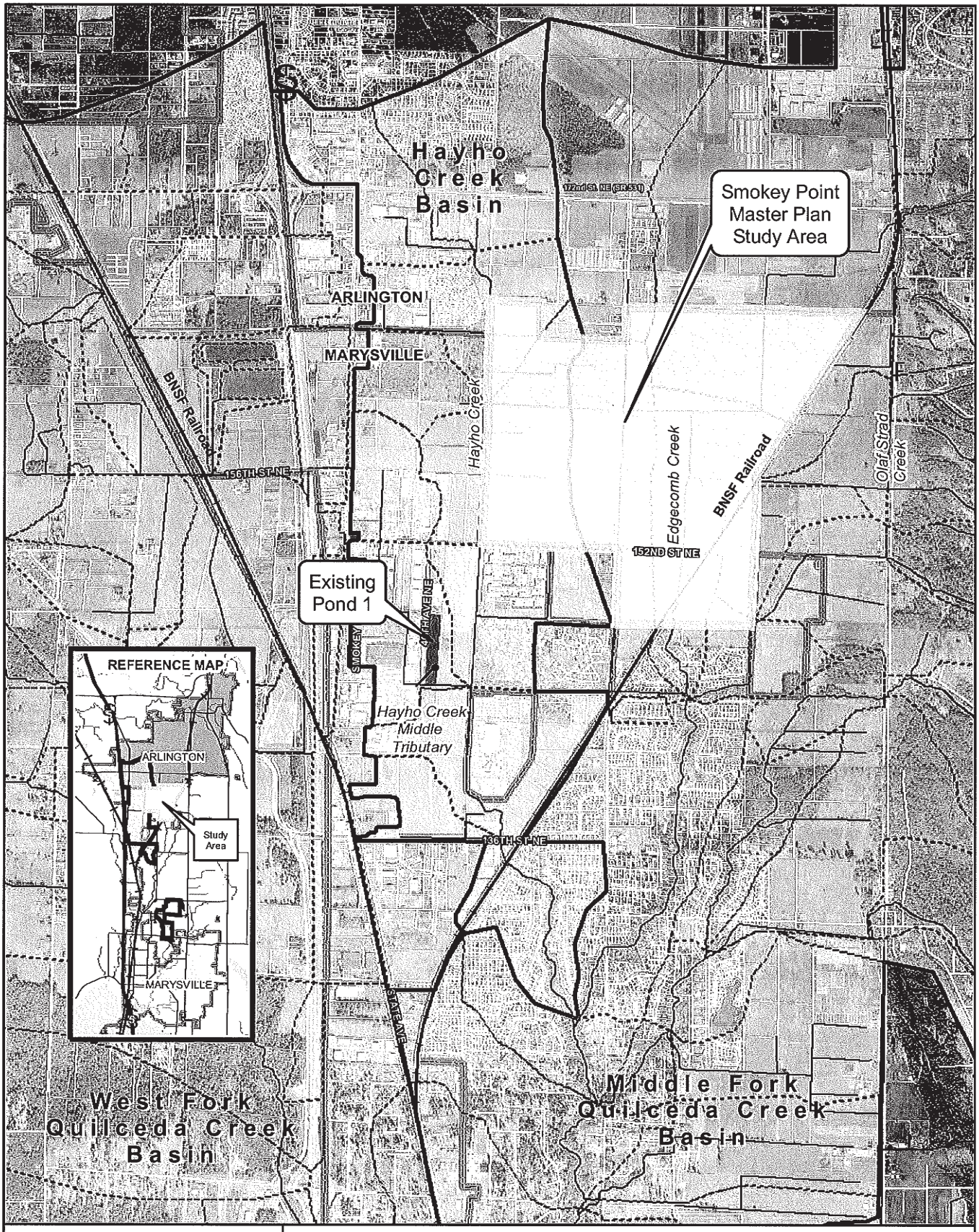

Figure 1
Vicinity Map

Legend

- City Boundary
- Stream
- Basin Boundary
- Subbasin Boundary
- Middle Fork Quilceda Creek Basin
- West Fork Quilceda Creek Basin
- Hayho Creek Basin

F

0 0.25 0.5 Miles

Source: GIS data obtained from Snohomish County GIS, City of Marysville GIS and Otak GIS.
Disclaimer: This data is not to survey accuracy and is meant for planning purposes only.

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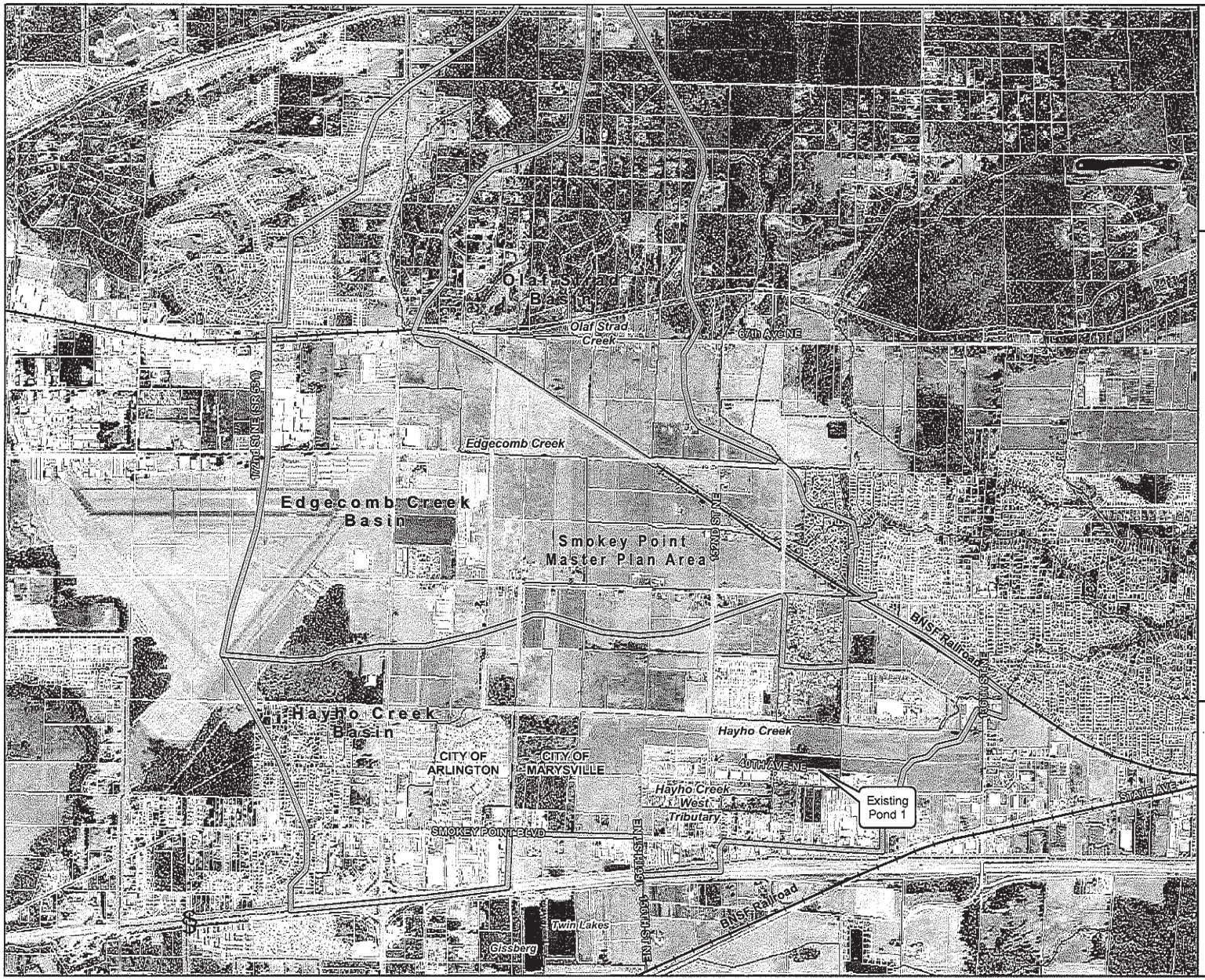

0 1,000 2,000 4,000 Feet

Legend

- Stream
- City Boundary
- Study Area Boundary
- Basin Boundary
- Existing Pond 1 Site

Figure 2
Study Area
Drainage Basin Boundaries

City of Marysville, Washington
80 Columbia Avenue
Marysville, Washington 98270
Phone: (360) 651-5100
Fax: (360) 651-5099

otak
10230 NE Points Drive
Kirkland, Washington 98033
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Technical Memorandum

otak

10230 NE Points Drive
Suite 400
Kirkland, WA 98033
Phone (425) 822-4446
Fax (425) 827-9577

To: Patricia Love, Community Planning Manager, Perteet, Inc.

From: Joe Simmler, PhD
Larry Grimm, PE

Copies:

Date: February 2, 2007

Subject: Drainage Technical Memorandum #2 Preferred Site Plan: Preliminary Drainage Review
Smokey Point Master Plan
City of Marysville, Washington

Project No.: 30813

Introduction

The development and selection of the conceptual drainage plan for the Smokey Point Master Plan area is described in this memorandum. The boundaries of the planning area are shown in Figure 1. In the following paragraphs, the preferred master land use plan and its associated land use conversion are described, followed by the results of preliminary hydrologic modeling to estimate required water quality and detention volumes on an area-wide basis. Water quality, detention, and conveyance facility siting options (onsite and regional) are described and evaluated, along with a review of the potential drainage impacts associated with the relocation of Edgecomb Creek. The elements of the selected drainage plan concepts are grouped and proposed alternative drainage concepts drainage plans are described. Existing conditions, defined in terms of basin boundaries, streams, topography, soils, habitat, and wetlands, have been previously described in draft Technical Memorandum #1, dated January 22, 2007.

Methodology and Approach

The Master Plan area encompasses portions of the Hayho Creek and Edgecomb Creek drainage basins. Of the 675 total acres within the Master Plan area, approximately 190 acres (28 percent) are located in the Hayho Creek Basin, and 485 acres (72 percent) are located in the Edgecomb Creek Basin. Agriculture, intermixed with some commercial and urban development, are the principle land use in both basins. The topography is flat with a slope of about 0.3 percent.

Drainage planning concepts have emphasized the use of regional facilities, although on-site concepts have also been considered. Each basin area is addressed separately. Rate control criteria have been developed based on the results of continuous runoff simulation modeling performed earlier by Otak, for the City's State Avenue project. Both basins are subject to planning constraints posed by high winter ground water levels, water quality treatment requirements of local fish-bearing waters, subtle changes in slope and topography, and the objective of minimizing pumping and optimizing the use of gravity for the conveyance, storage and treatment of the region's stormwater.

Preferred Master Plan Land Use Plan

The proposed land use, provided by the City (via Patricia Love of Perteet, Inc., Personal Communication) for evaluation in this Master Plan is defined by the following criteria:

- 25 percent of the land within the planning area is assumed to be wetlands and not available for development.
- Lot coverage of the developed land area by buildings/structures will be 50 percent.
- 60 percent of the developed land area will be in manufacturing; the other 40 percent will be in office space.
- 85 percent of developed areas will be in impervious surfaces; the remaining 15 percent will be in landscaped surfaces or open space.

Preliminary Hydrologic Modeling Results

The results of recent hydrologic modeling by Otak for the City in North Marysville (128th Street Regional Pond Feasibility Technical Memorandum, September 25, 2006) were used to provide preliminary sizing of water quality, rate control, and conveyance facilities. Uniformity of soils in the area and comparable developed impervious areas (85 percent) allowed the use of these results for preliminary planning within the Master Plan area. The hydrologic modeling used the USEPA Hydrologic Simulation Program-Fortran (HSPF) continuous rainfall-runoff model for computing runoff from rainfall. A one-hour time step was used to predict flow rates. Existing land cover for the modeling was assumed to be forest to reflect pre-European settlement conditions, as required by Ecology's 2005 Stormwater Management Manual for Western Washington (2005 Ecology Manual).

For the purposes of this analysis, the North Marysville results (September 25, 2006) were converted to volume per developed area for water quality treatment and detention. Undetained runoff rates and detained release rates were also estimated on a developed acre basis for use in sizing preliminary conveyance facilities. The estimated unit area values are given below.

- Water quality volume: 4,200 cubic feet per developed acre.
- Detention volume: 17,000 cubic feet per developed acre.
- Undetained runoff rate: 0.5 cfs per developed acre.
- Detain runoff rate: 0.04 cfs per developed acre.

Note that more detailed modeling will need to be performed as a part of the future master drainage plan work, to demonstrate flow peak and duration conformance at stream system points of compliance and more accurately size and locate needed facilities.

Drainage Plan Alternative Analysis

Presented in this section are the results of the analysis of the various conceptual alternatives considered for stormwater management in the planning area. Alternatives have been created to conform to the requirements of the 2005 Ecology Manual, as well as the unique characteristics of the planning area.

Water Quality Treatment Alternatives

Discharge from developed areas will be to Type F, fish inhabited, streams that drain into the Middle Fork of Quilceda Creek. This creek system contains Chinook spawning habitat and is regulated by the Endangered Species Act. Maintaining base flows, managing peak flows, and reducing pollutant loadings are key to the preservation of these critical habitat spawning areas. Industrial/commercial development discharges to Type F streams are required to have stormwater treated to an "enhanced treatment" level to reduce potential pollutant loadings, especially the discharge of dissolved metals.

Acceptable enhanced treatment methods described in the 2005 Ecology Manual include the following:

- Large sand filter
- Amended sand filter
- Stormwater treatment wetland
- Compost-amended filter strip
- Ecology embankment
- Two facility treatment train (as described in Table 3.2 of the 2005 Ecology Manual, provided as Table 1 below).

Table 1 Treatment Trains for Dissolved Metals Removal	
First Basic Treatment Facility	Second Treatment Facility
Biofiltration Swale	Basic Sand Filter or Sand Filter Vault or Media Filter[1]
Filter Strip	Linear Sand Filter with no presettling cell needed
Linear Sand Filter	Filter Strip
Basic Wetpond	Basic Sand Filter or Sand Filter Vault or Media Filter[1]
Wetvault	Basic Sand Filter or Sand Filter Vault or Media Filter[1]
Basic Combined Detention/Wetpool	Basic Sand Filter or Sand Filter Vault or Media Filter[1]
Basic Sand Filter or Sand Filter Vault with a presettling cell if the filter isn't preceded by a detention facility	Media Filter[1]

[1] The media must be of a nature that has the capability to remove dissolved metals effectively based on at least limited data. Ecology includes Stormfilter's ™ leaf compost and zeolite media in this category.

Based on our experience, the stormwater treatment wetland is an economical choice for water quality treatment when constructed as part of an open pond detention facility. As such, it has been selected to be the favored alternative during development of this regional conceptual plan.

Rate Control (Detention) Alternatives

Detention options include above-grade open water surface facilities and below-grade buried facilities, as listed below:

- Above grade options:
  - Open ponds with earth embankments*
  - Off-channel detention for high flows
  - Open vertical wall ponds
  - Parking lot ponds
  - Rooftop detention
  - Roof runoff pressure downspout system to above grade pond
  - Elevated sub-floor onsite detention
  - Porous pavement with aggregate storage section or "Infiltrator" chamber storage systems
- Below grade options:
  - Buried precast or cast-in-place concrete vaults
  - Buried pipe or "Infiltrator" chamber storage systems
  - Porous pavement with aggregate storage section or "Infiltrator" chamber storage systems

(*Note that open ponds within the 10,000-foot FAA wildlife hazard zone would have to include approved mitigation measures, as discussed below.)

If adequate parcels of land are available downstream at a reasonable price, the use of regional detention ponds within earth berms can be an affordable and effective approach for providing detention for a large area, such as the Master Plan area. All of the above options are applicable for either onsite or regional approaches. Onsite options would be privately constructed, while regional facilities would likely be constructed by the City with capacity in the facility being available for purchase by future developers, similar to Pond #1 in the adjacent Hayho Creek drainage basin.

The buried vault and pipe systems are the least desirable systems for the planning area because of the high seasonal ground water levels and the higher construction and maintenance costs. High ground water levels require that the vaults or pipes be designed to resist flotation when the systems are empty. The anti-flotation design can add considerable expense to vault or pipe system costs.

Stormwater collection will be accomplished on each of the parcels by future private developers. Conveyance systems will be needed in both the Hayho Creek and Edgecomb Creek basins to convey new flows to (1) points of discharge within the creek systems (where detention and stormwater treatment are provided onsite), to (2) regional treatment and detention facilities (where a regional approach is taken), and to (3) points of discharge from regional facilities.

Conveyance alternatives include:

- Gravity pipelines
- Gravity open channels
- Combination of gravity open channels with pipelines
- Pumping and pressure pipelines

Where feasible, gravity open channels are preferred because of lower construction costs (assuming City right-of-way locations vs. land purchase) and the added water quality treatment that vegetated channels provide. Gravity pipelines are preferred next, followed by pumping and pressure pipeline systems, which are the least desirable because of higher costs, energy consumption, and reduced reliability during power outages.

Gravity pipelines can be designed to operate under a slight pressure (surcharge) in order to discharge from a higher elevation to a lower elevation bermed pond with an above grade detention water level. Pond 1 conveyance system in the Hayho Creek drainage system, is designed in this manner. This design method is applicable to both basins within the planning area.

Preliminary conveyance corridors identified for the planning area are shown in Figure 2. The alignments are based in part on the proposed road system for the planning area. The conveyance system will need to maintain current land use drainage provisions. During the early years of development, roadside ditches may be appropriate. As development continues and road improvements are made, piped systems will likely need to be installed in order to convey the

increased flows. The lower portions of the proposed ditch/pipe conveyance systems to downstream regional detention facilities, will operate under piped surcharge conditions.

Low Impact Development Technique Alternatives

Low Impact Development (LID) techniques for the Master Plan Area are limited because of (1) high seasonal ground water levels, (2) low infiltration rates of the surfical soils, (3) the conversion of nearly all of the planning area from its original forest cover to agriculture uses, and (4) the proposed intensity of industrial/commercial development for the planning area.

Of the 23 different types of LID techniques reviewed (see Draft Technical Memorandum #1, dated January 22, 2007), those considered most applicable to the planning area and its development proposal include:

- Vegetated roofs
- Tree box filters
- Roof stormwater harvesting (for irrigation of landscaped areas)
- Pervious concrete sidewalks

LID water quality treatment techniques, such as filter strips and media filtration, could be used to provide a portion of the enhanced treatment requirement for developed areas. LID techniques would typically be constructed onsite by private developers.

Onsite and Regional Alternatives

Both onsite and regional stormwater management alternatives have been considered for the planning area. Onsite facilities would be planned, designed and constructed by the developer of the property. Regional facilities would likely be planned, designed and constructed by the City. The combination of onsite and regional facilities also has potential because of the flatness of the area and the desirability of avoiding pumped stormwater systems. Water quality treatment could occur onsite, with excess flows being conveyed to a downstream regional facility.

The development of conceptual onsite and regional approaches for stormwater management in the Master Planning area have emphasized the use of:

- Multi-functional approaches (involving both stormwater detention and treatment. as well as wetland mitigation, stream/habitat enhancement, parks/recreational uses, and aesthetics).
- Integration with open space opportunities.
- The use of off-channel storage, as land availability and drainage opportunities allow.

Consideration of these potential opportunities can lead to improved environmental design, reduced permitting/mitigation, lower land costs, improved aesthetics, and enhanced economic incentives for development of this Master Plan area.

FAA Hazardous Wildlife Separation Criteria

The Arlington Municipal Airport is located just north of the planning area, on the north side of 172nd Street NE (SR 531). Open bodies of water within 10,000 feet of air operations area are considered by the Federal Aviation Administration (FAA) to be hazardous wildlife attractants (FAA Advisory Circular No. 150/5200-33A, July 27, 2004). The portion of the planning area considered to be hazardous by the FAA criterion is shown in Figure 2 as the area within the semi-circle drawn from the most southern part of the airport.

Nearly all of the planning area is located within 10,000 feet of air operations areas at the Arlington airport. The FAA Advisory Circular No. 150/5200-33A titled "*Hazardous Wildlife Attractants on or Near Airports*", states that no permanent standing water is allowed and that a management plan for the safe operation of stormwater facilities should be developed to assure airport safety.

