Anniedale-Tynehead

Neighbourhood Concept Plan (NCP)

April 2012

City of Surrey

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ENGINEERING APPENDICES

ACKNOWLEDGMENTS

The City of Surrey acknowledges the contributions and participation of the following individual's organizations and staff members throughout the preparation of this Neighbourhood Concept Plan:

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[“Neighbourhood Concept Plan (NCP) land use densities, design guidelines, servicing requirements, transportation designs, parks, and amenity contributions, introduce new requirements at time of development application, along with the provisions for increased neighbourhood, service amenities and development potential.”]

REPORT STRUCTURE

This report provides a comprehensive set of plans, policies, designs and regulations to guide future growth and re-development in the Anniedale-Tynehead area of Surrey. The plan is divided into two sections and ten parts:

SECTION 1: PLANNING AND DEVELOPMENT

PART 1: The **Introduction** puts the overall plan into context, providing background information on the plan area, previous related studies, study process, opportunities and constraints of the area, and the various public consultation approaches used to identify issues important to the area and stakeholders.

PART 2: The **Neighbourhood Concept Plan Objectives** are prepared to provide a framework to the future land use, consisting of Neighbourhood planning principles and sustainable policies to guide development and redevelopment of all properties within the Anniedale-Tynehead community. The plan will provide a guide for the next thirty plus years of growth in the area, and will be subject to amendments and review as needed.

PART 3: The **Land Use and Design** includes general land use intent as well as proposed permitted and restricted uses in an area (e.g., public road use, commercial areas, buffers, etc) and selective guiding principles associated with each land uses type. In addition, design criteria that are expected from all developers and builders in planning, designing and constructing new development or projects in Anniedale-Tynehead are also provided. Developers and/or builders will be required to formally demonstrate, through the submission of secondary plan, block plan, subdivision or site plan-specific design documents, how the Design and Development Guidelines are being met, and focus on unique attributes or planned 'character' elements that will heighten the overall design of the plan, and/or site.

PART 4: The **Development Guidelines** includes Land Consolidation Strategy, Environmental Management, Cluster Housing, ALR Edge Guidelines and Heritage Policies.

SECTION 2: ENGINEERING, IMPLEMENTATION AND FINANCING

PART 5: The **Transportation Infrastructure, Policy, and development** overview and Requirements are contained in the fifth part.

PART 6: The **Sanitary Sewers Infrastructure**, Policy and development overview and requirements are contained in the sixth part.

PART 7: The **Storm Water Infrastructure**, Policy and development overview and requirements are contained in the seventh part.

PART 8: The **Water Infrastructure**, Policy and development overview and requirements are contained in the eighth part.

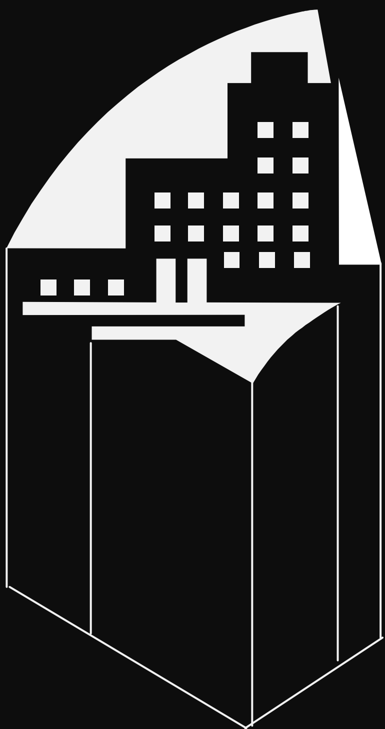
PART 9: The **Community Amenity Contributions, External Utility Agency Comments and Implementation strategy** is contained in the ninth part.

PART 10: The **Financing Strategy** for the Anniedale-Tynehead Neighbourhood Concept Plan is contained in the tenth part.

SECTION 1 Planning and Development

PART 1: Introduction
PART 2: Neighbourhood Concept Plan Objectives
PART 3: Land Use and Design
PART 4: Development Guidelines

SECTION 1: PLANNING AND DEVELOPMENT



What is a Neighbourhood Concept Plan (NCP)?

A neighbourhood concept plan is a policy and planning document, endorsed by Surrey City Council, to be considered with future amendments of the Official Community Plan (OCP) , Zoning Bylaw and other development Bylaws. The neighbourhood plan is different than the OCP as it does not have bylaw status, but specifically outlines a vision and direction for future urban neighbourhoods with greater detail on:

- Land use Policies and Objectives
- Circulation of Transportation network
- Parks and Open Space
- Infrastructure, Amenities and Utility Servicing
- Environmental Protection and Enhancement

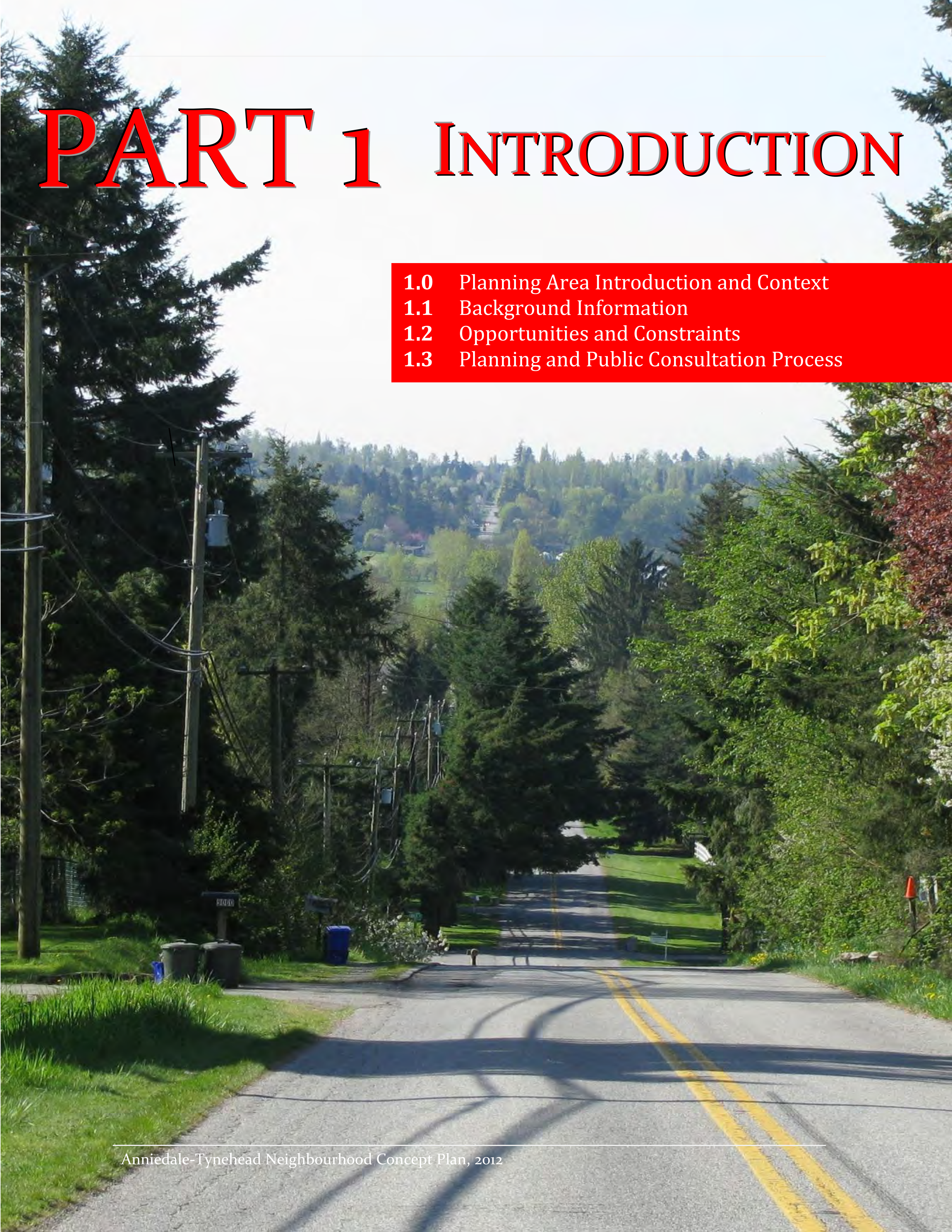
In turn, NCPs inform and guide what happens in the planning area with respect to future:

- OCP land use amendments;
- Zoning and rezoning;
- Development permit areas and development guidelines;
- Subdivision and Development;
- Urban Design and Development.

What are the Design and Development Guidelines?

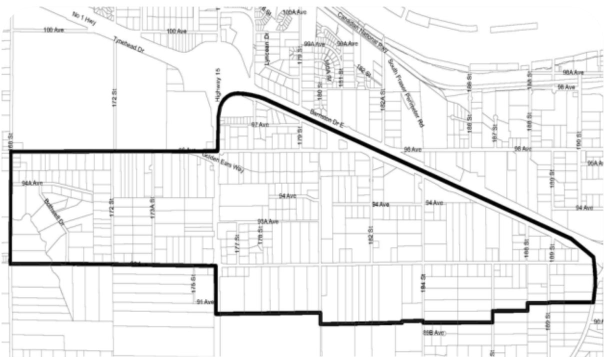
The Design and Development Guidelines provide design criteria that are expected from all developers and builders in planning, designing and constructing new development or projects in Anniedale-Tynehead. In addition, developers and/or builders will be required to formally demonstrate, through the submission of secondary plan, block plan, subdivision or site plan-specific design documents, how the design and Development Guidelines are being met, and focus on unique attributes or planned 'character' elements that will heighten the overall design of the plan, and/or site.