> *"2-3. Water Management Facilities. Drinking water intake and treatment facilities, stormwater and wastewater treatment facilities, associated retention and settling ponds, ponds built for recreational use, and ponds that result from mining activities often attract large numbers of potentially hazardous wildlife. To prevent wildlife hazards, land-use developers and airport operators may need to develop management plans, in compliance with local and state regulations, to support the operation of stormwater management facilities on or near all public-use airports to ensure a safe airport environment…*
>
> *b. New stormwater management facilities. The FAA strongly recommends that off-airport stormwater management systems located within the separations identified in Sections 1-2 through 1-4 be designed and operated so as not to create above-ground standing water. On-airport stormwater detention ponds should be designed, engineered, constructed, and maintained for a maximum 48-hour detention period for the design storm and remain completely dry between storms. To facilitate the control of hazardous wildlife, the FAA recommends the use of steep-sided, narrow, linearly shaped water detention basins. When it is not possible to place these ponds away from an airport's AOA, airport operators should use physical barriers, such as bird balls, wires grids, pillows, or netting, to prevent access of hazardous wildlife to open water and minimize aircraft-wildlife interactions. When physical barriers are used, airport operators must evaluate their use and ensure they will not adversely affect water rescue. Before installing any physical barriers over detention ponds on Part 139 airports, airport operators must get approval from the appropriate FAA Regional Airports Division Office. All vegetation in or around detention basins that provide food or cover for hazardous wildlife should be eliminated. If soil conditions and other requirements allow, the FAA encourages the use of underground stormwater infiltration systems, such as French drains or buried rock fields, because they are less attractive to wildlife."*

Several design concepts to accommodate the FAA criteria have been developed and are outlined below:

- Detention and water quality treatment in an open pond, with constructed wetland, outside of the FAA 10,000-foot wildlife hazard zone.
- Onsite or regional water quality and low flow detention (bankfull) and stream enhancement with flood storage for higher flows which would need to drain out within 48 hours (if inside FAA 10,000-foot wildlife hazard zone).
- Detention and water quality treatment in open pond with constructed wetland inside of FAA 10,000-foot wildlife hazard zone, with FAA-approved mitigation devices (bird balls, wire grids, netting, etc.) to prevent access of hazardous wildlife.
- Detention and water quality treatment inside of FAA 10,000-foot wildlife hazard zone with open pond designed to drain the design storm within 48 hours. Flows present in excess of 48 hours would be detained below pavement grade in "Infiltrator" and rock void system with impervious liner, conveyed to an open pond with FAA approved mitigation devices, or conveyed to an open pond beyond the 10,000-foot zone.

Potential Regional Treatment and Detention Sites

To minimize pumping of stormwater, regional detention facilities have been located at the lower elevation locations in the southerly part of the planning area. Potential sites for regional facilities in the Hayho Creek and Edgecomb Creek basins are shown in Figure 3. These sites, located in lower elevation areas to the south, have been selected on the basis of location and availability of the land. The availability, cost and wetland constraints of the parcels which make up individual sites have not yet been fully assessed.

Hayho Creek Basin

In the Hayho Creek basin, the existing City Regional Pond 1 facility and adjacent future Regional Pond 2, on city-owned property, offer convenient sites to serve this western part of the planning area. They are located as shown in Figure 3. Both of these regional sites are outside the FAA hazard zone. Pond 1, as constructed, and Pond 2, as proposed in 2006, have a combined detention capacity of 67.2 acre-feet (2,930,000 cubic feet). This volume has the capacity to serve about 172 acres of development at 17,000 cubic feet of detention per acre. This capacity, plus high flow off channel detention in Hayho Creek, will likely satisfy both existing and ultimate development of the upper basin. Approximately 105 acres of the northern area (about 79 acres net after wetland reductions) could be conveyed by gravity to the Pond 1 and 2 sites, using surcharged large diameter pipe(s). The remaining 85 acres of the more southern area (63 acres net) would need to be pumped into the conveyance system or handled onsite. One option to be considered is overdetaining runoff from the northern area to allow for the direct discharge (i.e. without detention) of new runoff flows from the more southern parcels.

In order to convey stormwater to either of these two City owned pond sites, flow would need to be conveyed under Hayho Creek on the north side of 152nd Street NE. To accomplish this, flows would need to be either conveyed via a shallow cover pipe under the streambed, pumped, or conveyed using an inverted siphon (depressed sewer) installed under the creek. The inverted siphon would need to be a multiple barrel design in order to convey the full range of design flows at self-cleaning velocities. All of these alternatives would connect to a new trunk storm line in 152nd Street NE, running from the west side of Hayho Creek to the existing Regional Pond 1 trunk system using a 48-inch pipe.

Edgecomb Creek Basin

Within the Edgecomb Creek Basin, four potential sites for regional facilities were identified and evaluated, both within and south of the Master Planning area. The sites are shown in Figure 3. The FAA 10,000-foot hazard zone boundary is also shown in Figure 3. The entire planning area is within the FAA 10,000-foot hazard zone.

The Edgecomb Creek portion of the planning area is about 485 acres. After adjusting this area for wetland areas (assumed to be 25 percent), the maximum net developable area is about 364 acres. Open pond detention and water quality facility land requirements have been estimated to be ten percent of the developed service area. For development of 364 acres, a pond area of 37 acres can be expected.

The regional sites located south of the planning area (Sites #3 and #4) would likely receive flow entirely by gravity conveyance. The sites within the planning area (Sites #1 and #2) will receive only a portion of the flow by gravity. If a pond design elevation (detention peak) of 109 feet is assumed, about 52 percent of the area (or 190 acres of developable land) could drain to the facility by gravity. At a design elevation of 105 feet, about 73 percent of the area (266 acres developable) could drain by gravity to the facility. The remaining non-gravity area would be addressed by one of the methods described for the Hayho Creek pumping service area or alternatively by overdetaining additional flows to allow runoff from the lower areas to discharge to the stream without detention.

Sites #2 and #3, east of the BNSF railroad right-of-way, would likely have a lower property acquisition cost than the properties on the west side. Site #2 on the east side of the railroad right-of-way is also part of an "add-on area" being evaluated by Shaw Environmental, Inc., as a part of its Edgecomb Creek Relocation Alternatives Analysis. The key elements of that analysis are discussed in a following section. The use of the add-on area as a regional detention site provides an opportunity to explore a multi-function project (stormwater, environmental mitigation and parks/recreation) and improved environmental designs, as discussed previously.

Basin Exchange Concepts

With the flatness of the planning area, it is possible to consider the exchange of basin areas, where runoff from the land area within one basin is diverted to an adjacent basin, in exchange for an equal amount of flow (or area) being permanently diverted from the second basin to the first basin.

This concept could offer the benefit of using existing regional facility, such as Pond 1, which is currently not fully used in terms of basin subscribers. If a development proposal in the Edgecomb Creek Basin has a proposed implementation schedule that is earlier than a development within Hayho Creek, then a basin exchange could be mutually beneficial for both the City and the Edgecomb Creek Basin developer. The Hayho Creek Basin exchange area could be incorporated into the Edgecomb Creek Basin at a later date. The technical feasibility of an exchange would need to be determined in a more detailed drainage master plan, with the ability to maintain gravity conveyance being one of the key criterion.

Edgecomb Creek Relocation Alternatives

Edgecomb Creek is currently located on the west side of the BNSF railroad tracks and follows a rectangular alignment along roads and parcel boundaries as it flows south to join the Middle Fork of Quilceda Creek. As part of this planning process, two alternative creek relocation alignments are being evaluated by Shaw Environmental, Inc., (as subconsultant to Perteet, Inc.). One alignment is on the west side of the railroad tracks and the other is on the east side of the railroad tracks, as shown in Figure 4. The existing Edgecomb Creek alignment is also shown in this figure. Planning concept criteria identified for these two stream rerouting alternatives by Shaw include the following:

- 100-year flood capacity in the high-flow channel
- A low-flow channel for year-round stream flow
- In-stream large woody debris (LWD) for habitat
- Vegetation throughout the channel and buffer
- 150-foot buffers on each side of the creek along the entire length
- Off-channel rearing habitats
- The connection of the hillside streams north of 162nd Street NE

An "Add-On Alternative" has also been developed by Shaw Environmental, Inc. for each of the two alternative stream relocation alignments. The Add-On Alternative is the triangular parcel in the southeast corner of the planning area which is bounded by the BNSF right-of-way on the west, as shown in Figure 3. The concept of the Add-On Alternative is to add environmental mitigation for the realignment of the stream, as described by Shaw Environmental, Inc. below.

> *"The Add-On Alternative could be paired with either the West or East Alternative alignment options for Edgecomb Creek. The Add-On could be implemented either in the future when more funding is available, or concurrently with the selected West or East Alternative. The conceptual plan is to build a regional detention*

facility to store stormwater and reduce peak flows. Wetlands would be restored and created to be used as mitigation for wetland impacts from the development in the annexation area west of the railroad.

Edgecomb Creek would flow through this area and an expanded floodplain could be built to provide additional surface water storage during storm events. Off-channel habitats and riparian plantings would improve habitat conditions. Existing wetlands in the southwest portion of the property could be enhanced by removing invasive vegetation and planting native shrubs and trees. The adjacent Strawberry Fields Park could be improved to include a wetland interpretation area and trial system. This portion of the annexation area is somewhat isolated from adjacent areas due to the railroad on the west and lack of road access to the east. Therefore, this area may have lower demand for future development than the area west of the railroad. Additional plans could include relocating the Middle Fork of Quilceda Creek, to flow through the area to enhance stream habitat conditions and to provide increased floodplain storage."

Drainage Plan Concept Selection

The requirements and components for the conceptual alternatives and options for stormwater management have been described above. Based on identified constraints and opportunities, along with guidance from the City's planning and public works staffs, the following are the selected, preferred conceptual drainage plans for each basin. These concepts will be developed in more detail in Technical Memorandum #3, the final drainage report.

Hayho Creek Basin

Preferred Conceptual Alternatives:

- Construct Pond 2 (detention and water quality pond) which will operate in parallel with existing Pond 1 by a connection between the two ponds.
- Extend the storm trunk sewer system in 152nd Street NE to the east side of Hayho Creek to receive flow from new development within the basin.
- For the portion of the basin that cannot gravity drain to Pond 1 and Pond 2 facilities, the following options will be considered:
  - Over-detention in the gravity flow service area to allow direct discharge of the lower portion of the planning area into Hayho Creek.
  - Onsite detention and water quality treatment, with discharge to Hayho Creek.
  - High flow off-channel detention storage (on the Pond 2 site).
  - Pumping of undetained discharges to the trunk storm sewer system, which will operate under a surcharged condition.
  - Detention in stream channel using additional capacity by creating additional floodplain capacity above the normal high water mark.

Edgecomb Creek Basin

Preferred Conceptual Alternative: Construct regional detention and water quality treatment in the southern portions of the Planning area. (The Add-On triangular parcel east of the BNSF Railroad right-of-way (Site #2) and the parcel southeast of the planning area (Site #3) are the candidate sites preferred by the City for the construction of regional water quality and detention facilities.

- The Add-On parcel will serve as much of the gravity service area of the basin as practicable, with the FAA criteria needing to be addressed in the design (i.e., no ponded water over 48 hours after a rainfall event.).
- The southeast off-site parcel will serve as much of the area that cannot be drained by gravity to the Add-On parcel, as practicable, assuming topography allows conveyance without pumping.
- Open-channel conveyance will be used where feasible, with the lower/southern portions of the backbone conveyance systems being surcharged using piped systems where flat slopes do not allow normal gravity flow.
- For areas that cannot drain by gravity to either of the two southern regional parcels, the options listed above for the Hayho Creek Basin would be considered for Edgecomb Creek Basin, including:
  - Over-detention in the gravity service area to allow for direct discharge of a portion of the pumped service area to Edgecomb Creek
  - On-site detention and water quality treatment discharge to Edgecomb Creek
  - High flow off-channel detention storage
  - Pumping of undetained discharges to the trunk storm sewer system, which operates under a surcharge condition
  - Detention in streams, utilizing additional floodplain storage created by modifying the stream channel and adjacent buffer area.

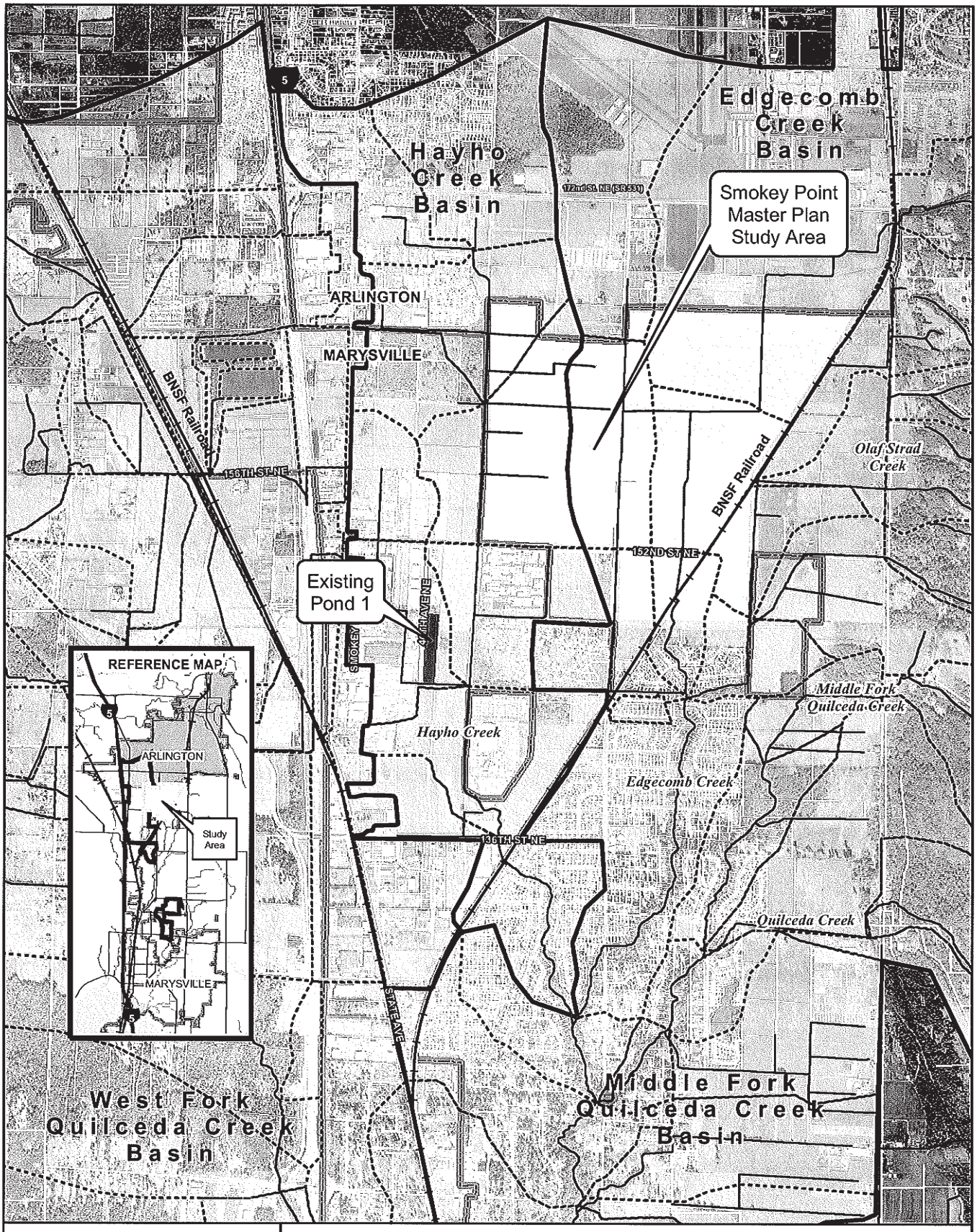

Figure 1
Vicinity Map

Legend

- City Boundary
- Stream
- Basin Boundary
- Subbasin Boundary
- Middle Fork Quilceda Creek Basin
- West Fork Quilceda Creek Basin
- Hayho Creek Basin

Source: GIS data obtained from Snohomish County GIS, City of Marysville GIS and Otak GIS.
Disclaimer: This data is not to survey accuracy and is meant for planning purposes only.

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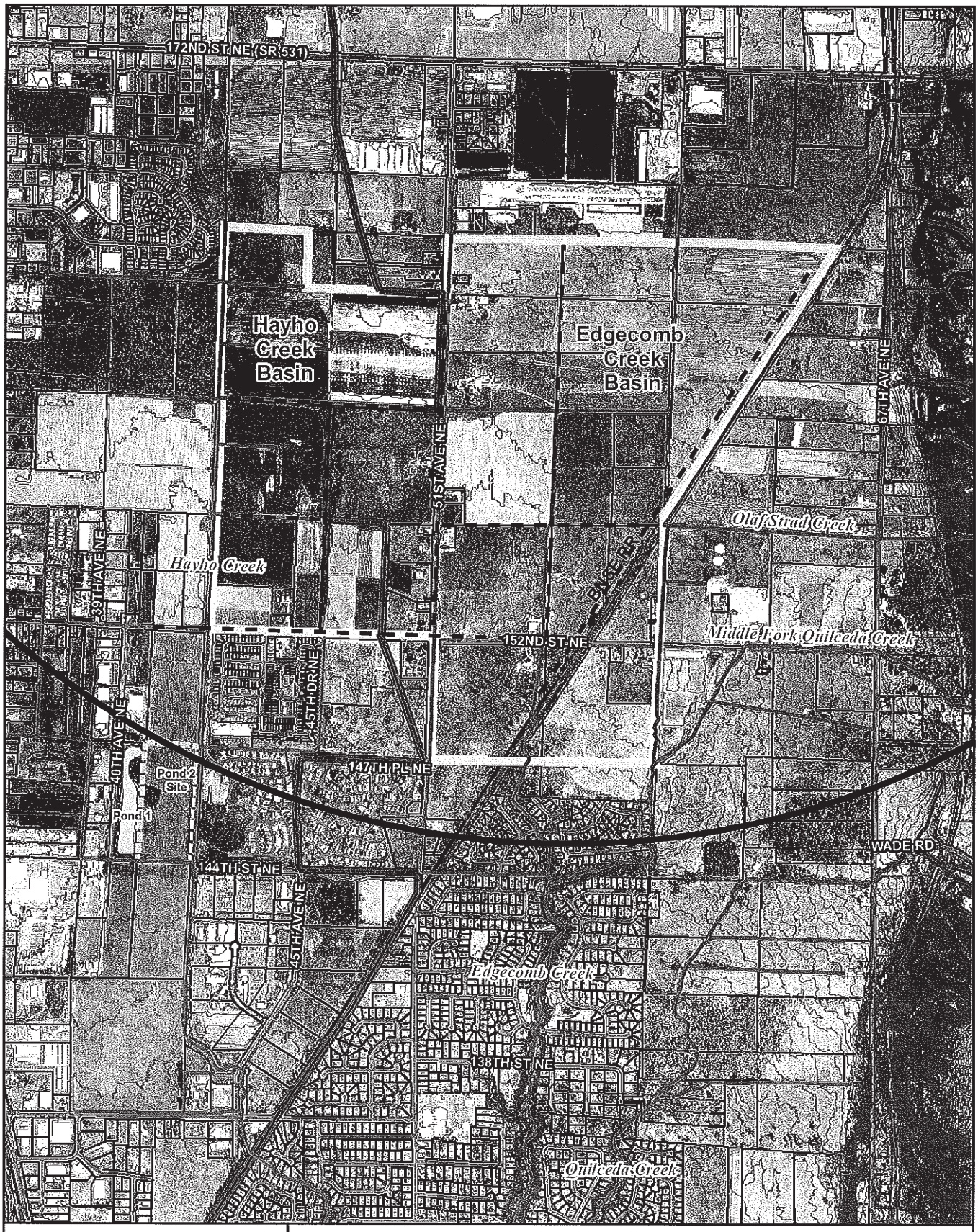

Figure 2
Potential
Conveyance Corridors

Legend

- Subbasin Boundary
- FAA Flight Path Boundary
- Project Area
- Conveyance Corridors
- Stream
- Pond 2 Site

0 1,600 Feet

Source: GIS data obtained from Snohomish County GIS, City of Marysville GIS and Otak GIS.
Disclaimer: This data is not to survey accuracy and is meant for planning purposes only.