PART 1 INTRODUCTION



PART 1: INTRODUCTION

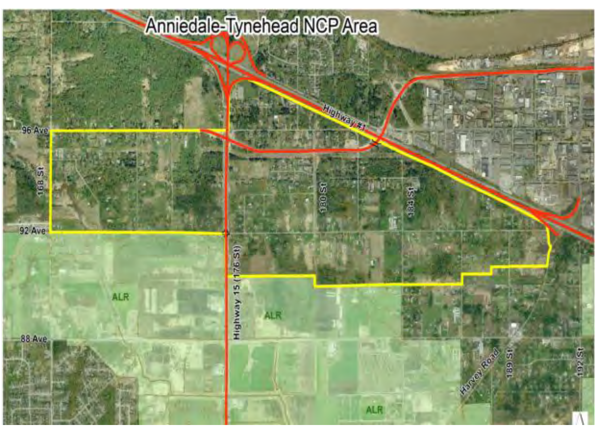
1.0 PLAN AREA INTRODUCTION AND CONTEXT



Anniedale-Tynehead NCP Boundaries

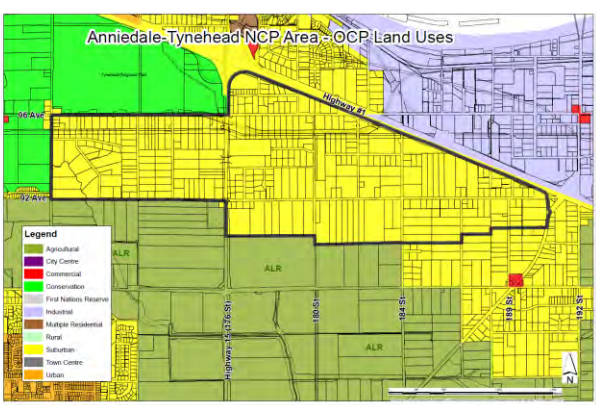
The Neighbourhood Concept plan area covers approximately 408 hectares (1008 acres) of North East Surrey. The NCP area is generally bounded by Highway 1 and 96 Avenue to the north and 168 Street to the west. The southern boundary is marked generally by the Agricultural Land Reserve (ALR) between 168 and 184 Streets and an approximate alignment with 90 Avenue jogging northward from 184 Street to Harvie Road. The eastern boundary is marked by Harvie Road's termination at Highway 1.

There are approximately 374 individual properties in this NCP area. The current zoning is predominantly One-Acre Residential Zone (RA), and General Agriculture Zone (A-1).



Plan Area Location and Major Highway Locations

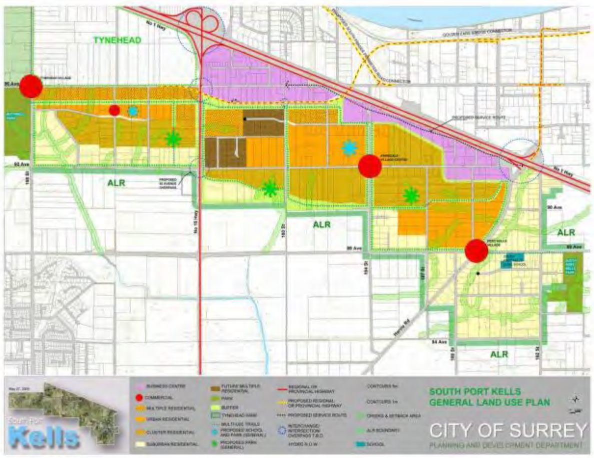
In this part of South Port Kells, four provincial or regional highways come together, making it an area that is unlike any other in the Lower Mainland. The Golden Ears Bridge (GEB) Connector Road, a responsibility of the Greater Vancouver Transportation Authority (TransLink) traverses the area south of 96 Avenue. Under the Ministry of Transportation's Gateway Program, Highway 1 will be widened and Highway 15 has been improved between 88 Avenue and Highway 1. A connection to the South Fraser Perimeter Road will be provided on the north side of Highway 1, outside of the plan area.



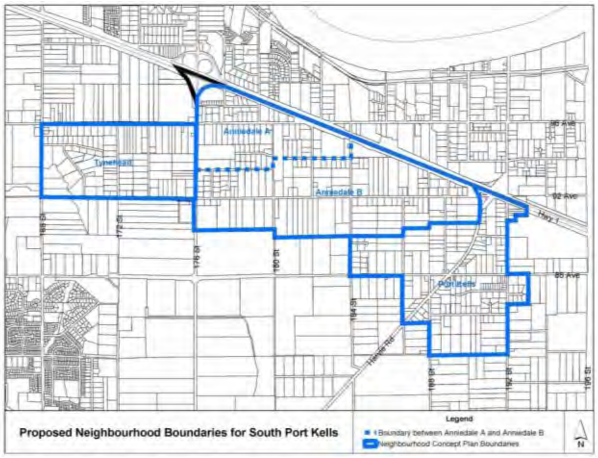
Suburban Lands in the OCP

The entire NCP area is designated Suburban in the City of Surrey's Official Community Plan. This designation provides for a maximum residential density of one unit per acre. The OCP also states that for Suburban designated lands indicated as having potential for urban, commercial, business or industrial development, the minimum lot area for subdivision is 0.8 hectare (2 acres).

1.1 PLANNING BACKGROUND AND INFORMATION



South Port Kells General Land Use Plan



Original Proposed Boundaries for South Port Kells Neighbourhood Plans

On June 13, 2005, Council approved the South Port Kells General Land Use Plan (GLUP) as the basis for preparing future NCPs. The South Port Kells GLUP was then further divided into three distinct neighbourhoods (Anniedale, Port Kells, and Tynehead).

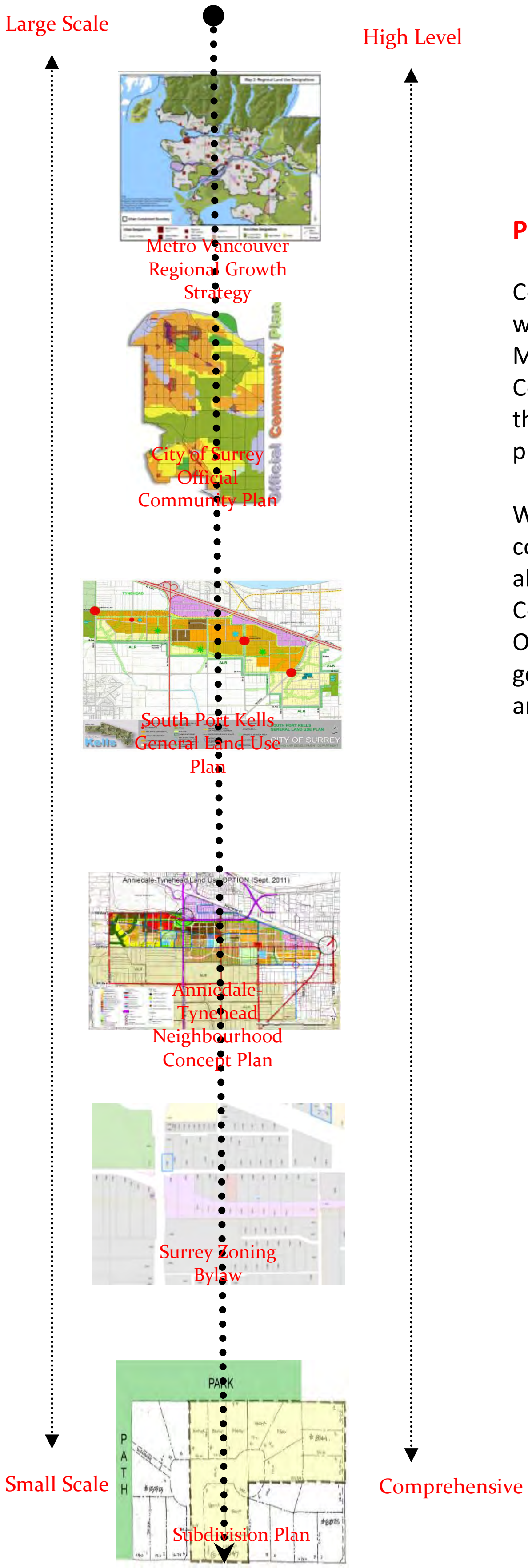
The Anniedale neighbourhood was further divided into two parts, Anniedale Area "A" and Anniedale Area "B" to advance planning for the area that was most significantly impacted by new highway construction. However, as the NCP process progressed, it became evident that the high cost of servicing as well as the uncertainty of access points from the Provincial and Regional transportation works would impact the ability to complete an NCP.

As a result, on April 19th, 2007 Council directed staff to suspend additional work on the Anniedale "A" NCP and instead requested staff to commence a planning process for an NCP for the combined Anniedale "A" and "B" area, once major transportation issues had been resolved (2007 Corporate Report R088).