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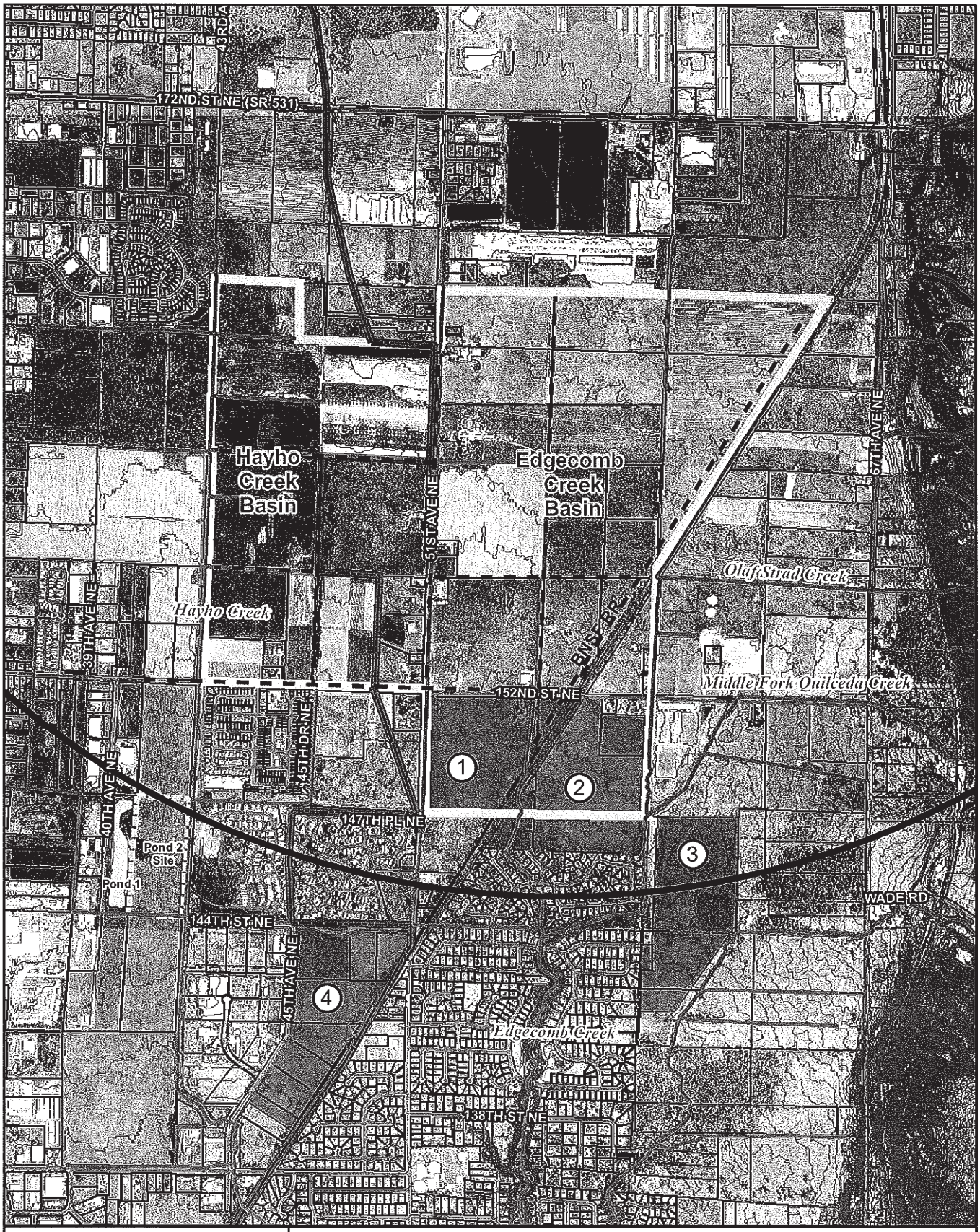

Figure 3
Potential
Stormwater Sites

Legend

- Subbasin Boundary
- FAA Flight Path Boundary
- Project Area
- (#) Potential Regional Site
- Stream
- Potential Stormwater Sites
- Pond 2 Site
- Conveyance Corridors

N

0 1,500 Feet

Source: GIS data obtained from Snohomish County GIS, City of Marysville GIS and Otak GIS.
Disclaimer: This data is not to survey accuracy and is meant for planning purposes only.

FILE: K:/project/30800/30813/GIS/mxds/figures/Figure3_PotenSWSites.mxd

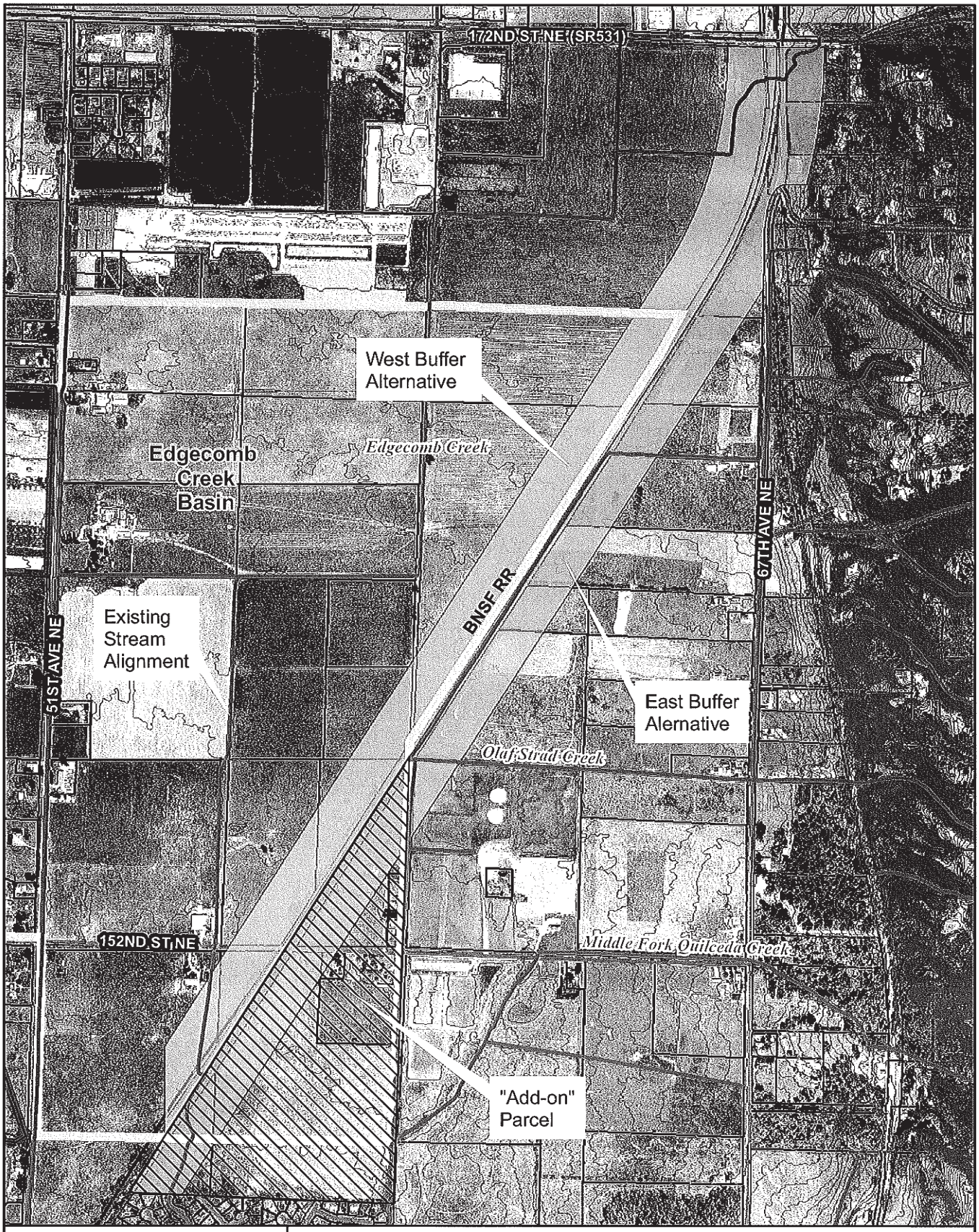

Figure 4

Edgecomb Creek
Relocation Alternatives

Legend

- Subbasin Boundary
- FAA Flight Path Boundary
- Project Area
- Stream
- Potential Wetland Mitigation Site

Source: GIS data obtained from Snohomish County GIS, City of Marysville GIS and Otak GIS.
Disclaimer: This data is not to survey accuracy and is meant for planning purposes only.

FILE: K:/project/30800/30813/GIS/mxds/figures/Figure4_RelocationAlts.mxd

Planning Level Project Cost Opinion
Hayho Creek Basin Drainage Facilities
Smokey Point Master Plan Area
City of Marysville, Washington

Otak, Inc. 2/8/2007

Item No.	Item Description	Unit	Quantity	Unit Price	Estimated Cost
	Construction				
1	Pond 2 detention and water quality pond and 48-inch storm drain to 152nd Street NE	LS			$2,256,000
2	Conveyance System to Pond 2 Connection	LS			$1,750,000
				Subtotal	$4,006,000
	State Sales Tax @ 8.5%				$340,510
	Engineering, Legal and Administrative @ 15%				$600,900
	Permitting @ 5%				$200,300
	Construction Management @ 20%				$801,200
	Conveyance Right-of-Way Acquisition - 20-feet Wide	Acres	3	$25,000	$75,000
	Property Acquistion - City Owned Value	Acres	18.9		$1,775,000
	Contingency @ 20%				$801,200
	Total				$8,600,110
	Total - (Rounded)				$8,600,000

Note: Wetland mitigation for Pond 2 is contained in the proposed wetland mitigation for Hayho Creek for Ponds 1 and 2.

Planning Level Project Cost Opinion
Edgecomb Creek Basin Drainage Facilities
Smokey Point Master Plan Area
City of Marysville, Washington

Otak, Inc. 2/8/2007

Item No.	Item Description	Unit	Quantity	Unit Price	Estimated Cost
	Construction				
1	Add-on Area Pond - Site # 2	Acre-feet	70	$34,000	$2,380,000
2	FAA Mitigation @ 20% of Add-On Area Pond				$476,000
3	Site #1 Pond	Acre-feet	53	$34,000	$1,802,000
4	Site #1 Pond and Site #2 Pond Outfalls to Creek	LS			$200,000
5	Conveyance System to Site #1 Pond and Site Pond #2				$3,220,000
				Subtotal	$8,078,000
	State Sales Tax @ 8.5%				$686,630
	Engineering, Legal and Administrative @ 15%				$1,211,700
	Permitting @ 5%				$403,900
	Construction Management @ 20%				$1,615,600
	Conveyance Right-of-Way Acquisition 20-feet Wide	Acres	8	$25,000	$200,000
	Property Acquistion	Acres	40	$16,000	$640,000
	Contingency @ 30%				$2,423,400
	Total				$15,259,230
	Total - (Rounded)				$15,300,000

Note: Wetland mitigation for the Edgecomb Creek facilities will be included as a part of the Edgecomb Creek relocation project.

FINAL REPORT

CITY OF MARYSVILLE
Smokey Point Master Plan
DRAINAGE ELEMENT

Submitted to Perteet, Inc.
2707 Colby Avenue, Suite 900
Everett, WA 98201

Submitted by Otak, Inc.
10230 NE Points Drive, Suite 400
Kirkland, WA 98033

Project No. 30813

February 9, 2007

Technical Memorandum

10230 NE Points Drive
Suite 400
Kirkland, WA 98033
Phone (425) 822-4446
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To:	Patricia Love, Community Planning Manager, Perteet, Inc.
From:	Joe Simmler, PhD Larry Grimm, PE
Copies:	
Date:	February 8, 2007
Subject:	Technical Memorandum #3: Preferred Drainage Plan, Smokey Point Neighborhood Master Plan
Project No.:	30813

Introduction

The Preferred Drainage Plan (Plan) presented in this memorandum completes the development of the Drainage Element for the Smokey Point Master Plan (Master Plan). This Plan has been developed from an analysis of alternatives, which included Low Impact Development (LID) techniques as described in Drainage Technical Memorandum #1, and various drainage alternatives for ultimate development, as described in Drainage Technical Memorandum #2. Conceptual drainage approaches for the planning area shown in Figure 1, included conveyance, water quality treatment, and detention for rate control. Each of the conceptual approaches were analyzed and evaluated to arrive at the preferred drainage concepts for the Hayho Creek and the Edgecomb Creek basins. These memoranda are provided in Appendix A .

A synopsis of Drainage Technical Memorandum #1 and #2 results is provided, followed by the preferred drainage conceptual plans for the Hayho Creek and Edgecomb Creek planning areas. Conceptual level cost estimates have also been prepared for each Preferred Drainage Plan. The details of these two preferred drainage plans will need to be further refined during the preparation of a master drainage plan for the planning area.

Synopsis of Drainage Technical Memoranda #1 and #2

LID Technique Selection: Technical Memorandum #1 (January 22, 2007)

From the results of the evaluations presented in Technical Memorandum #1, the following LID techniques are considered applicable to the Master Plan area:

- Vegetated (Green) roofs - to assist with onsite detention; runoff in excess of the vegetated roof demand would be subject to detention.
- Site planning and design - to incorporate LID techniques into final site designs; this could be encouraged by the City during the pre-application process.

- Tree box filters - to detain some runoff onsite, and romote pre-treatment of runoff, along with tree irrigation.
- Property owner education - to promote landowner awareness of LID operation and maintenance needs.
- Roof stormwater harvesting - to detain stormwater onsite and use it for irrigation of landscaped areas; runoff in excess of storage capacity would be subject to detention.
- Permeable concrete sidewalks and parking lots - to promote onsite detention and infiltration, as season and site conditions allow.

Selected LID techniques would likely be implemented onsite by individual developers as a part of their drainage plans for their individual properties. They would be used to complement the proposed regional facilities that are being considered by the City. Effective LID techniques may result in some reduction of regional drainage needs and costs, depending on local site conditions.

Stormwater Conceptual Plan Selection: Technical Memorandum #2 (February 2, 2007)

The analysis presented in Technical Memorandum #2 resulted in the selection of the following Preferred Conceptual Drainage Plans for the Hayho Creek and Edgecomb Creek planning areas. Note that the Edgecomb Creek conceptual drainage plan is compatible with both of the Edgecomb Creek relocation alternatives presented in the report (January 12, 2007) by Shaw Environmental The alternatives are shown in Figure 2.

Hayho Creek Basin

Preferred Conceptual Alternative:

- Construct Regional Pond 2 for detention and water quality pond treatment. This regional facility will operate, as currently planned, in parallel with existing Pond 1 via a connection between the two ponds.
- Extend the storm trunk sewer system along 152nd Street NE to the east side of Hayho Creek in order to receive flow from new development within the basin.
- For the portion of the basin that cannot gravity drain to Pond 1 and Pond 2, the following options have been considered:
  - Over-detention in the gravity flow service area to allow direct discharge of the lower portion of the planning area into Hayho Creek,
  - Requiring onsite detention and water quality treatment, with discharge to Hayho Creek,
  - Creation of high flow off-channel detention storage on the Pond 2 site, parallel to the Hayho stream channel,
  - Pumping of undetained discharges to the trunk storm sewer system, which will operate under a surcharged condition and discharge into Pond 2, and
  - Detaining excess stormwater runoff in an in-stream channel using the additional capacity creating by altering the stream buffer to add new floodplain capacity above the ordinary high water mark.

Edgecomb Creek Basin

Preferred Conceptual Alternative:

Construct regional detention and water quality treatment in the southern portions of the planning area. (Currently, the Add-On triangular parcel east of the BNSF Railroad right-of-way (Site #2) and the parcel southeast of the planning area (Site #1) are the candidate sites preferred by the City for the construction of regional water quality and detention facilities.)

- The Add-On parcel will serve as much of the gravity service area of the basin as practicable, with the FAA criteria needing to be addressed in the design (i.e., no ponded water over 48 hours after a rainfall event.).
- The southeast off-site parcel (Site #1) will serve as much of the area that cannot be drained by gravity to the Add-On parcel, as practicable, assuming topography allows conveyance without pumping.
- Open-channel conveyance will be used where feasible, with the lower/more southern portions of the backbone conveyance systems being surcharged using large diameter piped systems where flat slopes do not allow normal gravity flow.
- For areas that cannot drain by gravity to either of the two southern regional parcels, the options listed above for the Hayho Creek Basin would be considered for Edgecomb Creek Basin, including:
  - Over-detention in the gravity service area to allow for direct discharge of a portion of the pumped service area to Edgecomb Creek,
  - Onsite detention and water quality treatment discharge to Edgecomb Creek,
  - High flow off-channel detention storage,
  - Pumping of undetained discharges to the trunk storm sewer system, which operates under a surcharge condition, and
  - Detention in streams, utilizing additional floodplain storage created by modifying the stream channel and adjacent buffer area.

Preliminary Drainage Facility Definition

In this third technical memorandum, the preferred drainage concepts for each basin identified in Technical Memorandum #2 are further evaluated and preliminary drainage facilities defined. The preliminary facility plan for each basin is described below and is schematically displayed in Figure 3.

Hayho Creek Basin

For the Hayho Creek Basin, the key drainage facilities and their associated costs for the Preferred Drainage Plan are presented below. This basin within the Master Plan area contains a total of 190 acres. With wetlands assumed to be 25 percent of the gross area, the developable area is estimated to be 142 acres.

Detention and Water Quality Treatment Facilities

Existing Regional Pond 1 and proposed Regional Pond 2 have been selected to serve the majority of the drainage from new development within the Hayho Creek Basin portion of the Master Plan area. The location of Ponds 1 and 2 are shown in Figure 3. They offer sufficient water quality treatment and detention capacity for the gravity-flow service area and 50 percent of the pumped service area. The remaining 50 percent of the area is assumed to provide water quality treatment and detention onsite and discharge to Hayho Creek. The preliminary design of Pond 2 was completed in April, 2006. The two ponds would, as currently planned, be hydraulic connected by an opening in the berm separating the ponds, where excess flows from Pond 1 would overflow into Pond 2. The ponds would function as one facility for detention purposes. The combined detention volume of both ponds is 67.2 acre-feet (2,930,000 cubic feet). Enhanced water quality treatment for both Ponds 1 and 2 is provided by constructed wetlands, located in the bottom of each of the ponds. The ponds are sized to treat 91 percent of all runoff, as required in the 2005 Ecology Manual. Both ponds are located outside the FAA 10,000-foot wildlife hazard zone, and therefore can retain standing water for periods greater than 48 hours. The preliminary design of Pond 2 includes trail provisions, principally on top of the pond berms, as a recreational/aesthetic amenity. With a maximum detention design elevation of 105.8, approximately 79 acres of gravity flow and 31 acres of pumped flow from developed land (78% of the developable land) within the Master Plan area would be able to drain into Regional Ponds 1 and 2. The remaining 32 acres (22%) of developable land would address detention and water quality treatment onsite.

Conveyance System Concept

An initial proposal for regional conveyance to Ponds 1 and 2 is shown in Figure 3. The pipe conveyance sizes are expected to range from a 60-inch diameter pipe (or two 42-inch diameter pipes) in the upper basin to a 72-inch diameter pipe (or two 48-inch diameter pipes) in the lower part of the drainage system. Systems for the collection of stormwater within individual properties would be constructed privately and delivered to the storm conveyance system. The sizes of the piped conveyance system assumes that one-half of the properties in the pumped service zone would pump into the pipe conveyance system. The remaining half of the pumped service area is assumed to provide water quality treatment and detention onsite and be discharged to Hayho Creek.

Phasing Opportunities

The major phasing opportunity would be to use the available capacity in Pond 1 before constructing (or during construction) of Pond 2. Pond 2 could be constructed in two phases. However a two-phase pond would be more costly than a single, larger pond constructed all at one time. Note that an engineering economic analysis that considers the time value of money would be necessary to judge the viability of phasing the construction of Pond 2. This analysis would use assumptions pertaining to capacity purchase schedules and pond capacity requirements.

The conveyance pipe system could be phased if multiple pipes are used (i.e. two smaller pipes, rather than on larger pipe). The first phase of construction would need to acquire the necessary right-of-way or easements for the future second phase pipe(s). As with the phasing of Pond 2, the phasing of the conveyance system would cost more than if it were constructed all at one time. (Again, an engineering economic analysis, as suggested for Pond 2, should be made to determine the viability of conveyance phasing.)

Opinion of Project Costs

Estimates of preliminary costs have been prepared and are provided in Appendix C. Project costs are in 2007 dollars and include conveyance system right-of-way acquisition; the cost of construction; and allowances for design, administration, legal services, permitting and construction administration. The estimated total project cost of the Hayho Creek system is $8,600,000. Note that although the City owns the Pond 2 site, the cost of this property has been included in the project cost. Under the assumptions made for this analysis, approximately 110 acres (78%) of development (net of wetlands) would be served by the project. The remaining 32 acres (22%) of development, located lower in the basin, would be served by onsite private facilities.

Edgecomb Creek Basin

For the Edgecomb Creek Basin, the key drainage facilities and the associated cost of the Preferred Drainage Plan are presented below. This basin within the Master Plan area contains a total of 485 acres. The developable area is estimated at 364 acres after 25 percent of the gross area is deducted for the presence of wetlands.