By late 2008 the Ministry of Transportation had advanced work on the design of the Highway 1 widening. City staff worked with the Ministry in reviewing various options, and draft plans and models related to the design of the intersection of Highway 15 and the Golden Ears Connector, and the design of a 192 Street partial interchange with Highway One.

Support for proceeding with a combined Anniedale and Tynehead was expressed through a petition signed by 125 individuals representing 116 property owners, and received by Council on February 9, 2009. This petition requested that Council authorize staff to initiate the groundwork for an Anniedale "A", "B" and Tynehead NCP.

On March 30, 2009, Council received Corporate Report No. R034 and authorized staff to prepare a Terms of Reference for the Preparation of an NCP for Anniedale-Tynehead in South Port Kells.



Policy Framework Overview

Community Development in Surrey is conducted and administered within a series of plans, policies and by-laws. These include the Metro Vancouver Regional Growth Strategy, Surrey Official Community Plan, Secondary and Neighbourhood Concept Plans, the Zoning By-law, as well as several other city bylaws and provisional regulations.

Within the hierarchy of Plans, the Official Community Plan must conform to the Metro Vancouver Regional Growth Strategy while all the other Plans and By-Laws must conform to the Official Community Plan. Like the Regional Growth Strategy and the Official Community Plan, all other Plans within the hierarchy generally address the physical, social and economic aspects of the area for which they are prepared. (See **Figure 1.0**)

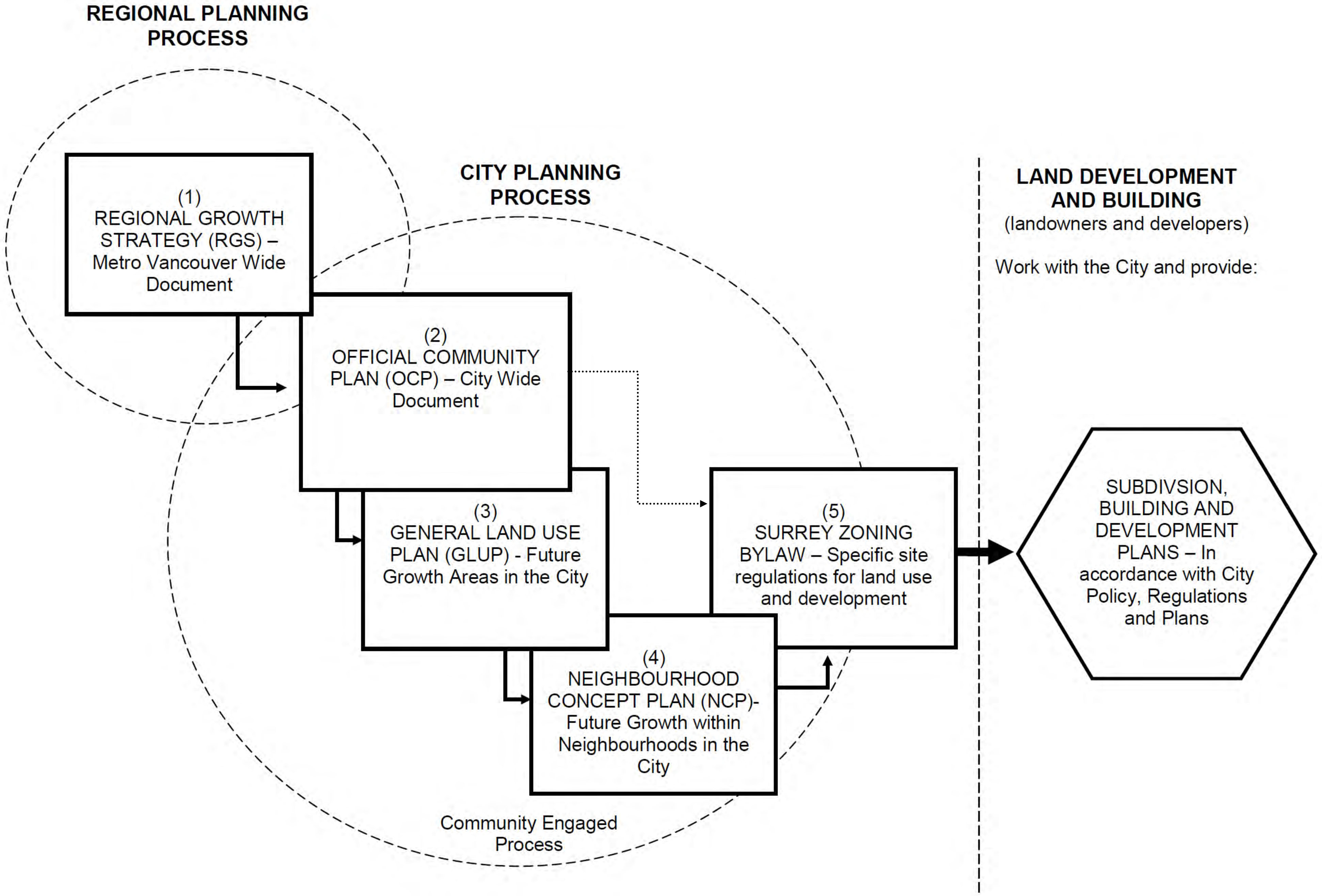


FIGURE 1.0 - LAND USE PLANNING FRAMEWORK

1. Regional Growth Strategy
This Planning Strategy establishes the general nature of future development in the Region of Metro Vancouver and forms the framework within which Regional Growth boundaries and Official Community Plans are to be prepared. In this respect, the City of Surrey Official Community Plan functions as a link between the broad concepts of the Regional Plan and local conditions and municipal objectives in the City of Surrey.

2. The Official Community Plan (Bylaw)
The Surrey Official Plan provides general policies and guidelines for development and the provision of community services in the entire City and forms the basis for Secondary and Neighbourhood Plan formulation.

3. General Land Use Plans (GLUPs)
General Land Use Plans provide an overall planning framework in designated future urban growth areas of the city that will act as a guide for the preparation of future Neighbourhood Concept Plans.

4. Neighbourhood Concept Plans (NCPs)
NCPs, once completed, plan for the servicing, development, and ultimate build-out of neighbourhoods within a GLUP area. They are prepared because the general policies directing city-wide growth and development are rarely detailed enough to address the specific issues in an individual community or neighbourhood. Once adopted by Council, these Plans inform the OCP and are integrated into the OCP by formal amendments as development (which is consistent with the NCPs) is approved.

5. Zoning By-law
The City of Surrey Zoning By-law, sets out detailed regulations for land use and development. Zoning is to be consistent with the objectives and policies of the OCP, and Neighbourhood Plans. The purpose of the Zoning By-law is to implement the policies of the various plans and provide standards for individual developments within the broad planning context.

1.2 OPPORTUNITIES AND CONSTRAINTS

The NCP area has multiple opportunities as well as constraints including transportation issues, high cost of servicing, agricultural land interface, and green space management.

Opportunities for consideration include:

- Plan a new full movement interchange with Highway 1 and 192 Street to improve access for employment land opportunities in the eastern portion of the Anniedale area and reduce the amount of traffic at both the existing Highway 1 and Highway 15 and 200 Street interchanges;
- Introduce new north-south arterial road connections to/from Anniedale to improve the accessibility between the Clayton, and Cloverdale neighbourhoods as well as the Campbell Heights employment lands;
- Create a continuous east-west and north-south internal local grid road network to adhere to Transportation Strategic Plan objectives of improving mobility choice which supports increased walking cycling and transit use and re attractive and reduce short-cutting and circuitous traffic patterns on Local Roads;

- Locate Industrial, Business park uses in close proximity to regional traffic routes such as Highway 15, Highway 1, and Golden Ears Way;
- Highlight views into the Agricultural Land Reserve and viewscapes into the plan area along the hillside;
- Incorporate the existing treed area along the hillside as a natural buffer between agricultural and residential uses;
- Use density bonusing as an incentive to increase preservation of green infrastructure in the plan area;

- Improve the wildlife connectivity through upgrading the Highway 1 wildlife underpass out of Anniedale and other wildlife corridors.
- Improve the health of the Serpentine River though a Riparian Enhancement area to allow installation of back channelling works; and
- Create a strong sense of place and identity for the future development by emphasizing the history and heritage of the area through the Urban Design of Commercial and Industrial area, Heritage Revitalisation agreements for significant sites, and commemoration and interpretation opportunities where preservation is not to be considered.

Constraints and issues for consideration include:

- Direct access controls on routes under the jurisdiction of other agencies would limit neighbourhood accessibility and potential land use designation to and along major regional corridors, including Golden Ears Way, Highway 1 and Highway 15;
- The at-grade signalized intersection of Golden Ears Way (GEW) & Highway 15 would not support the anticipated long term demands of both regional and neighbourhood traffic for typical industry standards of delay and level of service without major infrastructure improvements beyond those currently planned by regional and provincial agencies;
- The additional north south arterial connections would potential attract longer distance external and regional traffic, particularly 180 Street through Anniedale if Golden Ears Way & Highway 15 remains a congested at-grade intersection; and,
- The limited access to the Anniedale Triangle employment area at Golden Ears Way and 180 Street and the limited connectivity between the Anniedale and Tynehead neighbourhoods would require grade separated overpasses of Golden Ears Way and Highway 15, respectively, to support the development in the NCP
- Major servicing work in order for development to occur, including connection to water source at Cherry Hill, and ultimately Fleetwood Reservoir, construction of five sanitary pump stations, installation of eight stormwater detention ponds to intercept increased run-off from development, and construction of two overpasses along Highway 15, and one over Anniedale Road.

1.3 PLANNING AND PUBLIC CONSULTATION PROCESS

The public consultation process involved meeting with several stakeholder groups, City Advisory committee, governmental agencies as well as area city representatives and residents.

An integrated, multi-stakeholder approach to the planning process was used to arrive at the preferred development concept and the Stage 1 Land Use Concept, which formed the basis for the Stage 2 Land Use Concept Plan. The following consultative initiatives used:

Public Open House

The Anniedale-Tynehead Citizen Advisory Committee

A Citizen Advisory Committee (CAC) was established early in the NCP planning process through a community representative nomination and voting process. The goal of the CAC was to bring local knowledge and community concerns to the planning process and to involve residents in addressing the concerns. The CAC consisted of thirteen property owners (or representatives of property owners) and two association members within the plan area and residents of the surrounding neighbourhoods, The Committee met monthly through Stage 1 of the planning process to provide input into the development of the Land Use Concept, and at key points during Stage 2 as Engineering servicing and financing strategies were being finalized.

Tynehead Hall – Location of CAC meetings during NCP Process

Public Meetings

Public meetings/open houses were held at key milestones during the NCP plan process to provide opportunities for interested parties to comment on the preferred development concept and utilities and transportation infrastructure.

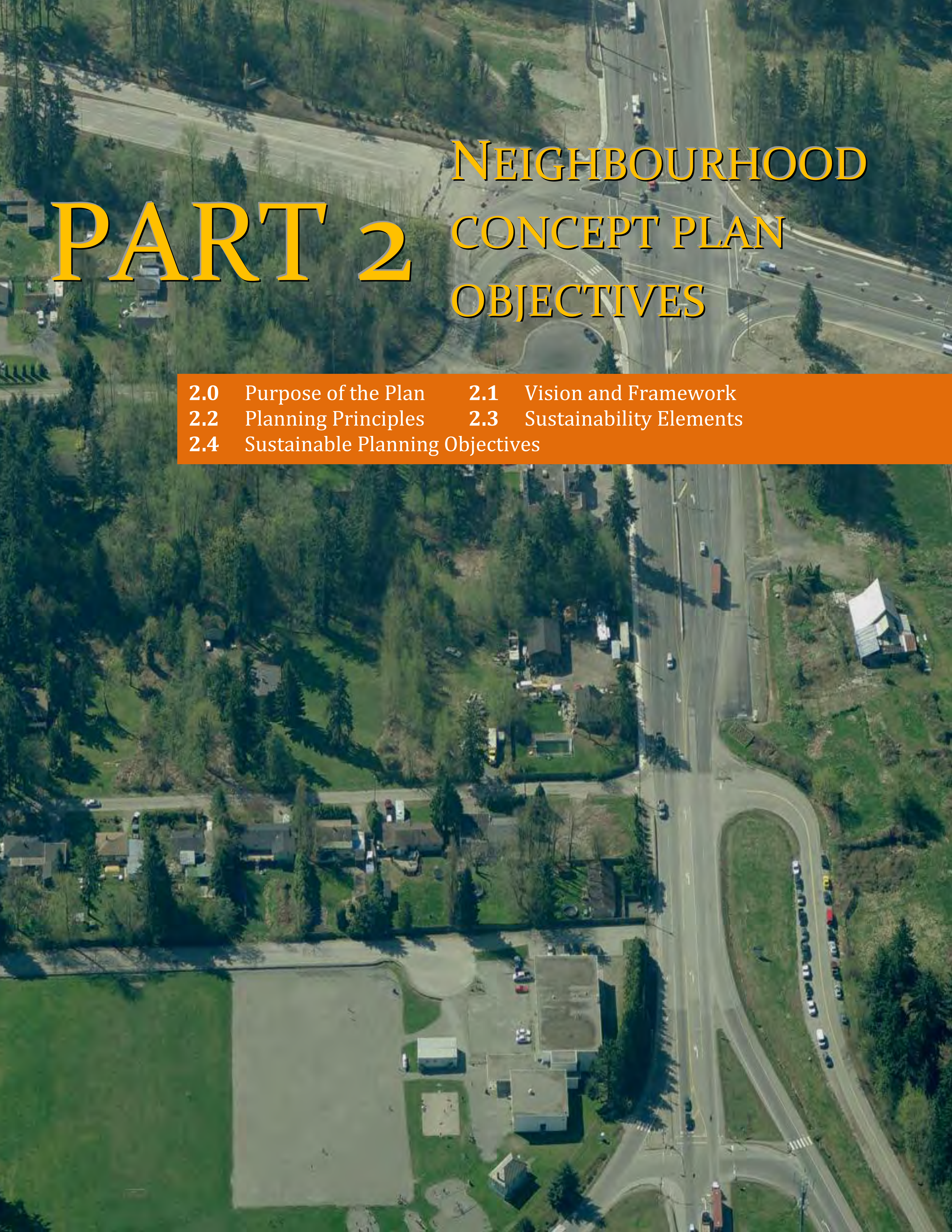
Shannon Hall, Cloverdale – Location of Public Meetings during NCP process

Interagency Meetings

Meetings with external agencies were held throughout the planning process. Representatives from Translink, MoTI, MAL, BC Hydro, Fortis BC, and the Surrey School District took part in the meetings.

Meetings with Committees of Council

The plan was also presented to the various Committees of Council including the Environmental Advisory Committee, Agricultural Advisory Committee, the Development Advisory Committee, and the Heritage Advisory Commission.



PART 2 Neighbourhood Concept Plan Objectives

PART 2: NEIGHBOURHOOD CONCEPT PLAN OBJECTIVES

2.0 PURPOSE OF THE PLAN

The purpose of this plan is to outline the desired future land uses in the Anniedale-Tynehead Neighbourhood in the South Port Kells area of North East Surrey. The Plan includes strategies for land use and development, infrastructure servicing, transportation, heritage protection, ecosystem preservation, tree protection and other related development issues.

Secondary Land Use Plans play a critical role in influencing the spatial pattern, character and liveability of a developing community. The distribution and density of land uses can determine, where people might work, live, shop and play. It can influence building types and therefore who might live in a community. The proximity of uses can determine people's travels needs. As a result, land use can significantly affect the diversity, lifestyle, transportation needs and efficiency of a community. It is perhaps the most significant factor is becoming a complete community.

The Neighbourhood Concept Plan provides an effective means of guiding future development along with related policy, design guidelines and strategy required for development. For example, it will enable development applications to be reviewed against a Council-adopted land use plan and set of policies specific to this area. Together, these elements are intended to establish the foundation for the creation of a healthy and sustainable neighbourhood.

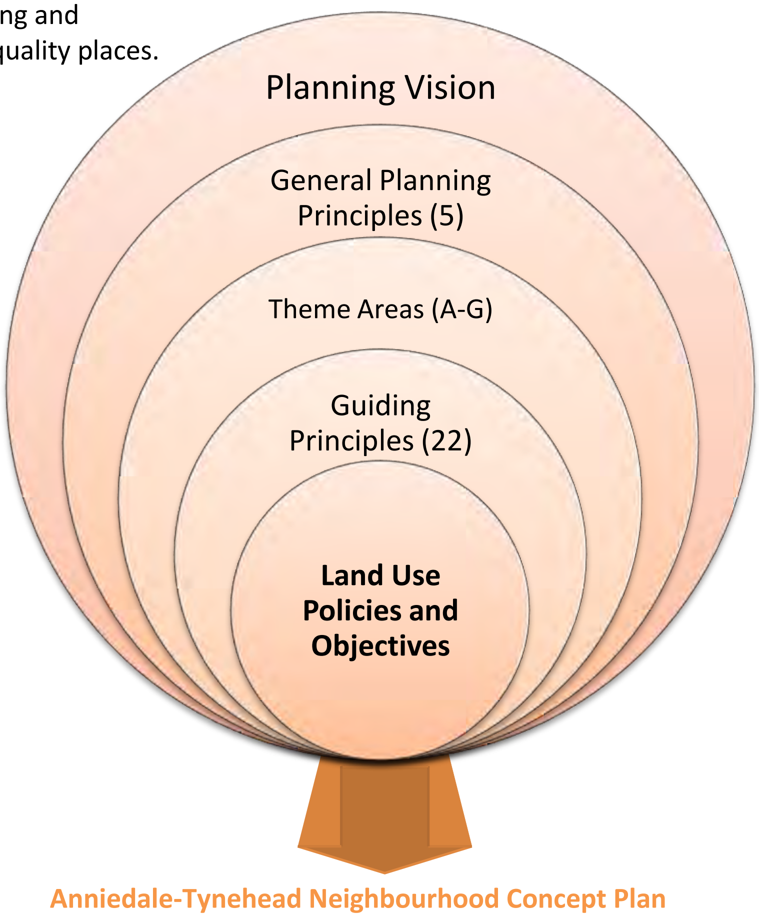
2.1 VISION AND FRAMEWORK

[“The Anniedale-Tynehead neighbourhood is a unique, diverse, and thriving complete community that complements its surroundings, contributes to the healthy growth of Surrey, and builds on its strategic location in the region. Anniedale-Tynehead community is a model of sustainable development that integrates the natural environment, interconnects neighbourhoods, provides a diversity of housing and employment choice, and ensures a legacy of quality places.”]