Detention and Water Quality Facilities

Two of the three preferred regional detention sites are located on the east side of the BNSF railroad tracks, as shown in Figure 3. These sites are preferred due to the lower costs for property on the east side of the tracks in comparison to the properties west side of the tracks, and the opportunity of integrating the detention function of the regional facility with the stream re-location design elements. Sites #1 and #2 are the candidate sites for two proposed regional ponds. Site #2 would need to be designed with mitigation, as it is in the FAA wildlife hazard zone. Site #3 is an alternative site; however, it would likely have a higher property value than the more easterly regional site and is also in the FAA wildlife hazard zone. If not needed, Site #3 could be developed with onsite detention and onsite water quality facilities, and could possibly discharge via gravity to the Edgecomb Creek system to the south. This onsite detention and water quality system could also be used to accept the drainage from the properties of the pumped service area for the easterly ponds. These properties are located north and northwest of Site #3, as shown in Figure 3.

Regional Sites #1 and #2 have the capacity to accept the runoff from approximately 315 acres of developed land. The remaining 49 acres would address their stormwater detention and treatment needs on site. With a maximum detention design elevation of 105, approximately 266 developable

acres (84% of the developable land) would be able to gravity drain to these two ponds. The pond on Site #2 has the detention capacity to serve about 180 acres (49%) of new development. This is about two-thirds of the gravity service area. The remainder of the gravity zone and a part of the pressure zone could be detained in a Site #1 pond with possible expansion of the pond to the north into the FAA wildlife hazard zone. Points of discharge from these two ponds will need to be determined during preparation of the master drainage plan for the area.

Definition of water quality treatment methods for locations within the FAA wildlife hazard zone will require a detailed evaluation to arrive at cost-effective choices. This will be done during preparation of the master drainage plan. One option is to provide treatment of undetained flows onsite using low head methods, such as filter strips, for areas subject to vehicular traffic. Another option is wet ponds with FAA-approved mitigation measures in conjunction with detention in the same facility.

Conveyance System Concept

The preliminary regional conveyance system for the Edgecomb Creek Basin is shown in Figure 3. Two north-south conveyance systems are needed to collect discharges over the east-west width of the basin. These connect to east-west conveyance line(s) in the 152nd Street NE corridor that would convey the basin flows to regional detention ponds located on the east side of the BNSF railroad tracks.

The preliminary sizing for the westerly system includes a 36-inch diameter pipe in the upper basin and a 54-inch diameter pipe in the lower basin. The easterly system includes a 48-inch diameter pipe in the upper basin and a 72-inch diameter pipe (or two 48-inch diameter pipes) in the lower basin. The conveyance lines will need to be constructed under the BNSF railroad tracks by boring and jacking methods. Permits will be needed from BNSF for this work. Conveyance lines will also need to be constructed under Edgecomb Creek for either of the west or east stream relocation alignments. Systems for the collection of stormwater within individual properties would need be constructed privately and delivered to the regional storm conveyance system. As with the Hayho Creek Basin, the proposed pipe sizes assume that one-half of the properties in the pumped service zone would pump into the pipe conveyance system. The remaining half of the pumped service area is assumed to provide water quality treatment and detention onsite and discharge to open channels discharging to the Edgecomb Creek system. (Note: An option to replace pumping is to over-detain gravity service areas, so the more southern areas can discharge directly to the stream).

Edgecomb Creek Relocation Coordination

The proposed Edgecomb Creek relocation alignments are shown in Figure 2. The preferred Site #2 pond is proposed with either of the two alignments. The plan for the "Add-on Area" would be developed during preparation of the master drainage plan. The "Add-on Area" plan would address the stream relocation alignment with the developed area, water quality system and detention pond layouts, wetland mitigation area, and other functions identified.

Phasing Opportunities

Detention and water quality system phasing would be developed during preparation of the master drainage plan and correlated with land development scenarios. An anticipated development schedule would also need to be prepared to support ultimate build-out of the Master Plan Area. With this schedule, phasing opportunities would be identified and evaluated for feasibility. An engineering economic analysis considering the time value of money should be performed as a part of the evaluation.

As discussed for the Hayho Creek Basin, the conveyance pipe system could be easily phased if two or more multiple pipes are used. The first phased system would need to acquire any necessary rights-of-way and/or easements for the future second phase pipe(s). Phasing of the conveyance system would cost more than if it were constructed all at once; although, some developer funding may be anticipated to support future phasing. An engineering economic analysis as discussed above would also be made during preparation of the master drainage plan to determine the viability of conveyance phasing.

Opinion of Project Costs

The preliminary estimates of project cost have been prepared and are provided in Appendix C. Project costs are in 2007 dollars and include the cost of construction and allowances for design, administration, legal services, permitting/mitigation, property and right-of-way acquisition, and construction administration. The estimated project cost of conveyance, water quality treatment and detention in the Edgecomb Creek Basin for the gravity service area (at design detention water surface elevation of 105) and one-half of the pumped service area is $15,300,000. Under the assumptions made for this analysis, approximately 315 acres (86%) of development (minus wetland areas) would be served by the project. The remaining 49 acres (14%) of development would be served by private onsite facilities.

Recommendations

Preliminary drainage facility plans to serve the Hayho Creek and Edgecomb Creek basins in the Smokey Point Master Plan Area have been outlined above. These plans, which are considered feasible from a technical standpoint, require further analysis and verification through a master drainage planning process. It is recommended that preparation of the Master Drainage Plan be initiated as early in the annexation process as possible to provide the City and potential developers with refined facility and project cost information.

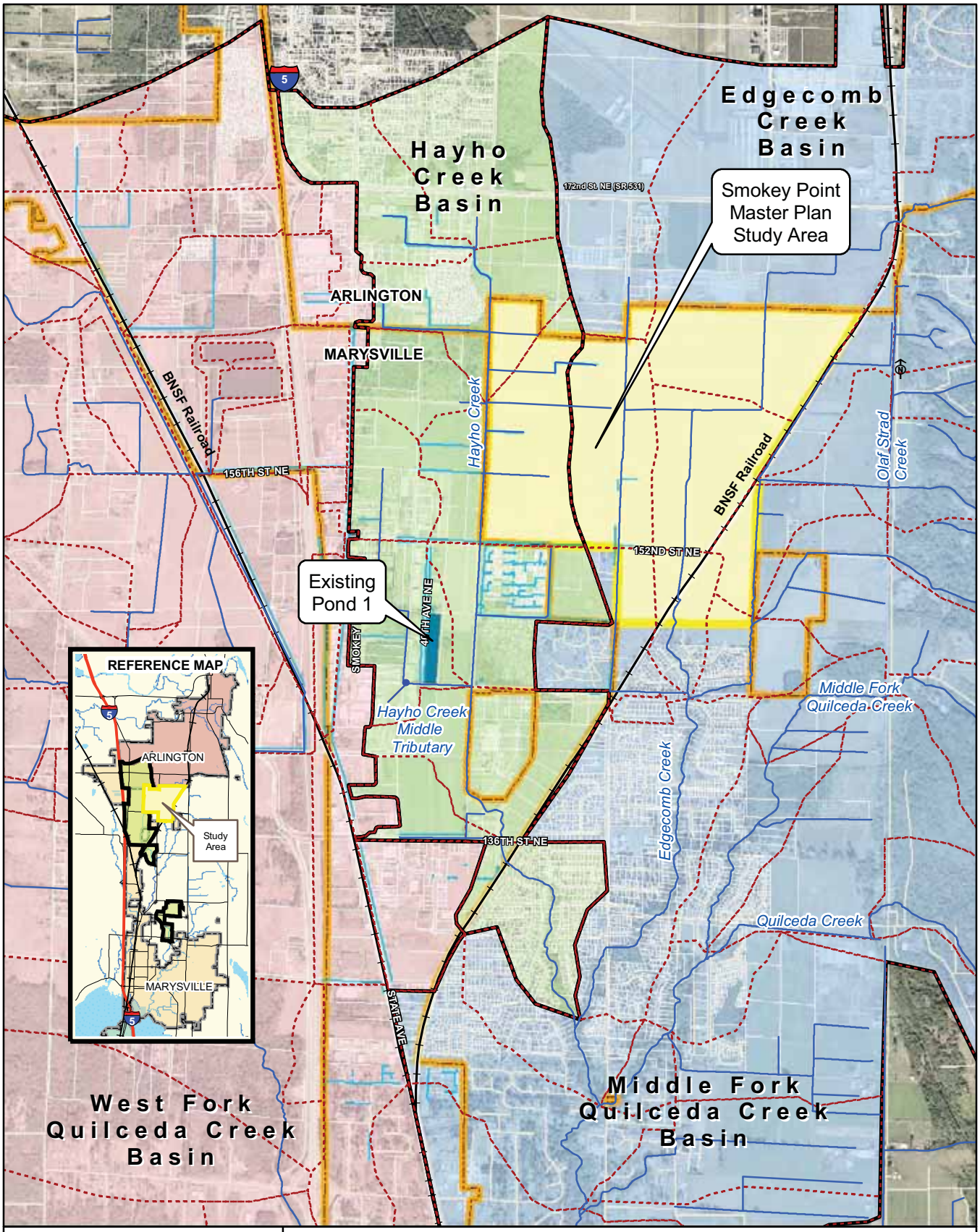

Figure 1
Vicinity Map

Legend

- City Boundary
- Stream
- Basin Boundary
- Subbasin Boundary
- Middle Fork Quilceda Creek Basin
- West Fork Quilceda Creek Basin
- Hayho Creek Basin

Source: GIS data obtained from Snohomish County GIS, City of Marysville GIS and Otak GIS.
Disclaimer: This data is not to survey accuracy and is meant for planning purposes only.

0 0.25 0.5 Miles

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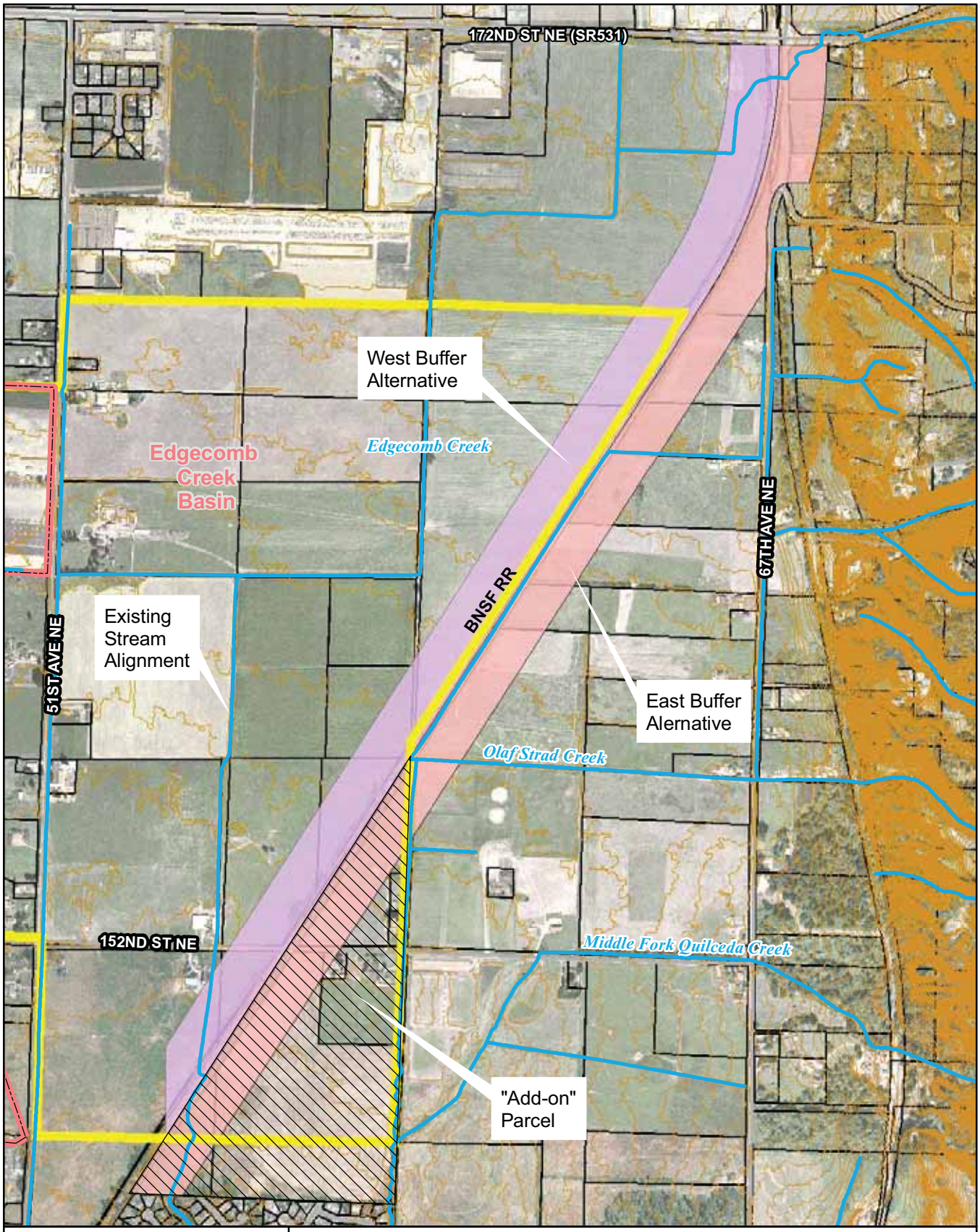

Figure 2

Edgecomb Creek
Relocation Alternatives

Legend

- Subbasin Boundary
- FAA Flight Path Boundary
- Project Area
- Stream
- Potential Wetland Mitigation Site

N

0 1,000 Feet

Source: GIS data obtained from Snohomish County GIS, City of Marysville GIS and Otak GIS.
Disclaimer: This data is not to survey accuracy and is meant for planning purposes only.

FILE: K:/project/30800/30813/GIS/mxds/figures/Tech memo 3/Figure2_RelocationAlts.mxd

SMOKEY POINT MASTER PLAN

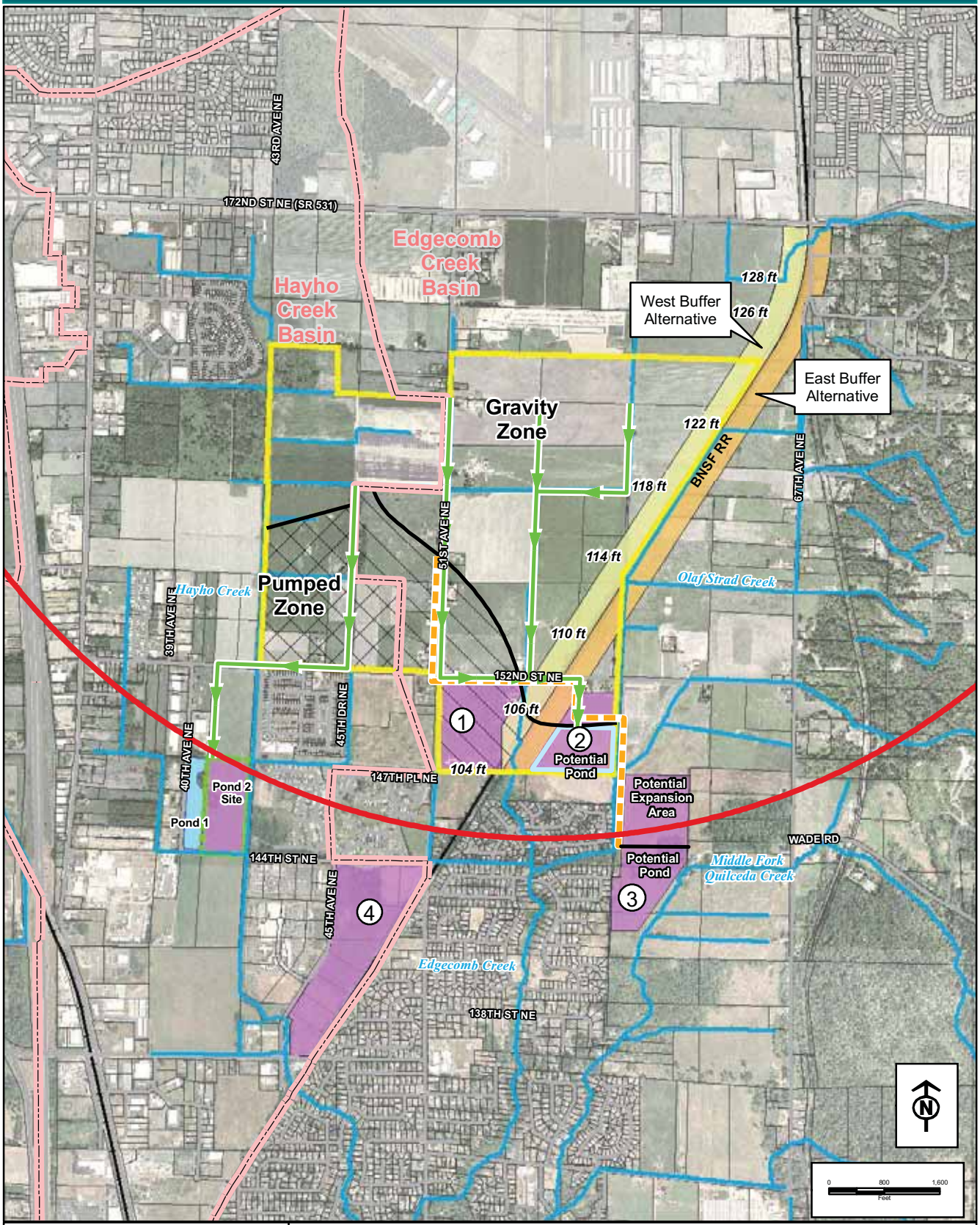

Figure 3
Preliminary
Facility Plan

Legend

- Subbasin Boundary
- Wildlife Hazard Zone
- Project Area
- Pond 2 Site
- Stream
- Potential Stormwater Sites
- Conveyance Line
- Conveyance Line (Site #3 Pond)
- HayhoCreek-Private on-site system or pumping
- Edgecomb Creek-Private on-site system or pumping (WSE 109 and 105 zones)

Source: GIS data obtained from Snohomish County GIS, City of Marysville GIS, Otak GIS and Aerials Express 2005.
Disclaimer: This data is not to survey accuracy and is meant for planning purposes only.

Appendix A

Tech Memo #1

Technical Memorandum

10230 NE Points Drive
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To: Perteet, Inc.
Patricia Love, Community Planning Manager,

From: Otak, Inc.
Joe Simmler, PhD, Larry Grimm, PE,

Copies:

Date: Draft January 22, 2007

Subject: Drainage Technical Memorandum #1—
Low Impact Development Evaluation
for Master Plan Area

Smokey Point Neighborhood Master Plan EIS
City of Marysville, WA

Project No.: 30813

Introduction

The results of the evaluation and selection of Low Impact Development (LID) techniques for stormwater management in the Smokey Point Neighborhood Master Plan area are presented in this memorandum. The Low Impact Development Technical Guidance Manual for the Puget Sound [1] (Guidance Manual) describes LID as follows: *Low impact development (LID) is a stormwater strategy that emphasizes conservation and use of natural site features integrated with distributed, small-scale stormwater controls to more closely mimic natural hydrologic patterns in residential, commercial, and industrial settings*. The full menu of LID techniques presented in the Guidance Manual has been considered in the following evaluations for the Smokey Point neighborhood.

This technical memorandum describes the objectives of the master planning effort, existing drainage-related conditions, and proposed land use alternatives in order to provide a framework and reference for the LID evaluations. Various LID techniques are then identified and described. An evaluation is presented of the techniques with respect to master plan objectives and site opportunities and constraints. The results of the LID review and technique selection process for the City of Marysville are described and conclusions and recommendations are made.

[1] Puget Sound Action Team, Washington State University Pierce County Extension, Low Impact Development Guidance Manual for Puget Sound, January 2005 (Revised May, 2005)

Master Plan Objectives

The Smokey Point Neighborhood Master Plan addresses a 675-acre area located south of the Arlington Airport, as shown in Figure 1. Concurrent with this master planning effort, this area is being annexed to the City of Marysville from Snohomish County. The proposed land use includes a future industrial center—the planning of which will need to be consistent with the City's vision of a high-tech commercial/industrial corridor for the area—with a minimum of residential development.

Specific objectives have been established for the master planning work. These include: (1) establishing land use and transportation standards; (2) preparing a critical areas analysis and preliminary mitigation plans; (3) developing conceptual stormwater management plans including regional and LID approaches; and (4) establishing land use regulations that will allow the expansion and growth of the Arlington Airport. This technical memorandum addresses the LID objectives of the master plan, as applicable to Objective 3—developing a conceptual stormwater management plan.