The Anniedale-Tynehead NCP land use concept is associated with the South Port Kells General Land Use Plan, which envisioned South Port Kells as a complete community with local commercial nodes, a business area, a mix of residential uses and densities, community facilities, schools, parks, pathways, open space and protected areas. The guiding principles for the development of the Anniedale-Tynehead area were established in association with the visioning process conducted during the initial General Land Use Plan process.

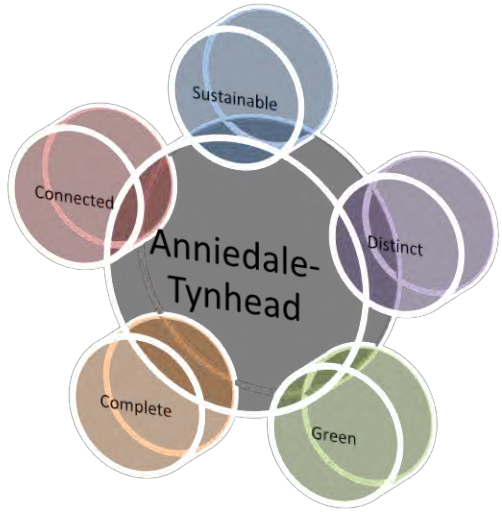
Vision

Anniedale-Tynehead is a unique, diverse, and thriving complete community that complements its surroundings, contributes to the healthy growth of Surrey, and builds on its strategic location in the region. The Anniedale-Tynehead community is a model of sustainable development that integrates the natural environment, interconnects neighbourhoods, provides a diversity of housing and employment choice, and ensures a legacy of quality places.



2.2 PLANNING PRINCIPLES

Derived from the Anniedale-Tynehead Community Vision statement, the Anniedale-Tynehead Citizen's Advisory Committee (CAC) assisted in the creation of a set of Planning Principles and Planning theme areas and Guiding Principles to develop the land use plan for the NCP. These principles reflect overall sustainability principles set out in the South Port Kells General Land Use Plan and the City's Sustainability Charter objectives.



ANNIEDALE-TYNEHEAD NCP – GENERAL PLANNING PRINCIPLES	
1 SUSTAINABLE	The Anniedale-Tynehead NCP will be based on the three pillars of sustainability: Social, Economic and Environmental Sustainability.
2 COMPLETE	The Plan will provide opportunities to Live, Work and Play. Anniedale-Tynehead will be planned as a "complete community" with a range of housing types, services, and employment and recreational opportunities.
3 DISTINCT	While Anniedale-Tynehead will have a distinct community identity, each neighbourhood should have its own recognizable character. It will be a beautiful place to live.
4 GREEN	Anniedale-Tynehead will have an abundance of open space, green corridors and protected wildlife areas to allow the residents to enjoy passive and active outdoor activities. Efforts will be made to preserve elements of the rural ambiance which currently exists in Anniedale-Tynehead.
5 CONNECTED	Anniedale-Tynehead will be a highly walkable community with an inter-connected street network, pathways, cycle routes and greenway system.

Guiding Principles

Based on five General Planning Principles developed for the Plan, seven Planning Theme areas (A-G) were identified that include 22 Guiding Principles for the development of the NCP. The *Guiding Principles* developed for the Anniedale-Tynehead NCP are described in the table below and guide several land use policy areas.

THEME AREA		ANNIEDALE-TYNEHEAD - GUIDING PRINCIPLES
A	Parks, Open Space, Recreational and Natural Areas	1. Retain significant environmental features including creeks, important vegetation and Green Infrastructure (Ecosystem Hubs, Sites and Corridors): i. Consider Park locations which incorporate protection of significant and/or valuable ecosystems; ii. Minimize clear cutting vegetation and clearing lands during development and encourage the planting and replanting of trees; iii. Encourage cluster development which enables density transference and site specific design that responds to the area's natural features.
		2. Create parks and recreation opportunities that are interconnected, both active and passive, which are accessible by residents of all ages and abilities on foot or by bicycle.
B	Roads, Transportation, Pedestrian and Bicycle Circulation	1. Design roads that provide for efficient movement of goods and people while sustaining the character or each neighbourhood.
		2. Design road networks and establish land use which encourages effective public transit service.
		3. Create opportunities for pedestrians and bicycle movement linked with adjacent community amenities. Daily needs should be within walking distance.
		4. Provide buffers along major highways and limit regional through-traffic in primarily residential areas.
C	Infrastructure and Servicing	1. Ensure the cost-efficient and adequate provisions for City services including sewer, drainage, water, roads and utilities without placing a financial hardship upon the City's resources.
		2. Ensure practices in the design of the drainage system, and the protection of water quality and resources.
		3. Recognize the interrelationship of the Anniedale-Tynehead area with adjacent Town Centres in Surrey and Township of Langley, especially with respect to commercial, institutional and transportation needs.

D	Sense of Place and Identity	1. Locate commercial and mixed use development near neighbourhood amenities parks, schools, and facilities to maximize neighbourhood gathering and 'place making' opportunities.
		2. Protect and maintain the natural beauty and distinctive heritage of the area by: i. protecting view corridors and heritage building and sites; ii. enhancing view opportunities along the south facing slope adjacent to the ALR;
		3. Capitalize on "Gateways" into the community at 176 Street and 96 Avenue through the use of public art and other gateway features to identify the community.
E	Residential Lands: Housing and Housing Density	1. Provide a variety of housing types, densities and forms to accommodate a range of lifestyle and housing choices for people across the spectrum of family type, age and income levels.
		2. Protect the character and quality of life in existing and established residential areas during development: i. avoid piecemeal re-development; ii. provide guidelines and implementation policies such as phasing plans, parcel consolidation plans, and minimum redevelopment parcel sizes.
		3. Locate higher density residential development adjacent to commercial areas, especially near centres and mix-use areas;
		4. Designate densities that make serving feasible while also respecting environmentally sensitive and agricultural (ALR) edge transition areas.
F	Employment Lands: Commercial and Industrial	1. Provide local retail and shopping opportunities in village centre in each neighbourhood to provide locally accessible neighbourhood services.
		2. Create opportunities for residents to work close to home by accommodating business and industrial development in the Anniedale triangle and other business park lands.
		3. Create opportunities for smaller scaled, pedestrian oriented commercial spaces and destinations where people can meet; such as cafes, coffee shops and corner stores, during different parts of the day and into the evening.
G	Agricultural Edge Transition	1. Recognize, protect and enhance the Agricultural Land Reserve (ALR) Boundary and its interface by clustering development and density away from the ALR.
		2. Ensure the establishment and long term maintenance of effective buffers (fences, planted landscaping, open spaces, natural vegetation), between urban development areas and the ALR.

2.3 SUSTAINABILITY ELEMENTS

Sustainability principles and features have been incorporated into the Anniedale-Tynehead NCP. The NCP framework provides for walkability and inter-connection, places for community gathering and social interaction, employment lands, diversity of housing form and tenure, protection of biodiversity through riparian area protection, and low impact development practices.

Sustainability addresses more than the simple effort to minimize energy consumption, emphasize "green" construction practices, and create a liveable community. These elements are described in more detail in the Sustainable Planning Objectives section.

Land Use Objectives: The Sustainable planning objectives of the Anniedale-Tynehead NCP build upon the South Port Kells GLUP visioning framework and provide development policies with regard to the form and character of future land uses, densities, and servicing requirements.

Planning objectives to build an outstanding neighbourhood that adds value to the greater community includes the following ideals:

Housing Diversity: Diverse, flexible housing options are the cornerstone of healthy, inclusive and sustainable communities. The plan will provide for a range of housing types that support a diverse community, including all age groups, income levels, abilities, and household types and sizes.

Housing types will include multiple-unit residential in the form of apartments and townhouses as well as live-work residential housing. Fee-simple lots include ground oriented row houses, single family homes on small to medium sized lots, as well as larger sized lots. To allow for rental suites, small-lot single family homes will be able to accommodate either a secondary suite or coach house.

Residential designations will support both market and non-market housing (social housing) options. This includes housing for people who require supports in order to live and participate in the community; this includes housing for seniors, people with disabilities, and people who are homeless or at risk of homelessness.

Sustainability Charter

Access to Nature: Respect, conserve, and enhance the significant and valued natural/ecosystem (Green Infrastructure Network GIN) opportunity assets. Use innovative development approaches to preserve treed escarpment areas.

Walkabilty & Connection: Provide an interconnected street and path system to ensure that future community is walkable, healthy, accessible and livable. Provide connection to parks, schools, employment areas and community facilities.

Accessibility: Design neighbourhoods that are friendly and responsive to unique needs of children, youth, seniors and those with special needs.

Jobs Close to Home Provide opportunities for employment in the plan area. Include a range of employment types including opportunity for small scale live-work spaces.

Transit Supportive Development: Provide a minimum overall residential density of 37 dwelling units per hectare (15 units per acre) along future transit alignments. Situate commercial and community services along planned transit routes.

Greenhouse Gas Emissions Reduction: Create a complete compact community with higher development densities, a mix of land uses, interconnected road systems, and options for multimodal transportation modes to help reduce green house gas emissions and future energy needs.

Transportation Objectives

The City's Transportation Strategic Plan was developed to examine how the City can provide a transportation system that caters to the mobility needs of all, including the movement of goods and services associated with a successful economy as well as reducing the existing over-reliance on the automobile and increasing the number of walking, cycling and transit trips throughout the City.

The Strategic Plan aims to promote a balanced transport system that gives sustainable choices in the way we travel to, from and within Surrey and which integrates with other policy areas associated with the environment, health and safety, economic well-being and land use. Transportation has a part to play in all aspects of people's lives and a good system responds to many and varying needs and priorities. The Strategic Plan has taken a holistic approach to transportation and has six guiding principles:

1. Effective And Efficient Network Management
2. More Travel Choice
3. Safer, Healthier Communities
4. Successful Local Economies
5. Protection of our Built and Natural Environment
6. Transportation Integration

Emphasis is placed on providing a Transportation System that is efficient, equitable, safe, and sustainable and that promotes alternative and sustainable travel choices with a hierarchy for consideration as follows;

1. Walking
2. Transit
3. Bicycles
4. Commercial Traffic and Trucks
5. High Occupancy Vehicles
6. Single Occupancy Vehicles

The Walking Plan and soon to be completed Cycling Plan builds upon the Transportation Strategic Plan's recognition of the importance of these two modes of transportation.

Walking & Cycling

- Provide finer pedestrian/cycling network through a finer grid road network and provide shortcuts within and between developments to minimize walking & cycling distances;
- Use utility corridors for off-street walking and cycling routes;
- Provide for jobs, shopping, services and schools all within 30 minutes by walking or cycling and preferably closer;
- Maintain all arterial and collector roads to be "complete streets" by proving pedestrian facilities through buffered sidewalks and bike lanes;
- Ensure development "addresses the street" to improve pedestrian environment;
- Encourage use of rear lanes to reduce pedestrian, cyclist and vehicle conflicts at driveways on collector roads;;
- Provide frequent crossings of streets in convenient locations with shorter crossing distances using curb extensions at intersections, and mid-block median crossings with two-stage crossings on major roads,
- Provide end-of-trip facilities (bicycle parking, lockers, showers, and benches);
- Provide pedestrian/cyclist scale lighting.

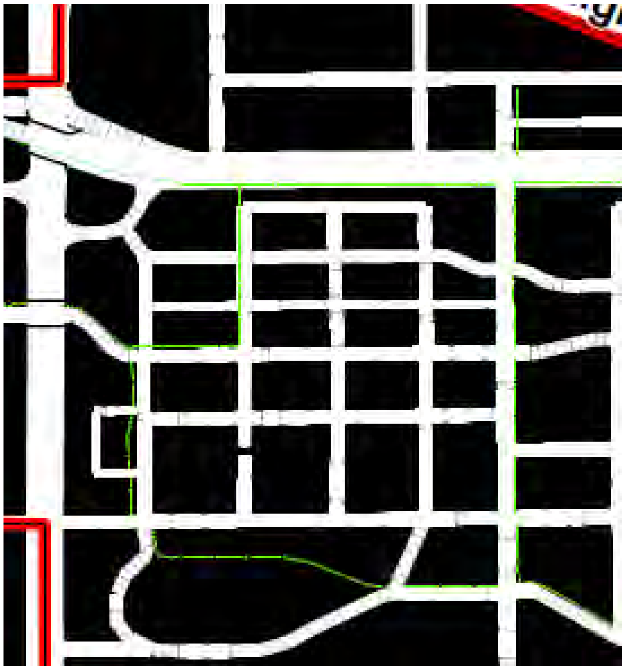
Transit

- Provide a finer grid road network which supports increased walking access to transit service;
- Create a continuity of the highest population & employment densities along transit routes to create high density corridors;
- Locate major activity nodes, anchors and destinations where transit routes intersect;
- Locate transit stops within 400m walking distance of the major activity generators, destination, and highest density corridors;
- Co-ordinate transit investment with land use planning in support of high density, mixed use and compact development;

Commercial Traffic & Trucks

- Promote access to employment lands for all modes;
- Provide road network improvements that help reduce congestion in support of more efficient goods movement and economic vitality;
- Improve strategic road network that will both support economic development and reduce the impacts of truck traffic on communities;
- Maintain efficient goods movement on regional routes through NCP;

Road Network



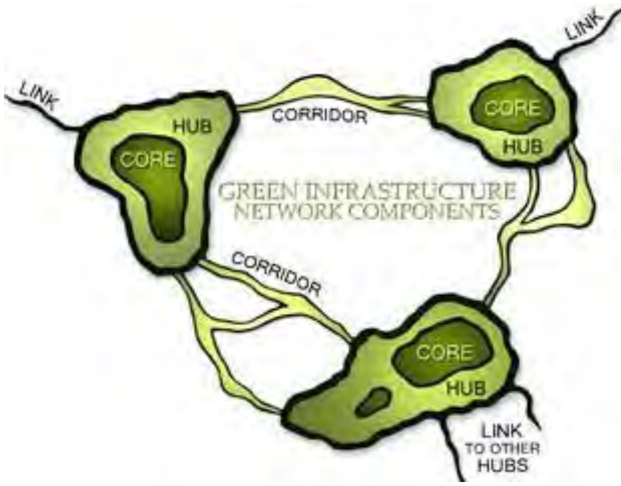
- Promote community connectivity for all modes through the development of a higher density road network in a grid or modified grid pattern with a reduction in the number of cul-de-sacs to reduce traffic concentration, provide multiple route options, and promote increased use of network by pedestrians and cyclists;
- Target the grid road network for closely spaced streets with minimum 100 metre and maximum 200 metre long blocks;
- Recognize that a road right-of-way is a "public space" and must be a "complete street" for all forms of movement, not only for vehicles but also for pedestrians, cyclists and transit buses;
- Maximize connections with arterial & collector routes to provide direct routes to major origins & destinations, e.g. Surrey City Central, Fleetwood, Cloverdale, Clayton, Willowbrook, Langley City Centre, etc.
- Maximize efficiency of existing transportation network infrastructure before providing new or widening of existing infrastructure particularly through the Agricultural Land Reserve (ALR), with signal coordination and intersection improvements;

Land Use- and Transportation Integration Best Practices

- Provide self contained, "complete" communities with residential, commercial (retail & services) and employment opportunities (jobs/housing balance);
- Create compact, diverse and mixed-use communities; avoid large blocks of "mono zoning";
- Incorporate best practices for storm water management into transportation projects with swales, rain gardens, streets trees, boulevards, medians;

- Maximize greening in, and adjacent to, transportation corridors;
- Reduce impacts of roads on water quality, vegetation, trees and land consumption and protect significant trees where possible.

2.4 GREEN INFRASTRUCTURE NETWORK



The Anniedale-Tynehead NCP is the first Land Use Plan in the City of Surrey to incorporate Green Infrastructure Network (GIN) planning as part of the land use planning and Ecosystem Assessment process, based on the Surrey Ecosystem Management Study (EMS) objectives. Environmental mapping, selection of Park locations, buffer areas and Green Space Transfer areas within cluster designations where heavily influenced by the City of Surrey GIN Opportunities mapping.

"Green infrastructure" is a term identified in the Surrey Ecosystem Management Study (2009) as an interconnected network of natural or "green" elements that occur at a variety of scales – site/building, neighbourhood, community-wide, regional, and beyond. Similar to traditional "grey" infrastructure (roads, power, gas and other utilities, etc.) green infrastructure provides a critical underlying foundation to support the function and quality of neighbourhoods in the Anniedale-Tynehead NCP and also supports the function of the City and Regional ecological systems.

Green Infrastructure Management Objectives:

Ecosystem Hubs

- Identify the 'minimum core' of upland ecosystem hubs to be retained based on Vegetation ranking and detailed site specific biological studies prior to development approvals. In general hub cores that are round and as large as practical are preferred, so that interior habitats are preserved.
- Ensure larger hubs are considered for preservation as they provide a greater variety of biodiversity and habitats. (A 5 acre site will tend to support a greater diversity of species and habitats than a 1 acre site).

Ecosystem Sites

- The collective influences of many small habitats can be as great as a single larger park; to encourage biodiversity ensure small habitats are considered as critical areas for many urban species, or remnant populations of rare or endangered species.
- Where possible, integrate smaller natural sites, and clumps of trees forming part of the neighbourhood tree canopy and

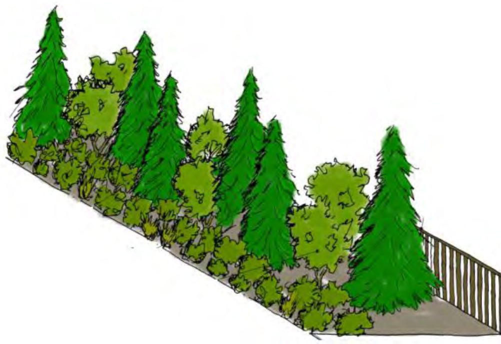
'naturescape' practices into the general urban matrix and site plans. Small habitats can be critical to species' survival.