Existing Conditions Summary

The pre-project setting and conditions relating to drainage are described in this section. These include drainage basins and patterns, hydrologic characteristics, topography, geology and soils, existing land use, and wetlands. The salmonid habitat of streams within the study area is also described.

Site Streams and Hydrology

The study area is located within the Middle Fork Quilceda Creek drainage basin, as shown in Figure 2. The majority of the study area drains to the Edgecomb Creek, while a lesser area drains to Hayho Creek. Both of these creeks are tributary to Middle Fork Quilceda Creek. The subbasin boundaries for Edgecomb and Hayho Creeks are also shown in Figure 2. The Hayho Creek subbasin was referred to as the "Smokey Point Channel West" subbasin in the December 2002 *Quilceda Creek Drainage Needs Report* by Snohomish County.

The City of Marysville has classified the streams within the Quilceda-Allen watershed. The classifications are shown in Figure A-1, Appendix A. Both Edgecomb and Hayho Creeks are classified as Type F streams. Type F streams are defined as "Those stream segments within the ordinary high water mark that are not Type S streams, and which are demonstrated or provisionally assumed to be used by salmonid fish."

Mean annual rainfall at the site is about 36 inches, based on the HSPF precipitation data set for North Marysville. December is the wettest month with an average rainfall of 5.0 inches. Mean daily temperatures range from 38º F in January to 64º F in August.

Flooding problems currently exist and have been reported within both the Hayho Creek and Edgecomb subbasins. These are described in Snohomish County's *Quilceda Creek Drainage Needs Report DNR No. 1* (December 2002, Quilceda DNR). Specific projects are proposed in DNR No. 1 to correct identified problems.

Topography

The topography in the study area slopes gently downward in a northeast to southeast direction at a grade of approximately 0.3 percent (three feet fall in 1,000 feet). Existing contours for the study area along with stream systems are shown in Figure 3. The prominent slope direction is south-southwest. The elevation of the basin ranges from approximately 124 feet in the northeast, to about 104 feet in the southeast. The flat topography creates challenges for designing and constructing stormwater conveyance and detention facilities. Many of the parcels that have been developed previously in the North Marysville area have been constructed on fill to provide the vertical drop needed to build gravity stormwater management systems.

Existing Land Use

Existing land use within the project tributary area is predominantly agricultural with small areas of single family, low density residential.

Soils

The North Marysville area lies within a north-south valley known as the Marysville Trough. The National Resources Conservation Service (NRCS, formerly the SCS) Soil Survey of Snohomish County Area, Washington identifies soils in the study area as primarily a combination of Custer fine sandy loam and Norma loam soils. The NRCS delineation of soil types in the study area are defined in the City's 2005 Comprehensive Plan, and are shown in Figure A-2, Appendix A. These soils are relatively uniform, primarily consisting of glacially deposited sand and gravel to a depth well below the typical limits of excavation. These soils are known to be porous and have seasonally high groundwater tables that restrict infiltration, contribute to localized flooding, and increase the amount and rate of surface water runoff.

Two geotechnical reports for properties adjacent to the study area were made available to the consulting team by the City. These included the Nelson Geotechnical Associates report for Dujardin Development Corporation's 150-acre berry farm property in the southeast quadrant of the 152nd Street NE/43rd Avenue NE intersection; and the AGRA Earth & Environmental report for the City of Marysville 60-acre Strawberry Fields Athletic Complex in the southwest quadrant of the 152nd

Street NE/59th Avenue NE intersection. The Dujardin property is located immediately south of the southwest corner of the study area and was being planned for residential development. The Strawberry Fields complex is located immediately east of the southeast corner of the study area. Relevant information from those reports is provided as a general reference for the master planning work.

The reports indicate the soil conditions in the area to be characterized by recessional outwash sands and silty sands. The report for the Dujardin property indicated that a surfical layer of 1.0 to 1.5 feet of modified soil was found in all explorations. Below the modified soil, a 0.5 to 2.5-foot layer of loose to medium dense soil was encountered. This consisted of silty sand or sand with silt. The deepest unit encountered was outwash. It was found at depths from one to four feet and interpreted as medium dense. The outwash consisted of fine to medium gray sand with silt to medium to course sand with gravel. The report for the Strawberry Fields site indicated that somewhat variable near-surface soil conditions were found. These consisted of loose to medium dense, interlayered silty sand/sandy silt in the upper two to four feet, underlain by a medium dense, saturated, coarse sand deposit. It also indicated that a one to two-foot thick layer of clayey silt was encountered below a depth of about two feet in the northeastern, east-central and southeastern portions of the site. Topsoil and sod was observed to an average depth of roughly six inches across the site.

Explorations at the Dujardin property encountered groundwater at depth ranging from three to four feet, while at the Strawberry Fields groundwater was encounter at depths of two to four feet. Shallow ground water level monitoring points were installed on both properties. Depths from ground surface to ground water at the Dujardin property ranged from 12 inches to 32 inches in early February 1999. At the Strawberry Fields, depths from ground surface to ground water ranged from 0.5 feet to 3.5 feet in early February 1997. Winter water levels within the study area may be similar to those encountered for the two properties.

Wetlands

Wetlands exist within the study area, but have not been delineated for individual parcels. Potential wetland areas within the study area, and defined in the City's 2005 Comprehensive Plan, are shown in Figure A-3, Appendix A.

Selected Land Use Development Criteria

The selected land development criteria of the Master Plan includes the following:

- 25 percent of the land within planning area is assumed to be wetlands and not available for development
- Lot coverage by buildings will be 50 percent

- 60 percent of the developed land area will be manufacturing, the other 40 percent will be office space
- 85 percent of developed areas will be impervious surfaces, the remaining 15 percent will be landscaped surfaces or open space

LID Technique Evaluation

The study area, as characterized above, has several constraints with respect to use of LID techniques. These include:

- Seasonally high ground water levels
- Limited infiltration capacity of site soils because of high winter groundwater levels
- Lack of native vegetation resulting from agricultural use of the land
- Flat slopes
- Salmonid populations in the receiving waters

LID techniques from the Guidance Manual include the following:

- Site assessment
- Site planning and design
- Site phasing and fingerprinting
- Preserving native soils and vegetation
- Clearing and grading
- Bioretention cells
- Sloped bioretention
- Bioretention swales
- Tree box filters
- Maintenance
- Amending construction site soils
- Permeable pavement
- Vegetated roof
- Minimal excavation foundations
- Homeowner education
- Downspout dispersion
- Roof stormwater harvesting systems
- Filter strips
- Media filtration

The LID techniques have been evaluated with respect to the identified constraints and the proposed commercial/industrial park land use for the site. The results of this evaluation together with descriptions of the techniques are given in Table 1. As may be noted from Table 1, many of the LID techniques cannot be applied to the Study Area because of the limited infiltration capacity of the soils, the flatness of the site, and the proposed intensity of development.

Table 1 LID Technique Evaluation			
LID Technique	Description	Applicability	Comments
Site assessment	The site assessment process evaluates the hydrology, topography, soils, vegetation, and water features of the site to identify how stormwater moves through the site prior to development. Wetlands, riparian management areas and floodplains are considered in the assessment process.	Applicable	
Site planning and design	Site planning and design addresses road, driveway, and parking layouts, road crossings, street trees, site layout, and building design. LID practices applicable to a given site influence the planning and design of these elements for the site.	Applicable	
Site phasing and fingerprinting	Site construction phase planning is performed to minimize impacts on LID elements. Site fingerprinting refers to placing development away from environmentally sensitive areas (wetlands, steep slopes, etc.), future open spaces, tree save areas, future restoration areas, and temporary and permanent vegetative buffer zones. It also confines ground disturbance to areas where structures, roads and rights-of-way will exist after construction is complete.	Partially applicable	- Development will be setback from sensitive area - Existing site soils are disturbed from agricultural uses of the land. - Industrial park design standard is for 85% impervious and 15% landscaping/open space
Preserving native soils and vegetation	This technique addresses preservation of native soils and vegetation as a primary LID objective to limit impacts on aquatic systems. This is done through reduction of total impervious surface coverage; providing areas for infiltration of project runoff; and maintaining or closely mimicking the natural hydrologic function of the site.	Not applicable	- Existing site soils are disturbed from agricultural uses of the land. - Industrial park design standard is for 85% impervious and 15% landscaping/open space

Clearing and grading	For project clearing and grading, the primary LID technique is to minimize site disturbance through reducing the extent of grading and retaining vegetative cover. This technique seeks to minimize hydrologic modifications and control sediment yield from the site.	Partially applicable	- Sediment yield from site will be controlled by BMPs - Existing site soils are disturbed from agricultural uses of the land. - Industrial park design standard is for 85% impervious and 15% landscaping/open space
Bioretention cells	Bioretention cells (also known as "rain gardens") provide for onsite retention of stormwater through the use of vegetated depressions engineered to collect, store and infiltrate runoff.	Not applicable	- Seasonally high ground water levels
Sloped biodetention	The sloped biodetention technique uses grassy vegetative barriers such as hedgerows on contours to detain stormwater and reduce pollutant loads.	Not applicable	- Site has flat slopes
Bioretention swales	Bioretention swales function to collect, store and infiltrate runoff on a linear basis such as in landscaped swales in roadway medians.	Not applicable	- Seasonally high ground water levels
Tree box filters	Tree box filters are a mini bioretention area installed beneath trees. With this technique, runoff is directed to the tree box where it is cleaned by vegetation and soil before being discharged to a catch basin. The runoff also helps to irrigate the tree.	Applicable	
Maintenance	On-going maintenance and long term protection of native vegetation and soils associated with LID stormwater facilities are necessary to their successful performance. Clearly written maintenance procedures and LID area protection plans are important to this element.	Applicable	

Amending construction site soils	With this technique, disturbed site soils are amended to enhance their hydrologic attributes and environmental benefits in landscaped areas. Soil amendment specifications include organic matter content, pH, depth of amendment and subsoil preparation.	Applicable	
Permeable pavement	Permeable pavement surfaces accommodate pedestrian, bicycle and vehicular traffic while allowing the infiltration, treatment and storage of stormwater. The general categories of this technique relate to the pavement wearing material and include: • Permeable asphalt concrete • Permeable concrete • Permeable gravel • Permeable pavers Permeable pavement sections consist of: (1) a permeable wearing course or surface area designed to provide the strength needed for traffic loads; (2) an aggregate base below the surface section for support, vertical and lateral dispersion of water, and temporary storage of runoff; (3) and separation layer using non-woven geotextile fabric below the aggregate base to prevent upward migration of fine soil particles; and (4) where required, a water quality treatment layer to filter pollutants and protect the ground water.	Partially applicable	- The City of Marysville require a minimum of one foot separation from seasonally high ground water levels - Infiltration limited - If the aggregate base section is used for detention storage, an impervious liner will be needed below and on the sides of the section. - Permeable concrete sidewalk most feasible application for permeable pavement technique.

Vegetated roof	Vegetated roofs are also known as green roofs and eco-roofs. They are categorized as either intensive (deeper soil layer, intensive plantings, higher maintenance) or extensive (shallower soil layer, lower cost, lower maintenance). Benefits identified for vegetated roofs include energy efficiency and air quality, temperature and noise reduction in urban areas, improved aesthetics, extended roof life, and reduction in stormwater flows. The typical vegetated roof section includes from top to bottom: vegetation layer; growth medium (soil) layer; separation layer; drainage, aeration, water storage and root barrier layer; water proof membrane; and roof structure section.	Applicable	- Extensive category most appropriate for proposed industrial park
Minimal excavation foundations	This LID technique seeks to limit soil disturbance during construction by the use of minimal excavation systems. The objective is to limit compaction of site soils from heavy equipment operations which would result in degradation of the infiltration and storage capacities of the site soils.	Not applicable	- Industrial park design standard is for 85% impervious and 15% landscaping/open space
Property Owner/Homeowner education	Property Owner/Homeowner education is an important component of a successful LID maintenance program and LID area protection plan. Clearly written operations and maintenance procedures and protection management plans should be a part of any homeowner education program.	Applicable	
Downspout dispersion	Downspout dispersion provides for the dispersion and infiltration of roof runoff onsite. Several dispersion methods are available including splash blocks, gravel trenches and sheet flow.	Not applicable	- Large roofs - Seasonally high ground water levels - Infiltration limited

Roof stormwater harvesting systems	Roof stormwater harvesting (also know as "rainwater harvesting") is the collection and storage of roof runoff for domestic or irrigation purposes. Harvesting systems include a collection (roof) area, a filter, a storage device (tank or vault) and an outflow device.	Applicable	
Filter strips	Filter strips are grassy slopes located adjacent to an impervious area subject to vehicular traffic. Pollutants are removed by the action of grass blades which enhance sedimentation and trapping and adhesion of pollutants to the grass. Filter strips are graded to provide for sheet flow over the entire filter area.	Possibly applicable	- Flat site
Media filtration	Media filtration includes sand filter units or patented units using leaf compost material or other media such as perlite, zeolite and others. Pollutants are removed through filtration in sand filters and filtration, adsorption, ion exchange and microbial degradation in the patented units.	Applicable	

Recommended LID Components

From the results of the evaluations presented in Table 1, the following LID techniques are considered applicable to the master planning area:

- Vegetated (Green) roofs—Runoff in excess of the vegetated roof demand would be subject to detention.
- Site planning and design—This could be encouraged by the City during the pre-application process.
- Tree box filters—Promotes pre-treatment of runoff and tree irrigation.
- Property owner education—Promotes awareness of LID operation and maintenance needs.
- Roof stormwater harvesting (for irrigation of landscaped area)—Runoff in excess of storage capacity would be subject to detention.
- Permeable concrete sidewalks—This technique is being considered elsewhere by the City.

Figure 1
Figure 2

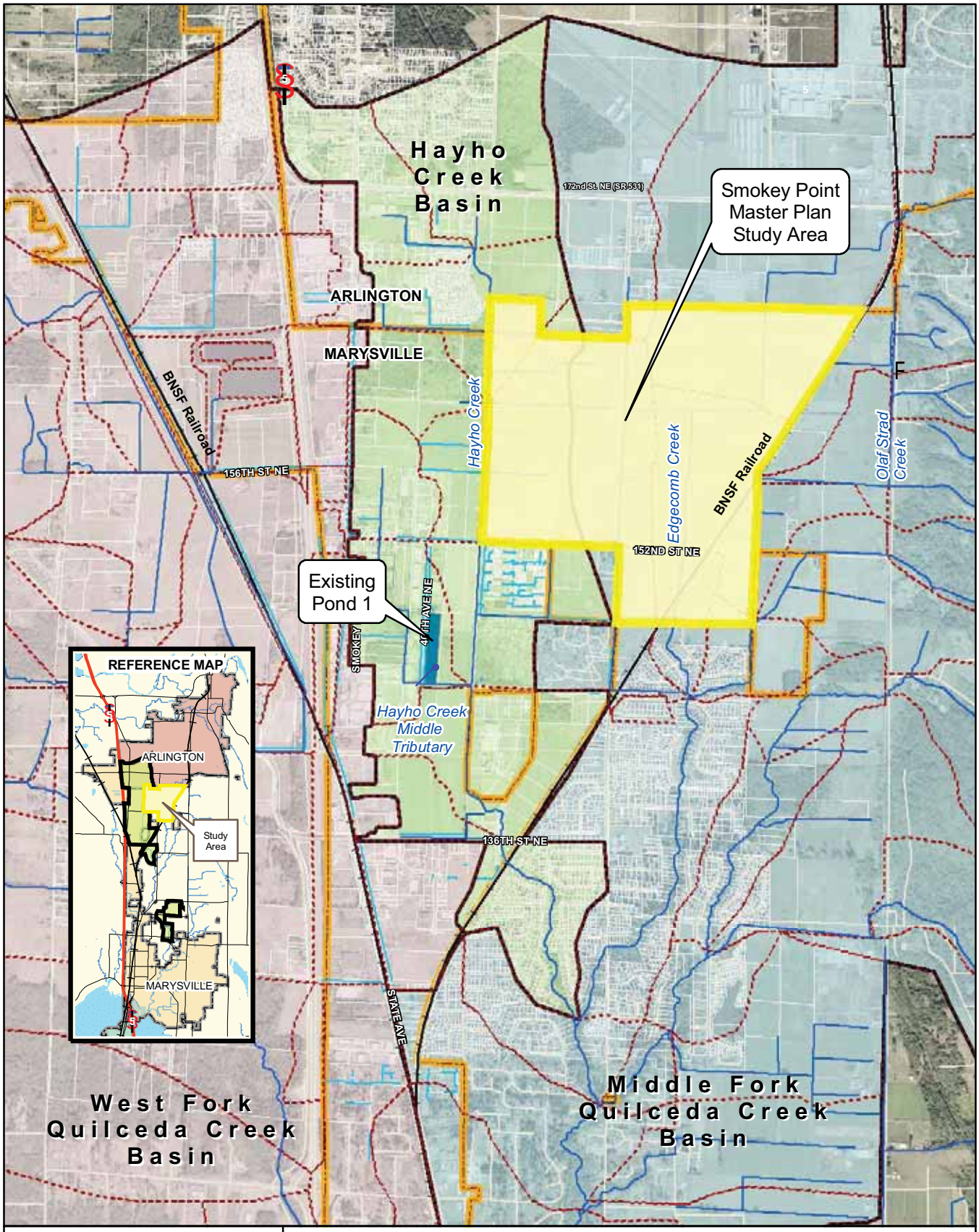


Figure 1
Vicinity Map

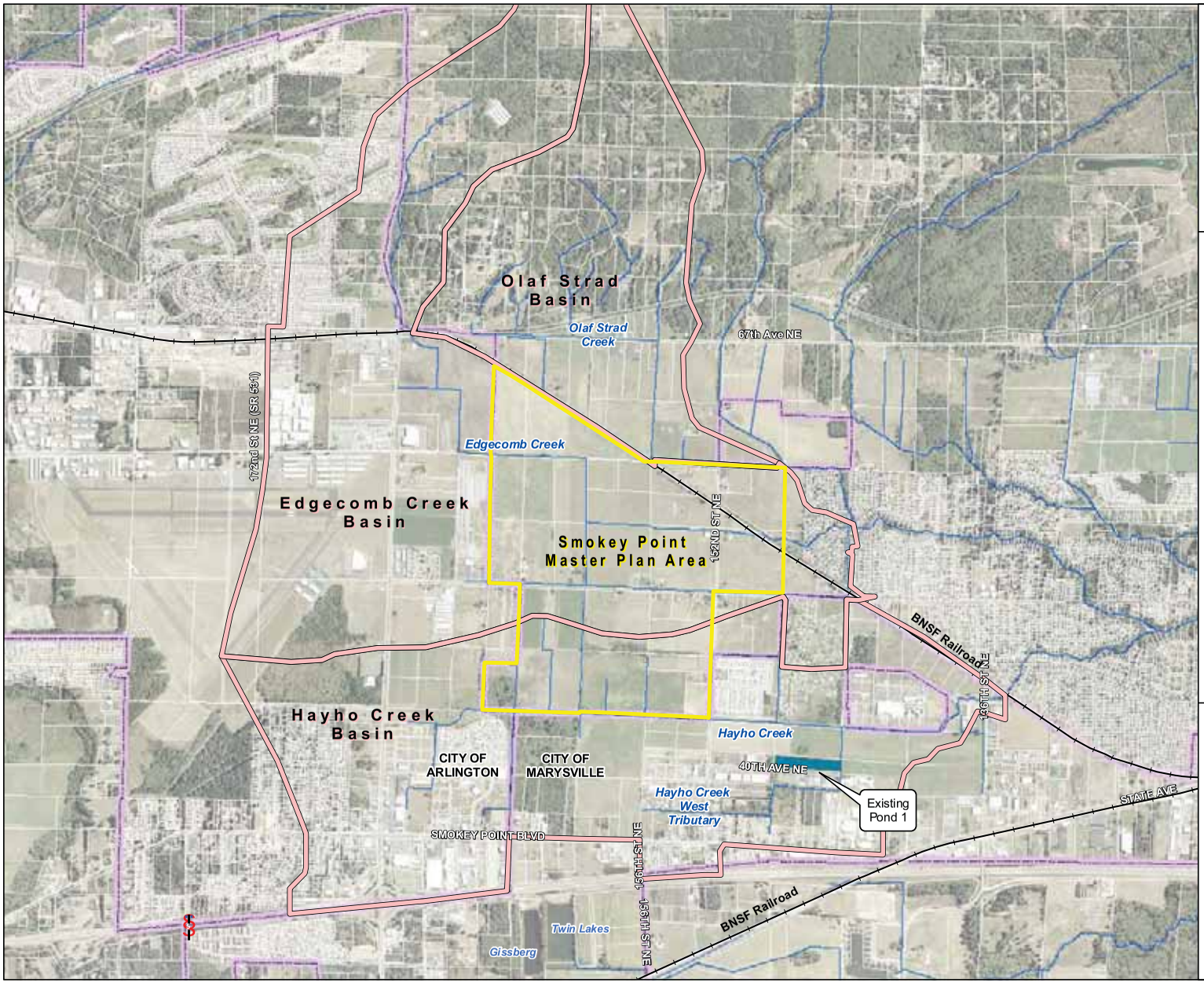
Legend

- City Boundary
- Stream
- Basin Boundary
- Subbasin Boundary
- Middle Fork Quilceda Creek Basin
- West Fork Quilceda Creek Basin
- Hayho Creek Basin

Source: GIS data obtained from Snohomish County GIS, City of Marysville GIS and Otak GIS.
Disclaimer: This data is not to survey accuracy and is meant for planning purposes only.