Ecosystem Corridors

- Protect streams and habitats of any threatened or endangered species, and access to both refuge cover and food supply for existing or desired species.
- Prioritize the protection and/or restoration of effective aquatic and/or wildlife corridors that link hubs and sites together, so that plant and animal species are able to disperse and intermix for genetic diversity and population security.
- Routes between hubs, sites and corridors will likely follow existing watercourse and riparian areas, steep slopes, floodplains, wooded sites, and other areas that are constrained to development.
- Width of corridors will vary and should be determined based on detailed biological studies of the species that are or could use the habitat provided by the linked hubs and the corridor.

Rainwater Management

- Ensure effectively manage of rainwater, control sediment and erosion, promote tree cover and minimize harmful emissions recognizing that clean water and natural stream flow regimes, clean air, and mitigation of climate change are key ingredients to support a GIN, as per NCP Stormwater Management Requirements.



ALR Interface

- Some Agricultural lands outside the NCP -in wildlife terms - are currently functioning as both a hub and a large corridor – supporting wildlife populations and allowing relatively free movement - which allows wildlife to adapt to agriculture practices and co-exist with active farming.
- Restricted public access to private agricultural lands, and encourage large vegetated buffers along ALR Boundary. Buffers help protect core areas.
- The impacts of human activity and other ecosystem stressors, such as invasive species, tend to be greatest at the edges of ecosystems. A buffer area helps protect core areas from these impacts.

Public Access

- Public appreciation of the natural values and biodiversity in Ecologically Significant areas is important to successful management.
- Trails, utilities and other access to these areas however, should be planned in ways that limit disturbance to the species resident in the area. Trails may be restricted to adjacent lands or outer limits, so that the core is undisturbed.

2.5 CLUSTER HOUSING

Cluster designations are located throughout the plan area and are identified throughout the Land Use Plan. A "Cluster Designation" enables the transfer of development potential from treed, open space and/ or environmentally important areas called, "Green Space Transfer (GT)" areas to the developable portions of the site. The City seeks to conserve/enhance as well as agricultural buffer areas the City seeks to create or preserve, to areas specifically designated to be developed "Development Sites".

Objectives

Cluster residential housing is designed to achieve the following objectives:

- Provide more efficient use of land in harmony with its natural features;
- Creativity in the design of developments through a carefully controlled process;
- To encourage a less sprawling form of development, a shorter network of streets and utilities, more economical development of land with less consumption of open space;
- To preserve permanently, natural topography and wooded areas within developed areas, and to preserve usable open space and recreation facilities close to home;
- To provide an efficient procedure to ensure appropriate high quality design and site planning to enhance the neighbourhood;
- To promote diverse housing at a variety of costs, and in particular housing types that meets the needs of the Town's diverse population;
- To support alternative residential development that has a positive impact on the community and incorporates unique public benefits; and
- To ensure that alternative residential development is compatible with surrounding land uses and that the impacts on public services will not exceed conventional residential development.

2.6 PLACEMAKING AND IDENTITY

The Plan for Anniedale-Tynehead recognizes and incorporates the history and the unique natural assets of the area. Unique assets of this community include natural views into, and out of, the plan area, as well as the history of sawmills and farming. These themes will be highlighted to build on the sense of identity for the Anniedale-Tynehead NCP area.

Views

Anniedale-Tynehead has strong natural beauty, which contributes to the area's sense of place and identity. There are magnificent views north to the mountains, south to the farmland, as well as views of the treed escarpment looking into the plan area.

Protecting and highlighting these view sheds and view corridors will reinforce the unique identity of Anniedale-Tynehead. The Cluster Housing Designations and Design Guidelines for Townhouse Escarpment Areas identify specific strategies for enhancing views and protecting the green hillside.

Mill east of Pike Road on Townline Avenue
Tynehead Memories

History

The Design Guidelines will draw on clues from the historical development to inform the creation of new development that has an identity rooted in the history of this place.

During the early 1800's, sawmills were located in close proximity to the river. Plank roads allowed the transport of logs from the river to sawmills, and then lumber was moved to the railroad.

Although a small industry, fishing was also unique to this area. At the turn of the century, fishtraps were set in the Serpentine River to catch spawning salmon.

Over time as land was cleared, agricultural practices grew in the area and farming became a large part of the economy. Agricultural practices included poultry, fruit and vegetable farms, and on the low lands, grain and hay were produced.

Drawing on the history of the area, the Sawmill and Lumber and Agricultural & Pastoral themes will provide direction for the future redevelopment of this area. These themes have been incorporated into Placemaking and Design Guidelines. **Figure 2.0** identifies these general theme areas. The Sawmill and Lumber theme will be most prevalent in the northern part of the NCP and the Agricultural and Pastoral theme in the southern part of the plan.

A "plank road" was also located in the vicinity of what is now the gas/hydro right-of-way. This theme can be enhanced along the greenway proposed on the right-of-way.

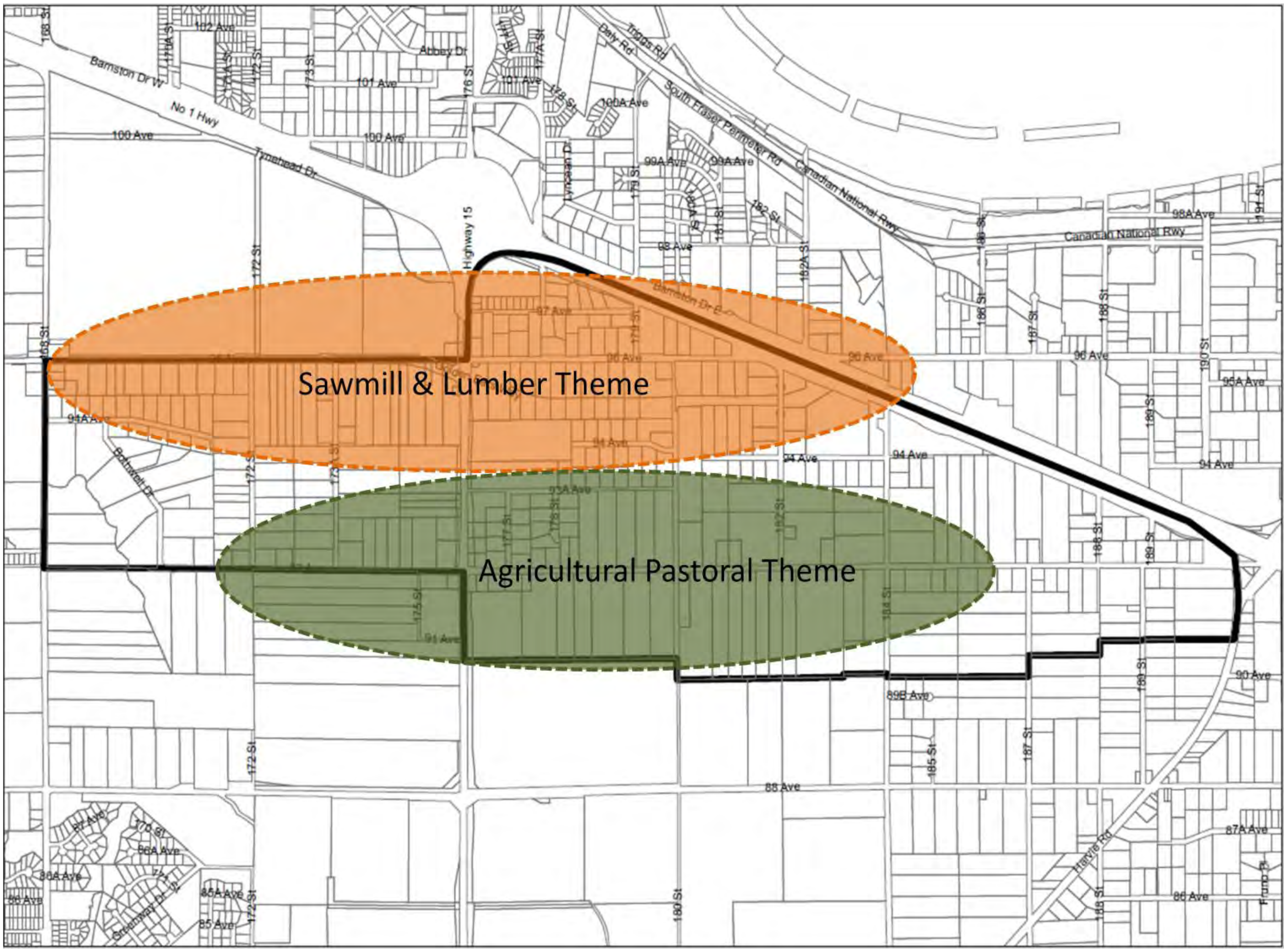


FIGURE 2.0 – THEME AREAS: SAWMILL AND LUMBER AND AGRICULTURAL PASTORAL

Sawmill and Lumber Theme

Sawmills were historically located on the future Tynehead Commercial and Regional commercial sites (see 4.5 Heritage Area Guidelines) To draw on this history, a sawmill and lumber theme will be used to guide the design of the redevelopment of those sites.