0 0.25 0.5 Miles

FILE: K:/project/30800/30813/GIS/mxds/figures/Figure1_VicinityMap.mxd



0 1,000 2,000 4,000 Feet

Legend

- Stream
- City Boundary
- Study Area Boundary
- Basin Boundary
- Existing Pond 1 Site

Figure 2
Study Area
Drainage Basin Boundaries

City of Marysville
80 Columbia Avenue
Marysville, Washington 98270
Phone: (360) 651-5100
Fax: (360) 651-5099

otak
10230 NE Points Drive
Kirkland, Washington 98033
Phone: (425) 822-4446
Fax: (425) 827-9577

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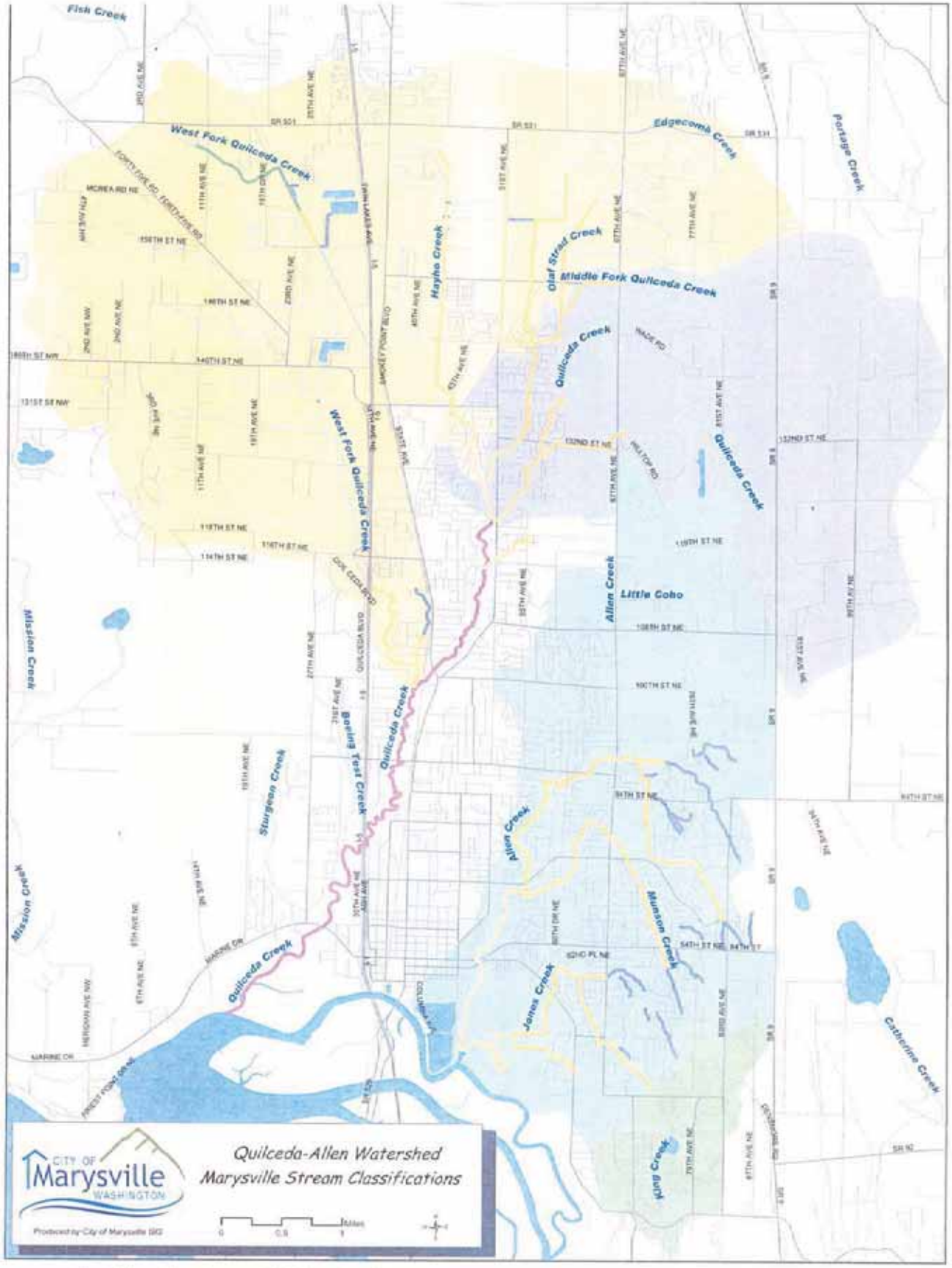
Appendix A—
Figures A-1, A-2 and A-3



Type S Stream. Those streams, within their ordinary high water mark, as inventoried as shorelines of the state.

Type F Stream. Those stream segments within the ordinary high water mark that are not Type S streams, and which are demonstrated or provisionally presumed to be used by salmonid fish.

Type Np Stream. Those stream segments within the ordinary high water mark that are perennial and are not Type S or Type F streams.

Type Ns Stream. Those stream segments within the ordinary high water mark that are not Type S, Type F, or Type Np streams. These include seasonal streams in which surface flow is not present for at least some portion of a year of normal rainfall that are not located downstream from any Type Np stream segment.

Basins

- *Allen Cr.*
- *Ebey Slough*
- *West Fork Quilceda Cr.*
- *Edgecomb Cr.*
- *Middle Fork Quilceda Cr.*
- *Quilceda Cr.*
- *Sunnyside Cr.*

Marysville Stream Classifications

- *S*
- *F*
- *NP*
- *NS*

Figure A-1

Figure 6-3 Soils

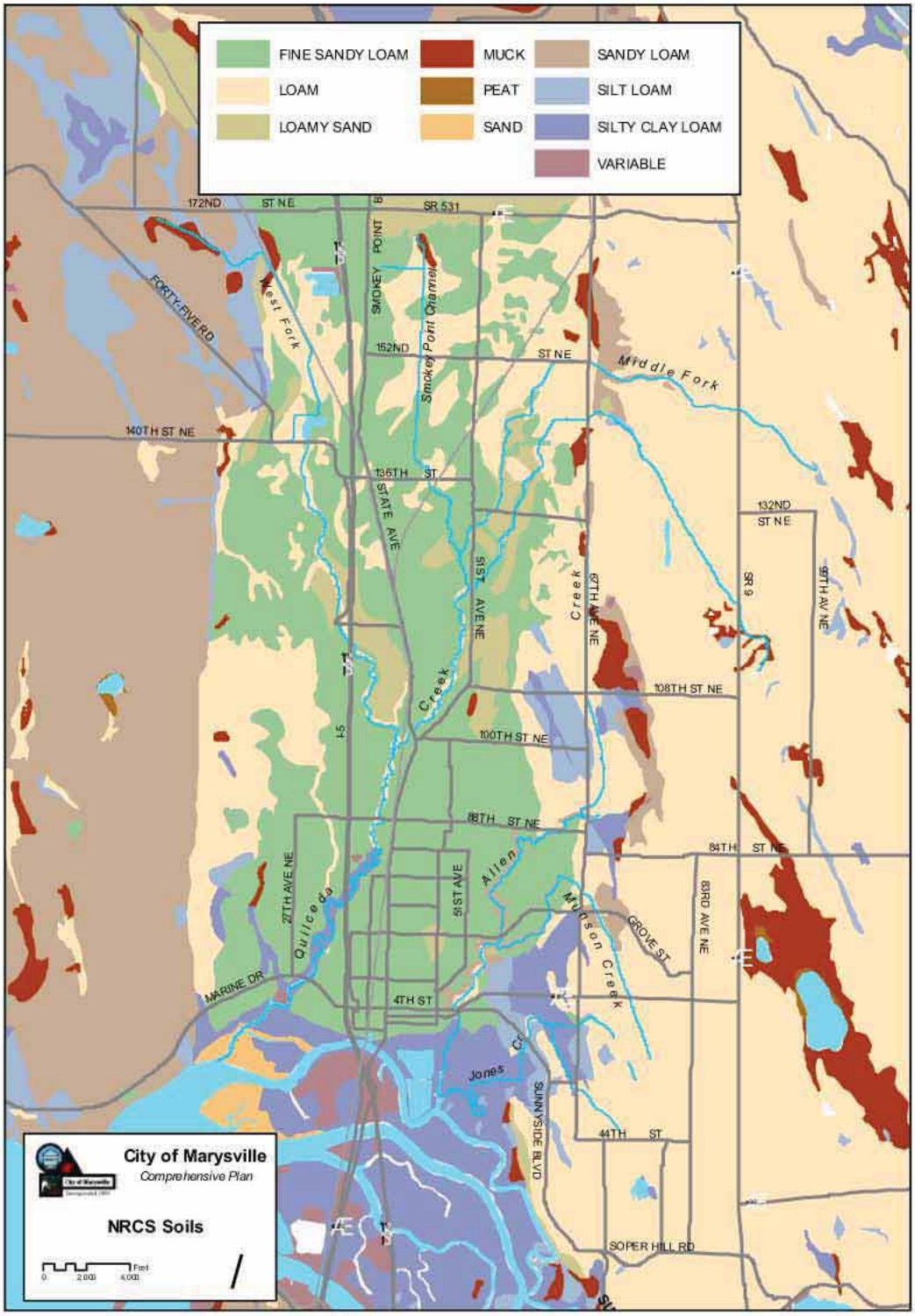


Figure A-2

Figure 6-6 Wetlands

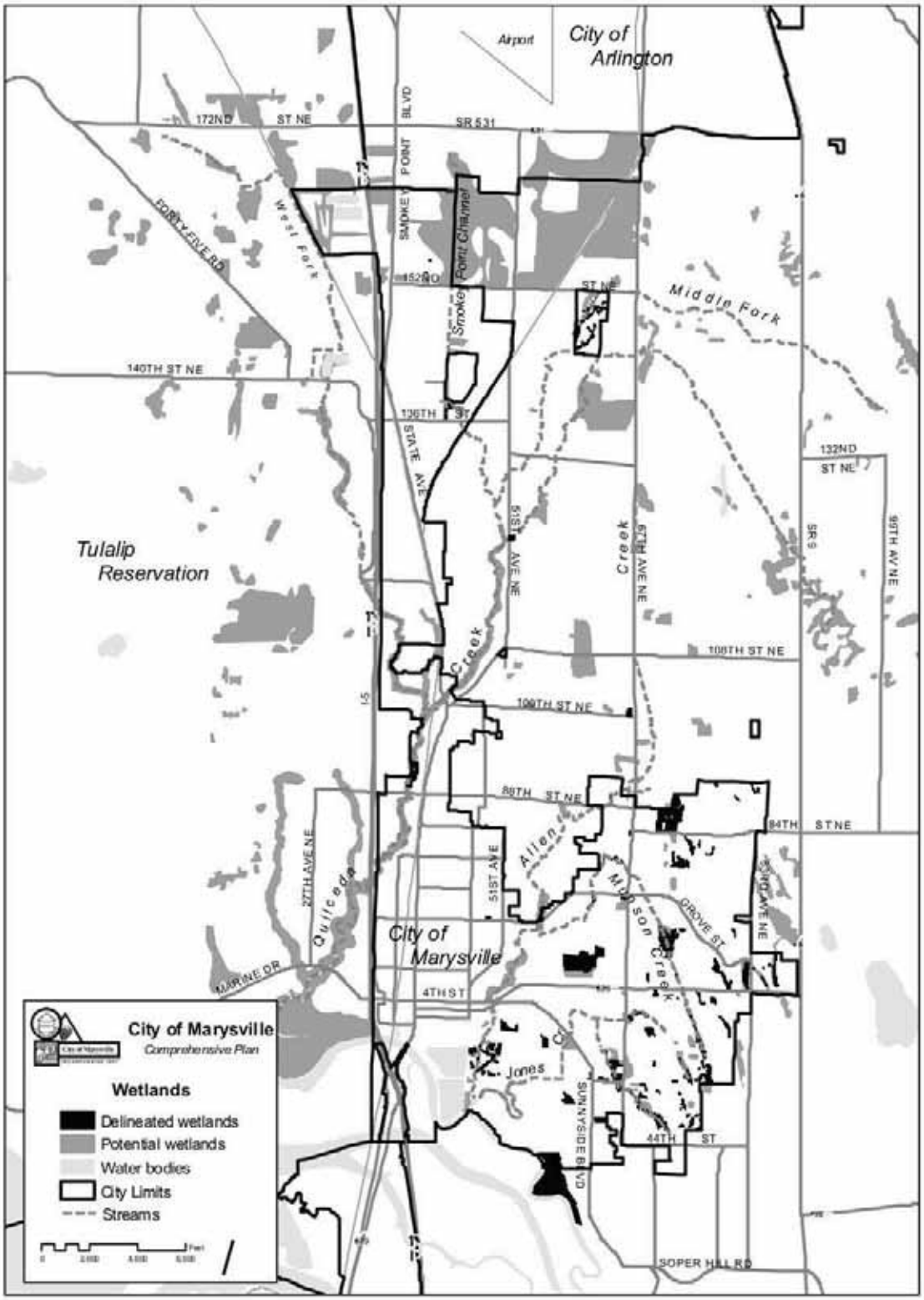


Figure A-3

Tech Memo #2

Technical Memorandum

10230 NE Points Drive
Suite 400
Kirkland, WA 98033
Phone (425) 822-4446
Fax (425) 827-9577

To: Patricia Love, Community Planning Manager, Perteet, Inc.

From: Joe Simmler, PhD
Larry Grimm, PE

Copies:

Date: February 2, 2007

Subject: Drainage Technical Memorandum #2 Preferred Site Plan: Preliminary Drainage Review
Smokey Point Master Plan
City of Marysville, Washington

Project No.: 30813

Introduction

The development and selection of the conceptual drainage plan for the Smokey Point Master Plan area is described in this memorandum. The boundaries of the planning area are shown in Figure 1. In the following paragraphs, the preferred master land use plan and its associated land use conversion are described, followed by the results of preliminary hydrologic modeling to estimate required water quality and detention volumes on an area-wide basis. Water quality, detention, and conveyance facility siting options (onsite and regional) are described and evaluated, along with a review of the potential drainage impacts associated with the relocation of Edgecomb Creek. The elements of the selected drainage plan concepts are grouped and proposed alternative drainage concepts drainage plans are described. Existing conditions, defined in terms of basin boundaries, streams, topography, soils, habitat, and wetlands, have been previously described in draft Technical Memorandum #1, dated January 22, 2007.

Methodology and Approach

The Master Plan area encompasses portions of the Hayho Creek and Edgecomb Creek drainage basins. Of the 675 total acres within the Master Plan area, approximately 190 acres (28 percent) are located in the Hayho Creek Basin, and 485 acres (72 percent) are located in the Edgecomb Creek Basin. Agriculture, intermixed with some commercial and urban development, are the principle land use in both basins. The topography is flat with a slope of about 0.3 percent.

Drainage planning concepts have emphasized the use of regional facilities, although on-site concepts have also been considered. Each basin area is addressed separately. Rate control criteria have been developed based on the results of continuous runoff simulation modeling performed earlier by Otak, for the City's State Avenue project. Both basins are subject to planning constraints posed by high winter ground water levels, water quality treatment requirements of local fish-bearing waters, subtle changes in slope and topography, and the objective of minimizing pumping and optimizing the use of gravity for the conveyance, storage and treatment of the region's stormwater.

Preferred Master Plan Land Use Plan

The proposed land use, provided by the City (via Patricia Love of Perteet, Inc., Personal Communication) for evaluation in this Master Plan is defined by the following criteria:

- 25 percent of the land within the planning area is assumed to be wetlands and not available for development.
- Lot coverage of the developed land area by buildings/structures will be 50 percent.
- 60 percent of the developed land area will be in manufacturing; the other 40 percent will be in office space.
- 85 percent of developed areas will be in impervious surfaces; the remaining 15 percent will be in landscaped surfaces or open space.

Preliminary Hydrologic Modeling Results

The results of recent hydrologic modeling by Otak for the City in North Marysville (128th Street Regional Pond Feasibility Technical Memorandum, September 25, 2006) were used to provide preliminary sizing of water quality, rate control, and conveyance facilities. Uniformity of soils in the area and comparable developed impervious areas (85 percent) allowed the use of these results for preliminary planning within the Master Plan area. The hydrologic modeling used the USEPA Hydrologic Simulation Program-Fortran (HSPF) continuous rainfall-runoff model for computing runoff from rainfall. A one-hour time step was used to predict flow rates. Existing land cover for the modeling was assumed to be forest to reflect pre-European settlement conditions, as required by Ecology's 2005 Stormwater Management Manual for Western Washington (2005 Ecology Manual).

For the purposes of this analysis, the North Marysville results (September 25, 2006) were converted to volume per developed area for water quality treatment and detention. Undetained runoff rates and detained release rates were also estimated on a developed acre basis for use in sizing preliminary conveyance facilities. The estimated unit area values are given below.

- Water quality volume: 4,200 cubic feet per developed acre.
- Detention volume: 17,000 cubic feet per developed acre.
- Undetained runoff rate: 0.5 cfs per developed acre.
- Detain runoff rate: 0.04 cfs per developed acre.

Note that more detailed modeling will need to be performed as a part of the future master drainage plan work, to demonstrate flow peak and duration conformance at stream system points of compliance and more accurately size and locate needed facilities.

Drainage Plan Alternative Analysis

Presented in this section are the results of the analysis of the various conceptual alternatives considered for stormwater management in the planning area. Alternatives have been created to conform to the requirements of the 2005 Ecology Manual, as well as the unique characteristics of the planning area.

Water Quality Treatment Alternatives

Discharge from developed areas will be to Type F, fish inhabited, streams that drain into the Middle Fork of Quilceda Creek. This creek system contains Chinook spawning habitat and is regulated by the Endangered Species Act. Maintaining base flows, managing peak flows, and reducing pollutant loadings are key to the preservation of these critical habitat spawning areas. Industrial/commercial development discharges to Type F streams are required to have stormwater treated to an "enhanced treatment" level to reduce potential pollutant loadings, especially the discharge of dissolved metals.

Acceptable enhanced treatment methods described in the 2005 Ecology Manual include the following:

- Large sand filter
- Amended sand filter
- Stormwater treatment wetland
- Compost-amended filter strip
- Ecology embankment
- Two facility treatment train (as described in Table 3.2 of the 2005 Ecology Manual, provided as Table 1 below).

Table 1 Treatment Trains for Dissolved Metals Removal	
First Basic Treatment Facility	Second Treatment Facility
Biofiltration Swale	Basic Sand Filter or Sand Filter Vault or Media Filter[1]
Filter Strip	Linear Sand Filter with no presettling cell needed
Linear Sand Filter	Filter Strip
Basic Wetpond	Basic Sand Filter or Sand Filter Vault or Media Filter[1]
Wetvault	Basic Sand Filter or Sand Filter Vault or Media Filter[1]
Basic Combined Detention/Wetpool	Basic Sand Filter or Sand Filter Vault or Media Filter[1]
Basic Sand Filter or Sand Filter Vault with a presettling cell if the filter isn't preceded by a detention facility	Media Filter[1]

[1] The media must be of a nature that has the capability to remove dissolved metals effectively based on at least limited data. Ecology includes Stormfilter's ™ leaf compost and zeolite media in this category.

Based on our experience, the stormwater treatment wetland is an economical choice for water quality treatment when constructed as part of an open pond detention facility. As such, it has been selected to be the favored alternative during development of this regional conceptual plan.

Rate Control (Detention) Alternatives

Detention options include above-grade open water surface facilities and below-grade buried facilities, as listed below:

- Above grade options:
  - Open ponds with earth embankments*
  - Off-channel detention for high flows
  - Open vertical wall ponds
  - Parking lot ponds
  - Rooftop detention
  - Roof runoff pressure downspout system to above grade pond
  - Elevated sub-floor onsite detention
  - Porous pavement with aggregate storage section or "Infiltrator" chamber storage systems
- Below grade options:
  - Buried precast or cast-in-place concrete vaults
  - Buried pipe or "Infiltrator" chamber storage systems
  - Porous pavement with aggregate storage section or "Infiltrator" chamber storage systems

(*Note that open ponds within the 10,000-foot FAA wildlife hazard zone would have to include approved mitigation measures, as discussed below.)

If adequate parcels of land are available downstream at a reasonable price, the use of regional detention ponds within earth berms can be an affordable and effective approach for providing detention for a large area, such as the Master Plan area. All of the above options are applicable for either onsite or regional approaches. Onsite options would be privately constructed, while regional facilities would likely be constructed by the City with capacity in the facility being available for purchase by future developers, similar to Pond #1 in the adjacent Hayho Creek drainage basin.

The buried vault and pipe systems are the least desirable systems for the planning area because of the high seasonal ground water levels and the higher construction and maintenance costs. High ground water levels require that the vaults or pipes be designed to resist flotation when the systems are empty. The anti-flotation design can add considerable expense to vault or pipe system costs.

Stormwater collection will be accomplished on each of the parcels by future private developers. Conveyance systems will be needed in both the Hayho Creek and Edgecomb Creek basins to convey new flows to (1) points of discharge within the creek systems (where detention and stormwater treatment are provided onsite), to (2) regional treatment and detention facilities (where a regional approach is taken), and to (3) points of discharge from regional facilities.

Conveyance alternatives include:
- Gravity pipelines
- Gravity open channels
- Combination of gravity open channels with pipelines
- Pumping and pressure pipelines

Where feasible, gravity open channels are preferred because of lower construction costs (assuming City right-of-way locations vs. land purchase) and the added water quality treatment that vegetated channels provide. Gravity pipelines are preferred next, followed by pumping and pressure pipeline systems, which are the least desirable because of higher costs, energy consumption, and reduced reliability during power outages.

Gravity pipelines can be designed to operate under a slight pressure (surcharge) in order to discharge from a higher elevation to a lower elevation bermed pond with an above grade detention water level. Pond 1 conveyance system in the Hayho Creek drainage system, is designed in this manner. This design method is applicable to both basins within the planning area.

Preliminary conveyance corridors identified for the planning area are shown in Figure 2. The alignments are based in part on the proposed road system for the planning area. The conveyance system will need to maintain current land use drainage provisions. During the early years of development, roadside ditches may be appropriate. As development continues and road improvements are made, piped systems will likely need to be installed in order to convey the

increased flows. The lower portions of the proposed ditch/pipe conveyance systems to downstream regional detention facilities, will operate under piped surcharge conditions.

Low Impact Development Technique Alternatives

Low Impact Development (LID) techniques for the Master Plan Area are limited because of (1) high seasonal ground water levels, (2) low infiltration rates of the surfical soils, (3) the conversion of nearly all of the planning area from its original forest cover to agriculture uses, and (4) the proposed intensity of industrial/commercial development for the planning area.

Of the 23 different types of LID techniques reviewed (see Draft Technical Memorandum #1, dated January 22, 2007), those considered most applicable to the planning area and its development proposal include:

- Vegetated roofs
- Tree box filters
- Roof stormwater harvesting (for irrigation of landscaped areas)
- Pervious concrete sidewalks

LID water quality treatment techniques, such as filter strips and media filtration, could be used to provide a portion of the enhanced treatment requirement for developed areas. LID techniques would typically be constructed onsite by private developers.

Onsite and Regional Alternatives

Both onsite and regional stormwater management alternatives have been considered for the planning area. Onsite facilities would be planned, designed and constructed by the developer of the property. Regional facilities would likely be planned, designed and constructed by the City. The combination of onsite and regional facilities also has potential because of the flatness of the area and the desirability of avoiding pumped stormwater systems. Water quality treatment could occur onsite, with excess flows being conveyed to a downstream regional facility.

The development of conceptual onsite and regional approaches for stormwater management in the Master Planning area have emphasized the use of:

- Multi-functional approaches (involving both stormwater detention and treatment. as well as wetland mitigation, stream/habitat enhancement, parks/recreational uses, and aesthetics).
- Integration with open space opportunities.
- The use of off-channel storage, as land availability and drainage opportunities allow.

Consideration of these potential opportunities can lead to improved environmental design, reduced permitting/mitigation, lower land costs, improved aesthetics, and enhanced economic incentives for development of this Master Plan area.

FAA Hazardous Wildlife Separation Criteria

The Arlington Municipal Airport is located just north of the planning area, on the north side of 172nd Street NE (SR 531). Open bodies of water within 10,000 feet of air operations area are considered by the Federal Aviation Administration (FAA) to be hazardous wildlife attractants (FAA Advisory Circular No. 150/5200-33A, July 27, 2004). The portion of the planning area considered to be hazardous by the FAA criterion is shown in Figure 2 as the area within the semi-circle drawn from the most southern part of the airport.

Nearly all of the planning area is located within 10,000 feet of air operations areas at the Arlington airport. The FAA Advisory Circular No. 150/5200-33A titled "*Hazardous Wildlife Attractants on or Near Airports*", states that no permanent standing water is allowed and that a management plan for the safe operation of stormwater facilities should be developed to assure airport safety.

> *"2-3. Water Management Facilities. Drinking water intake and treatment facilities, stormwater and wastewater treatment facilities, associated retention and settling ponds, ponds built for recreational use, and ponds that result from mining activities often attract large numbers of potentially hazardous wildlife. To prevent wildlife hazards, land-use developers and airport operators may need to develop management plans, in compliance with local and state regulations, to support the operation of stormwater management facilities on or near all public-use airports to ensure a safe airport environment…*
>
> *b. New stormwater management facilities. The FAA strongly recommends that off-airport stormwater management systems located within the separations identified in Sections 1-2 through 1-4 be designed and operated so as not to create above-ground standing water. On-airport stormwater detention ponds should be designed, engineered, constructed, and maintained for a maximum 48-hour detention period for the design storm and remain completely dry between storms. To facilitate the control of hazardous wildlife, the FAA recommends the use of steep-sided, narrow, linearly shaped water detention basins. When it is not possible to place these ponds away from an airport's AOA, airport operators should use physical barriers, such as bird balls, wires grids, pillows, or netting, to prevent access of hazardous wildlife to open water and minimize aircraft-wildlife interactions. When physical barriers are used, airport operators must evaluate their use and ensure they will not adversely affect water rescue. Before installing any physical barriers over detention ponds on Part 139 airports, airport operators must get approval from the appropriate FAA Regional Airports Division Office. All vegetation in or around detention basins that provide food or cover for hazardous wildlife should be eliminated. If soil conditions and other requirements allow, the FAA encourages the use of underground stormwater infiltration systems, such as French drains or buried rock fields, because they are less attractive to wildlife."*

Several design concepts to accommodate the FAA criteria have been developed and are outlined below:

- Detention and water quality treatment in an open pond, with constructed wetland, outside of the FAA 10,000-foot wildlife hazard zone.
- Onsite or regional water quality and low flow detention (bankfull) and stream enhancement with flood storage for higher flows which would need to drain out within 48 hours (if inside FAA 10,000-foot wildlife hazard zone).
- Detention and water quality treatment in open pond with constructed wetland inside of FAA 10,000-foot wildlife hazard zone, with FAA-approved mitigation devices (bird balls, wire grids, netting, etc.) to prevent access of hazardous wildlife.
- Detention and water quality treatment inside of FAA 10,000-foot wildlife hazard zone with open pond designed to drain the design storm within 48 hours. Flows present in excess of 48 hours would be detained below pavement grade in "Infiltrator" and rock void system with impervious liner, conveyed to an open pond with FAA approved mitigation devices, or conveyed to an open pond beyond the 10,000-foot zone.

Potential Regional Treatment and Detention Sites

To minimize pumping of stormwater, regional detention facilities have been located at the lower elevation locations in the southerly part of the planning area. Potential sites for regional facilities in the Hayho Creek and Edgecomb Creek basins are shown in Figure 3. These sites, located in lower elevation areas to the south, have been selected on the basis of location and availability of the land. The availability, cost and wetland constraints of the parcels which make up individual sites have not yet been fully assessed.

Hayho Creek Basin

In the Hayho Creek basin, the existing City Regional Pond 1 facility and adjacent future Regional Pond 2, on city-owned property, offer convenient sites to serve this western part of the planning area. They are located as shown in Figure 3. Both of these regional sites are outside the FAA hazard zone. Pond 1, as constructed, and Pond 2, as proposed in 2006, have a combined detention capacity of 67.2 acre-feet (2,930,000 cubic feet). This volume has the capacity to serve about 172 acres of development at 17,000 cubic feet of detention per acre. This capacity, plus high flow off channel detention in Hayho Creek, will likely satisfy both existing and ultimate development of the upper basin. Approximately 105 acres of the northern area (about 79 acres net after wetland reductions) could be conveyed by gravity to the Pond 1 and 2 sites, using surcharged large diameter pipe(s). The remaining 85 acres of the more southern area (63 acres net) would need to be pumped into the conveyance system or handled onsite. One option to be considered is overdetaining runoff from the northern area to allow for the direct discharge (i.e. without detention) of new runoff flows from the more southern parcels.

In order to convey stormwater to either of these two City owned pond sites, flow would need to be conveyed under Hayho Creek on the north side of 152nd Street NE. To accomplish this, flows would need to be either conveyed via a shallow cover pipe under the streambed, pumped, or conveyed using an inverted siphon (depressed sewer) installed under the creek. The inverted siphon would need to be a multiple barrel design in order to convey the full range of design flows at self-cleaning velocities. All of these alternatives would connect to a new trunk storm line in 152nd Street NE, running from the west side of Hayho Creek to the existing Regional Pond 1 trunk system using a 48-inch pipe.

Edgecomb Creek Basin

Within the Edgecomb Creek Basin, four potential sites for regional facilities were identified and evaluated, both within and south of the Master Planning area. The sites are shown in Figure 3. The FAA 10,000-foot hazard zone boundary is also shown in Figure 3. The entire planning area is within the FAA 10,000-foot hazard zone.

The Edgecomb Creek portion of the planning area is about 485 acres. After adjusting this area for wetland areas (assumed to be 25 percent), the maximum net developable area is about 364 acres. Open pond detention and water quality facility land requirements have been estimated to be ten percent of the developed service area. For development of 364 acres, a pond area of 37 acres can be expected.

The regional sites located south of the planning area (Sites #3 and #4) would likely receive flow entirely by gravity conveyance. The sites within the planning area (Sites #1 and #2) will receive only a portion of the flow by gravity. If a pond design elevation (detention peak) of 109 feet is assumed, about 52 percent of the area (or 190 acres of developable land) could drain to the facility by gravity. At a design elevation of 105 feet, about 73 percent of the area (266 acres developable) could drain by gravity to the facility. The remaining non-gravity area would be addressed by one of the methods described for the Hayho Creek pumping service area or alternatively by overdetaining additional flows to allow runoff from the lower areas to discharge to the stream without detention.

Sites #2 and #3, east of the BNSF railroad right-of-way, would likely have a lower property acquisition cost than the properties on the west side. Site #2 on the east side of the railroad right-of-way is also part of an "add-on area" being evaluated by Shaw Environmental, Inc., as a part of its Edgecomb Creek Relocation Alternatives Analysis. The key elements of that analysis are discussed in a following section. The use of the add-on area as a regional detention site provides an opportunity to explore a multi-function project (stormwater, environmental mitigation and parks/recreation) and improved environmental designs, as discussed previously.

Basin Exchange Concepts

With the flatness of the planning area, it is possible to consider the exchange of basin areas, where runoff from the land area within one basin is diverted to an adjacent basin, in exchange for an equal amount of flow (or area) being permanently diverted from the second basin to the first basin.

This concept could offer the benefit of using existing regional facility, such as Pond 1, which is currently not fully used in terms of basin subscribers. If a development proposal in the Edgecomb Creek Basin has a proposed implementation schedule that is earlier than a development within Hayho Creek, then a basin exchange could be mutually beneficial for both the City and the Edgecomb Creek Basin developer. The Hayho Creek Basin exchange area could be incorporated into the Edgecomb Creek Basin at a later date. The technical feasibility of an exchange would need to be determined in a more detailed drainage master plan, with the ability to maintain gravity conveyance being one of the key criterion.

Edgecomb Creek Relocation Alternatives

Edgecomb Creek is currently located on the west side of the BNSF railroad tracks and follows a rectangular alignment along roads and parcel boundaries as it flows south to join the Middle Fork of Quilceda Creek. As part of this planning process, two alternative creek relocation alignments are being evaluated by Shaw Environmental, Inc., (as subconsultant to Perteet, Inc.). One alignment is on the west side of the railroad tracks and the other is on the east side of the railroad tracks, as shown in Figure 4. The existing Edgecomb Creek alignment is also shown in this figure. Planning concept criteria identified for these two stream rerouting alternatives by Shaw include the following:

- 100-year flood capacity in the high-flow channel
- A low-flow channel for year-round stream flow
- In-stream large woody debris (LWD) for habitat
- Vegetation throughout the channel and buffer
- 150-foot buffers on each side of the creek along the entire length
- Off-channel rearing habitats
- The connection of the hillside streams north of 162nd Street NE

An "Add-On Alternative" has also been developed by Shaw Environmental, Inc. for each of the two alternative stream relocation alignments. The Add-On Alternative is the triangular parcel in the southeast corner of the planning area which is bounded by the BNSF right-of-way on the west, as shown in Figure 3. The concept of the Add-On Alternative is to add environmental mitigation for the realignment of the stream, as described by Shaw Environmental, Inc. below.

> *"The Add-On Alternative could be paired with either the West or East Alternative alignment options for Edgecomb Creek. The Add-On could be implemented either in the future when more funding is available, or concurrently with the selected West or East Alternative. The conceptual plan is to build a regional detention*

facility to store stormwater and reduce peak flows. Wetlands would be restored and created to be used as mitigation for wetland impacts from the development in the annexation area west of the railroad.

Edgecomb Creek would flow through this area and an expanded floodplain could be built to provide additional surface water storage during storm events. Off-channel habitats and riparian plantings would improve habitat conditions. Existing wetlands in the southwest portion of the property could be enhanced by removing invasive vegetation and planting native shrubs and trees. The adjacent Strawberry Fields Park could be improved to include a wetland interpretation area and trial system. This portion of the annexation area is somewhat isolated from adjacent areas due to the railroad on the west and lack of road access to the east. Therefore, this area may have lower demand for future development than the area west of the railroad. Additional plans could include relocating the Middle Fork of Quilceda Creek, to flow through the area to enhance stream habitat conditions and to provide increased floodplain storage."

Drainage Plan Concept Selection

The requirements and components for the conceptual alternatives and options for stormwater management have been described above. Based on identified constraints and opportunities, along with guidance from the City's planning and public works staffs, the following are the selected, preferred conceptual drainage plans for each basin. These concepts will be developed in more detail in Technical Memorandum #3, the final drainage report.

Hayho Creek Basin

Preferred Conceptual Alternatives:

- Construct Pond 2 (detention and water quality pond) which will operate in parallel with existing Pond 1 by a connection between the two ponds.
- Extend the storm trunk sewer system in 152nd Street NE to the east side of Hayho Creek to receive flow from new development within the basin.
- For the portion of the basin that cannot gravity drain to Pond 1 and Pond 2 facilities, the following options will be considered:
  - Over-detention in the gravity flow service area to allow direct discharge of the lower portion of the planning area into Hayho Creek.
  - Onsite detention and water quality treatment, with discharge to Hayho Creek.
  - High flow off-channel detention storage (on the Pond 2 site).
  - Pumping of undetained discharges to the trunk storm sewer system, which will operate under a surcharged condition.
  - Detention in stream channel using additional capacity by creating additional floodplain capacity above the normal high water mark.

Edgecomb Creek Basin

Preferred Conceptual Alternative: Construct regional detention and water quality treatment in the southern portions of the Planning area. (The Add-On triangular parcel east of the BNSF Railroad right-of-way (Site #2) and the parcel southeast of the planning area (Site #3) are the candidate sites preferred by the City for the construction of regional water quality and detention facilities.

- The Add-On parcel will serve as much of the gravity service area of the basin as practicable, with the FAA criteria needing to be addressed in the design (i.e., no ponded water over 48 hours after a rainfall event.).
- The southeast off-site parcel will serve as much of the area that cannot be drained by gravity to the Add-On parcel, as practicable, assuming topography allows conveyance without pumping.
- Open-channel conveyance will be used where feasible, with the lower/southern portions of the backbone conveyance systems being surcharged using piped systems where flat slopes do not allow normal gravity flow.
- For areas that cannot drain by gravity to either of the two southern regional parcels, the options listed above for the Hayho Creek Basin would be considered for Edgecomb Creek Basin, including:
    - Over-detention in the gravity service area to allow for direct discharge of a portion of the pumped service area to Edgecomb Creek
    - On-site detention and water quality treatment discharge to Edgecomb Creek
    - High flow off-channel detention storage
    - Pumping of undetained discharges to the trunk storm sewer system, which operates under a surcharge condition
    - Detention in streams, utilizing additional floodplain storage created by modifying the stream channel and adjacent buffer area.

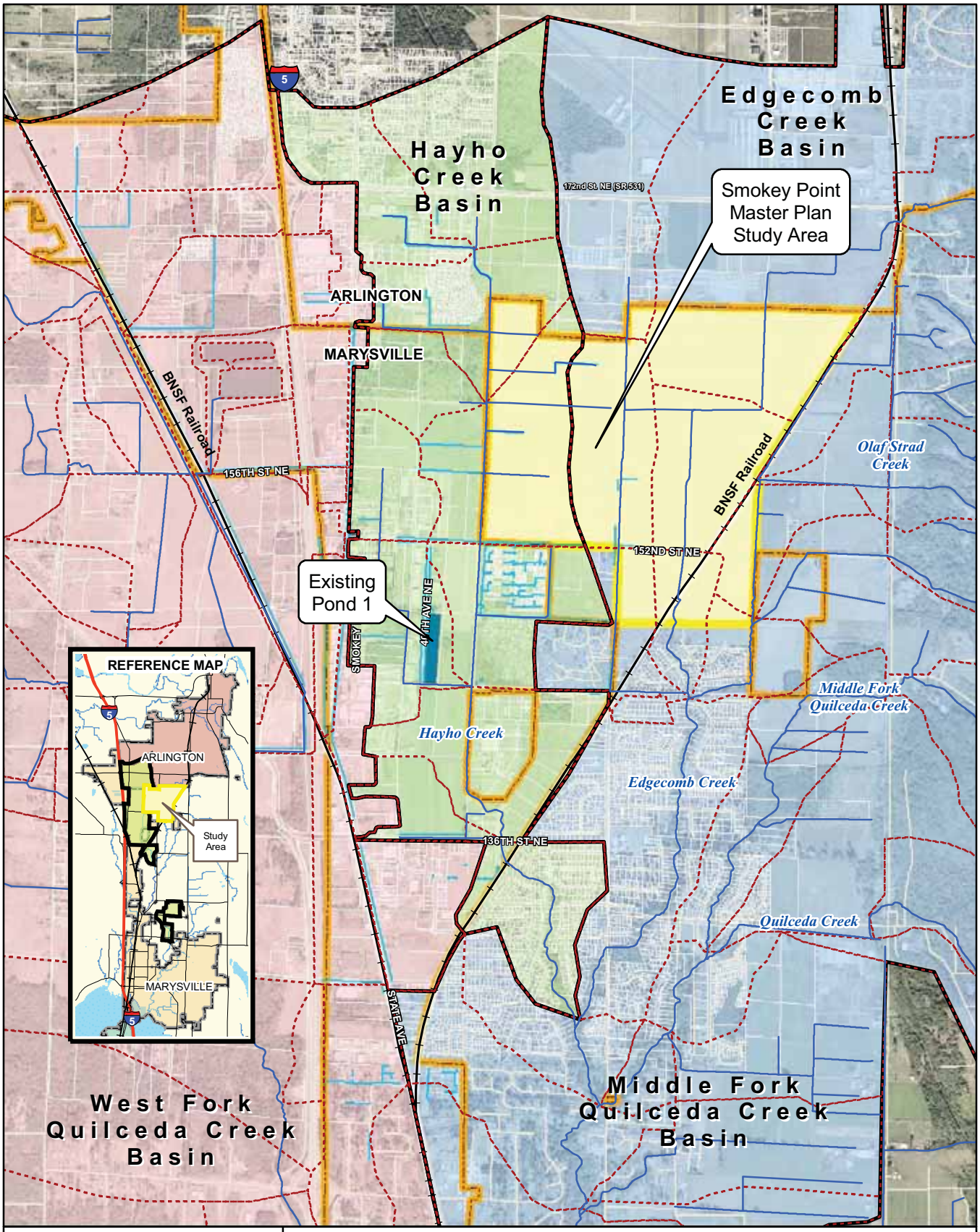


Figure 1
Vicinity Map

Legend

- City Boundary
- Stream
- Basin Boundary
- Subbasin Boundary
- Middle Fork Quilceda Creek Basin
- West Fork Quilceda Creek Basin
- Hayho Creek Basin

Source: GIS data obtained from Snohomish County GIS, City of Marysville GIS and Otak GIS.
Disclaimer: This data is not to survey accuracy and is meant for planning purposes only.

0 0.25 0.5 Miles

FILE: K:/project/30800/30813/GIS/mxds/figures/Figure1_VicinityMap.mxd

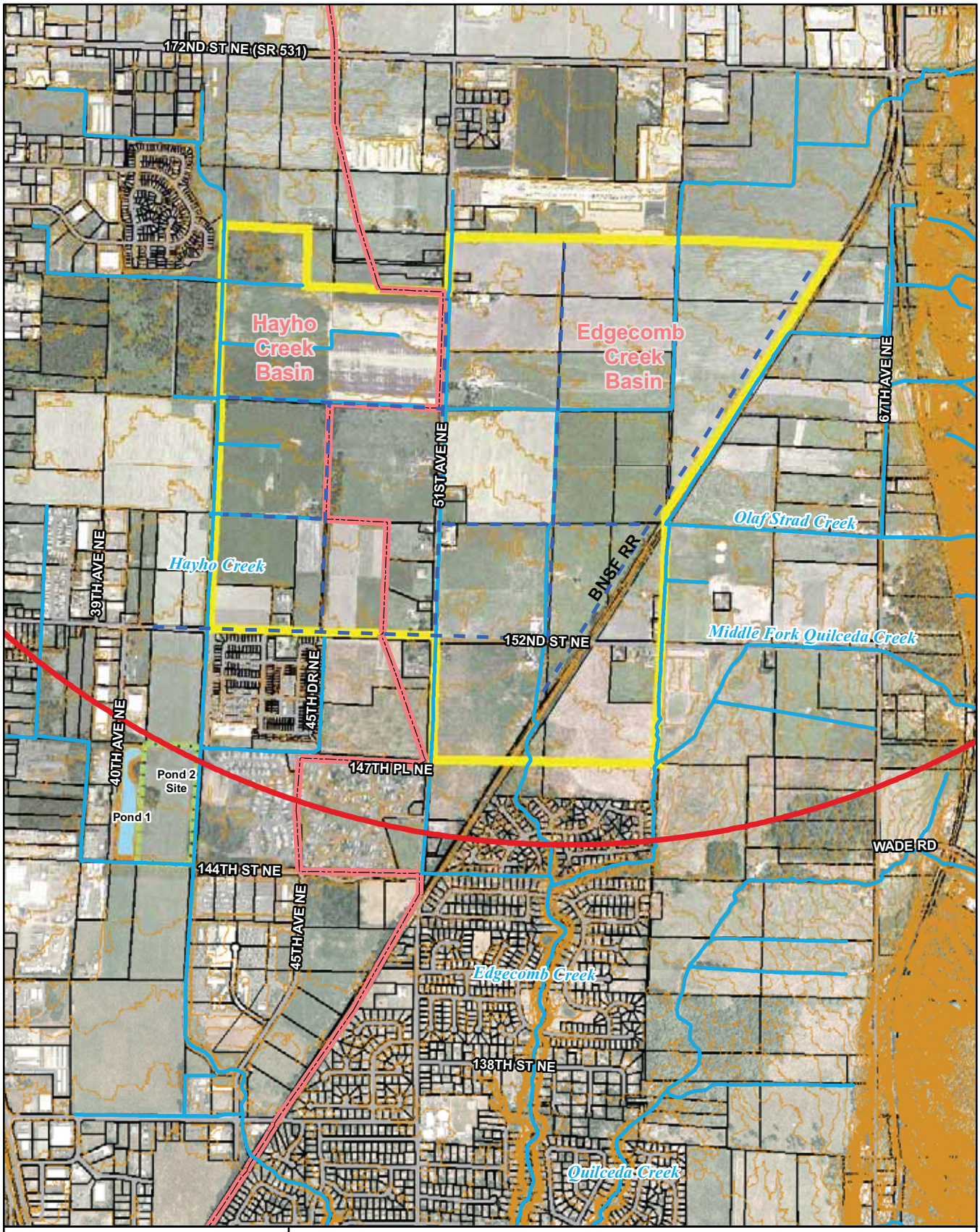


Figure 2

Potential Conveyance Corridors

Legend

- Subbasin Boundary
- FAA Flight Path Boundary
- Project Area
- Conveyance Corridors
- Stream
- Pond 2 Site

Source: GIS data obtained from Snohomish County GIS, City of Marysville GIS and Otak GIS.
Disclaimer: This data is not to survey accuracy and is meant for planning purposes only.

0 1,600 Feet

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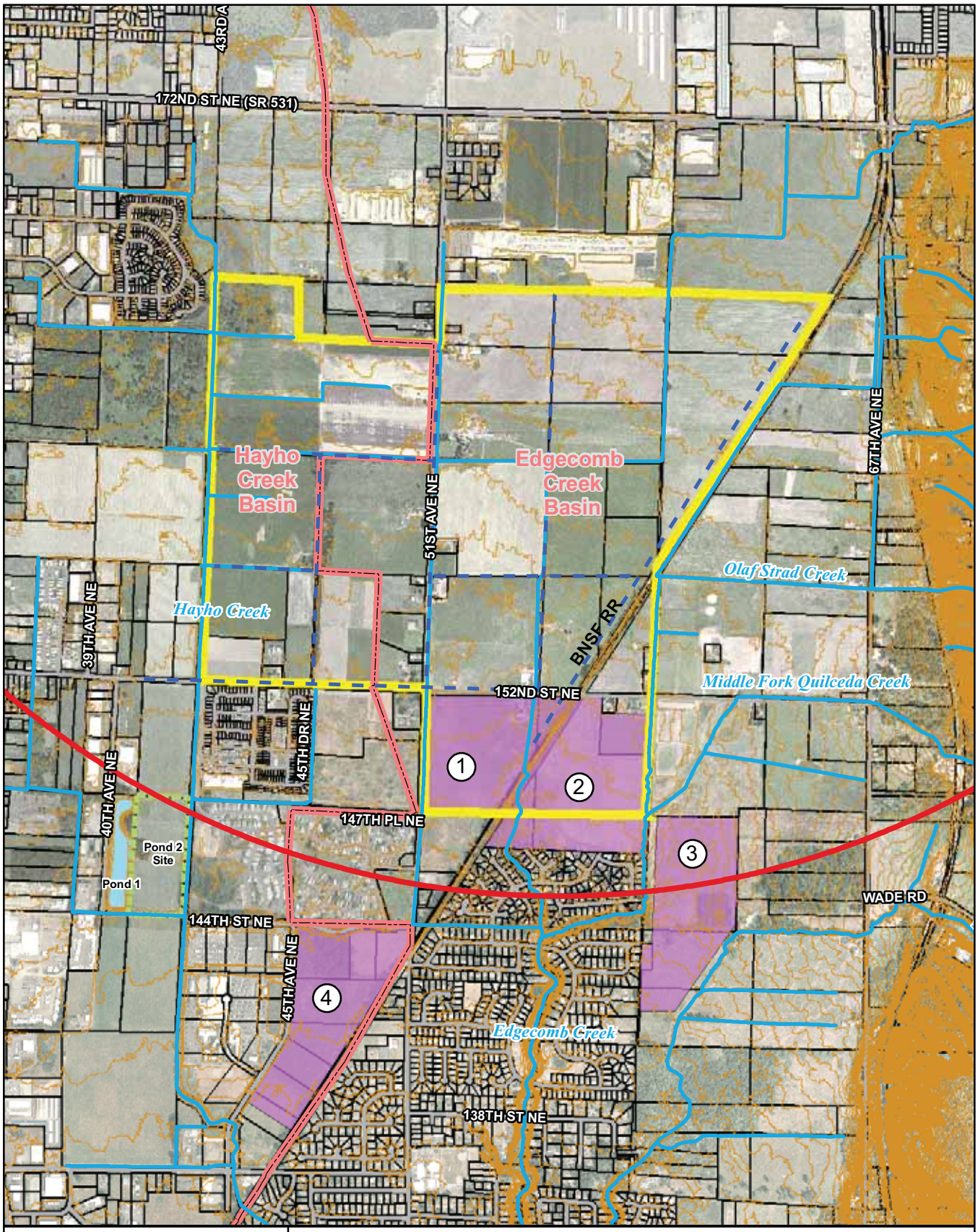

Figure 3
Potential Stormwater Sites

Legend

- Subbasin Boundary
- FAA Flight Path Boundary
- Project Area
- Potential Regional Site
- Stream
- Potential Stormwater Sites
- Pond 2 Site
- Conveyance Corridors

N

0 1,600 Feet

Source: GIS data obtained from Snohomish County GIS, City of Marysville GIS and Otak GIS.
Disclaimer: This data is not to survey accuracy and is meant for planning purposes only.

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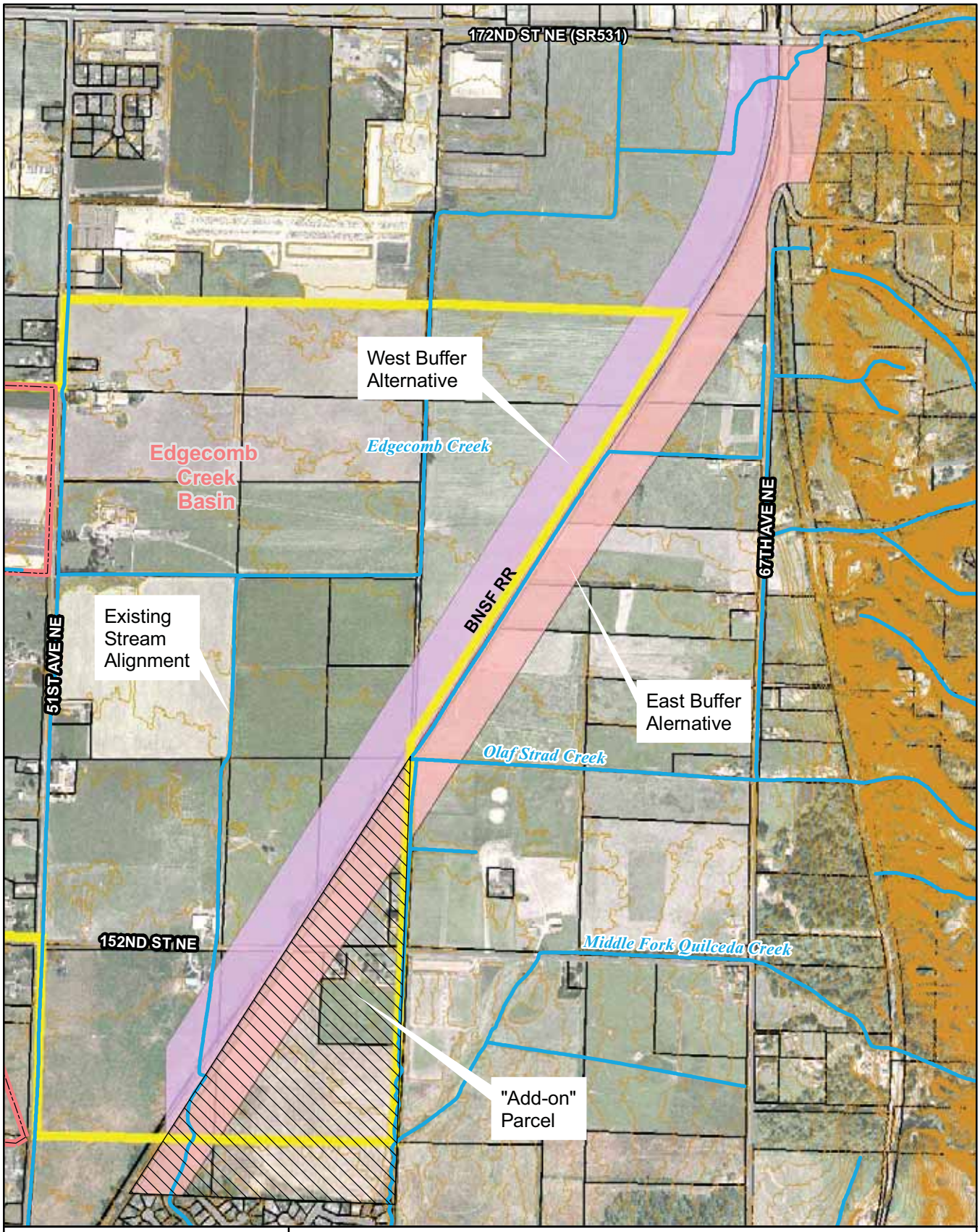

Figure 4

Edgecomb Creek
Relocation Alternatives

Legend

- Subbasin Boundary
- FAA Flight Path Boundary
- Project Area
- Stream
- Potential Wetland Mitigation Site

Source: GIS data obtained from Snohomish County GIS, City of Marysville GIS and Otak GIS.
Disclaimer: This data is not to survey accuracy and is meant for planning purposes only.

0 1,000 Feet

FILE: K:/project/30800/30813/GIS/mxds/figures/Figure4_RelocationAlts.mxd

Appendix B

Planning Level Project Cost Opinion
Hayho Creek Basin Drainage Facilities
Smokey Point Master Plan Area
City of Marysville, Washington

Otak, Inc. 2/8/2007

Item No.	Item Description	Unit	Quantity	Unit Price	Estimated Cost
	Construction				
1	Pond 2 detention and water quality pond and 48-inch storm drain to 152nd Street NE	LS			$2,256,000
2	Conveyance System to Pond 2 Connection	LS			$1,750,000
				Subtotal	$4,006,000
	State Sales Tax @ 8.5%				$340,510
	Engineering, Legal and Administrative @ 15%				$600,900
	Permitting @ 5%				$200,300
	Construction Management @ 20%				$801,200
	Conveyance Right-of-Way Acquisition - 20-feet Wide	Acres	3	$25,000	$75,000
	Property Acquistion - City Owned Value	Acres	18.9		$1,775,000
	Contingency @ 20%				$801,200
	Total				$8,600,110
	Total - (Rounded)				$8,600,000

Note: Wetland mitigation for Pond 2 is contained in the proposed wetland mitigation for Hayho Creek for Ponds 1 and 2.

Planning Level Project Cost Opinion
Edgecomb Creek Basin Drainage Facilities
Smokey Point Master Plan Area
City of Marysville, Washington

Otak, Inc. 2/8/2007

Item No.	Item Description	Unit	Quantity	Unit Price	Estimated Cost
	Construction				
1	Add-on Area Pond - Site # 2	Acre-feet	70	$34,000	$2,380,000
2	FAA Mitigation @ 20% of Add-On Area Pond				$476,000
3	Site #1 Pond	Acre-feet	53	$34,000	$1,802,000
4	Site #1 Pond and Site #2 Pond Outfalls to Creek	LS			$200,000
5	Conveyance System to Site #1 Pond and Site Pond #2				$3,220,000
				Subtotal	$8,078,000
	State Sales Tax @ 8.5%				$686,630
	Engineering, Legal and Administrative @ 15%				$1,211,700
	Permitting @ 5%				$403,900
	Construction Management @ 20%				$1,615,600
	Conveyance Right-of-Way Acquisition 20-feet Wide	Acres	8	$25,000	$200,000
	Property Acquistion	Acres	40	$16,000	$640,000
	Contingency @ 30%				$2,423,400
	Total				$15,259,230
	Total - (Rounded)				$15,300,000

Note: Wetland mitigation for the Edgecomb Creek facilities will be included as a part of the Edgecomb Creek relocation project.

Appendix A—
Figures A-1, A-2 and A-3

Type S Stream. Those streams, within their ordinary high water mark, as inventoried as shorelines of the state.

Type F Stream. Those stream segments within the ordinary high water mark that are not Type S streams, and which are demonstrated or provisionally presumed to be used by salmonid fish.

Type Np Stream. Those stream segments within the ordinary high water mark that are perennial and are not Type S or Type F streams.

Type Ns Stream. Those stream segments within the ordinary high water mark that are not Type S, Type F, or Type Np streams. These include seasonal streams in which surface flow is not present for at least some portion of a year of normal rainfall that are not located downstream from any Type Np stream segment.

Basins	*Marysville Stream Classifications*
Allen Cr.	*S*
Ebey Slough	*F*
West Fork Quilceda Cr.	*NP*
Edgecomb Cr.	*NS*
Middle Fork Quilceda Cr.	
Quilceda Cr.	
Sunnyside Cr.	

Figure A-1

Figure 6-3 Soils

Figure A-2

Figure 6-6 Wetlands

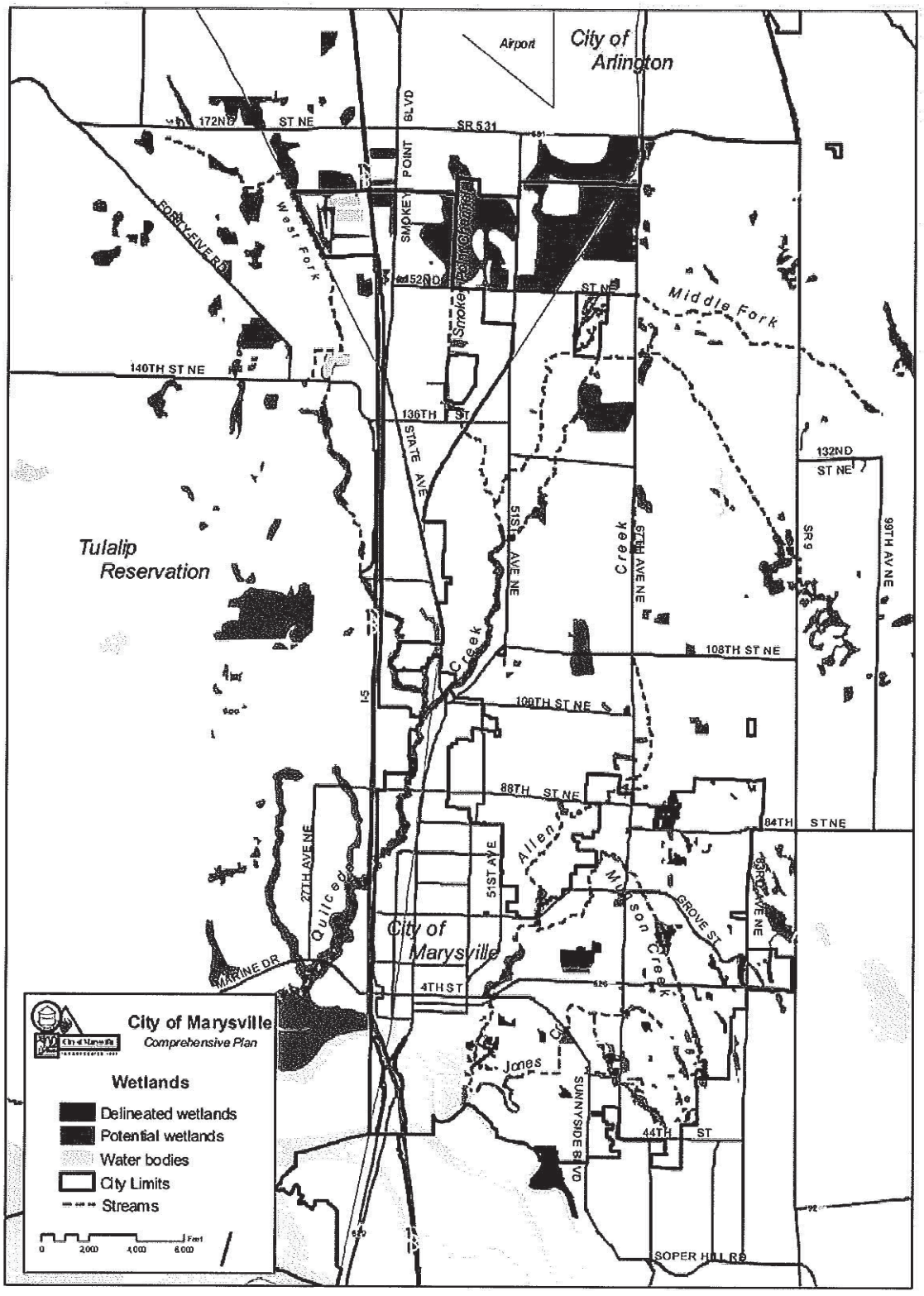

Figure A-3