Lumber themes can include:

- the use of wood and heavy timber construction,
- sawmill paraphernalia such as saw blades and metal tools,
- repetition of logs,
- tree rings

Examples of the lumber themes used in redevelopment projects are shown in the following photos:

Agricultural Theme

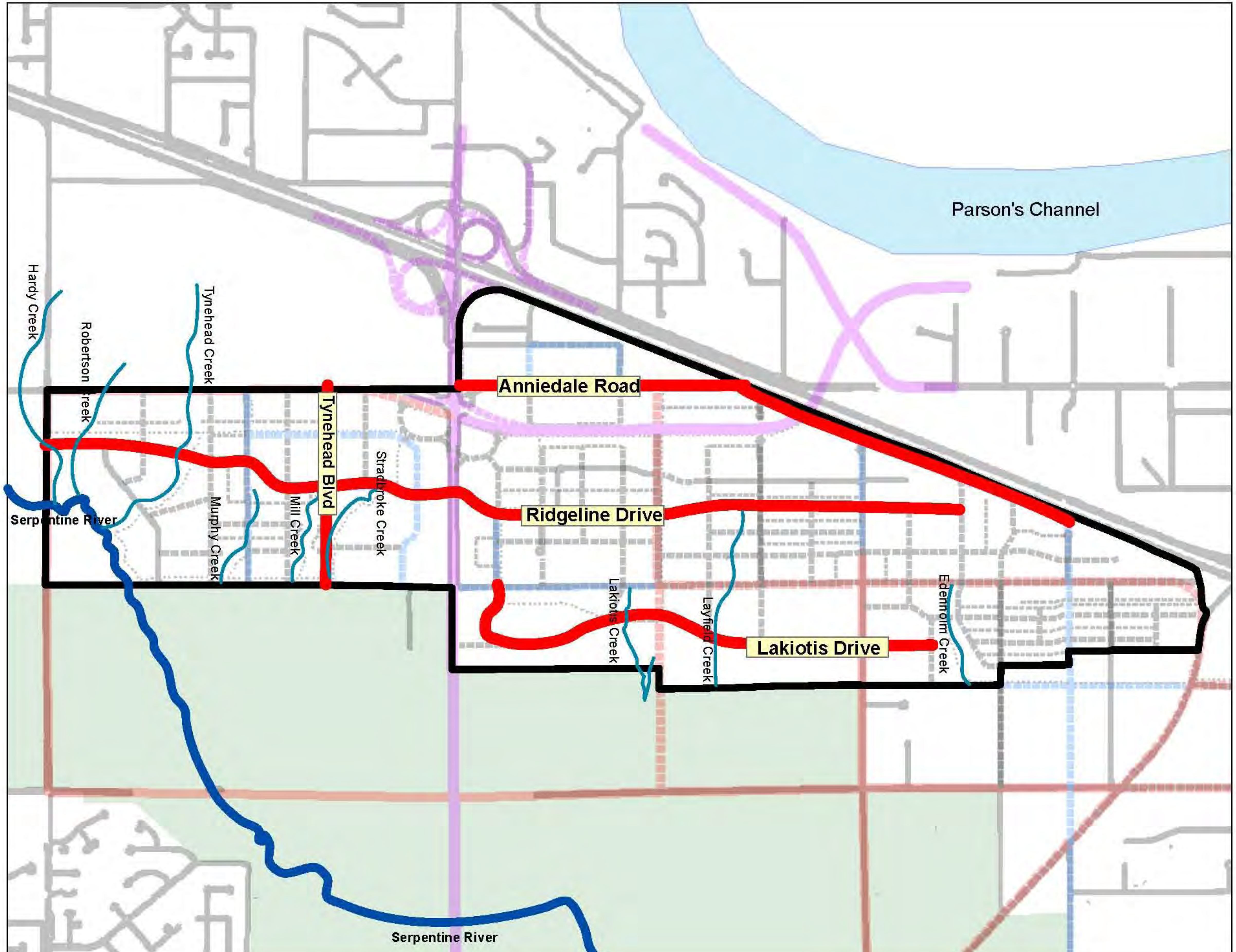
A pastoral theme will be used to guide the development of the townhouses along the south side of the plan. This area features views onto the agricultural lands to the south, and even to this day has a rural farming influence through planted hedgerows and split rail fences.

Public views to the south will also be highlighted in new developments. View corridor opportunities will be examined on a case-by-case basis.

Incorporation of the pastoral and farm house theme into the built form will include elements such as front porches, gable roofs, and split rail fences.

Place Naming

To further reinforce the Anniedale-Tynehead's history and sense of place, historical names from early settlers have been used to name some key streets, trails, ponds and creeks in the plan area (as shown **in Figure 2.1**).



CITY OF SURREY
the future lives here.

LEGEND

- Anniedale-Tynehead NCP Area
- Proposed New Road Name
- Proposed Creek Name

Anniedale-Tynehead NCP

Proposed Street and Creek Names

Figure 2.1

0 250 500 1,000 Meters

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PART 3 Land Use & Design

PART 3: LAND USE AND DESIGN

3.0 OVERVIEW OF LAND USES

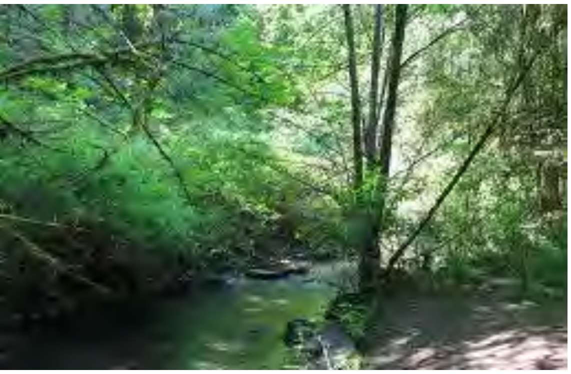
The proposed Stage 2 Land Use Concept Plan (see **Figure 3.0**) features a mix of land uses including a range of residential housing densities, commercial and plaza areas, industrial and business park areas, a community centre, neighbourhood parks, trail and pathway networks, riparian areas and three elementary schools and are summarized in **Table 3.0**.

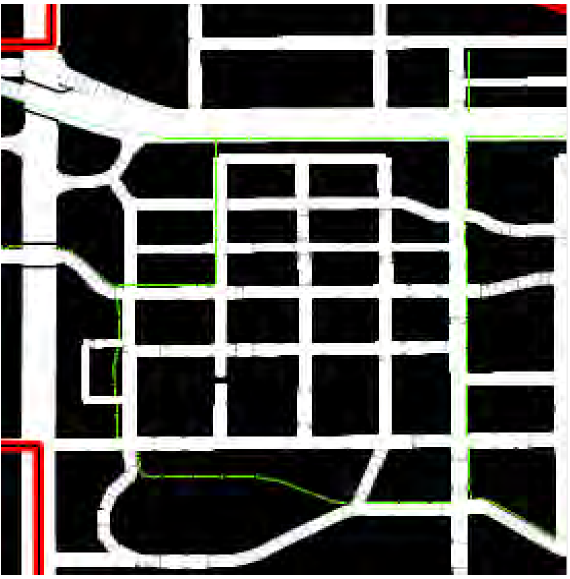
A wide range of residential densities are proposed in the plan, ranging from apartments and townhouses to single family dwellings. The highest densities are located in the northern portion of the plan close to future transit routes along 96 Avenue and 94A-Avenue (Ridgeline Drive). The residential densities decrease moving southward towards the Agricultural Land Reserve (ALR) and westward toward the Serpentine River. Cluster Housing designations have been proposed in key areas of the plan to allow for the retention of valuable tree stands and wildlife connectivity.

Three neighbourhood commercial areas are proposed in the NCP. These commercial areas are located at 96th Avenue and 168th Street, 180 Street and 93A- Avenue and at 184 Street and 92 Avenue. The commercial area at 96 Avenue and 168 Street will be required to incorporate heritage aspects into the development. All three commercial areas will include a public plaza, public seating, public art features, and a central open space to accommodate public gatherings or farmer's markets.

A large scale, regional shopping centre is proposed on the south side of 96 Avenue, to the west of Highway 15. This designation was proposed at this location because the site has good visibility from Highway 15 and Golden Ears Way. This commercial centre will be required to incorporate public gathering and amenity spaces at key locations in the development as well as a "main street" commercial area within the site. Specifics of the design requirements are outlined in the Design Guidelines contained in **Part 3** of this document.

A community centre is proposed along 93 A- Avenue (Ridgeline Drive) to the west of 180 Street. Situated along a street with future high density residential uses, future bus route, and planned commercial and live/work areas, this community centre will help form the heart of the community.





Seven neighbourhood parks and one Community Park are proposed to provide residents with recreational areas that offer both active and natural recreational space. The community park, located at 184 Street and 92 Avenue, will provide playing fields, a water park, playground, dog off-leash area and youth park all connected by trails and greenways. Detailed planning of this park and neighbourhood parks will be subject to public consultation with the future residents of the NCP.

The NCP trail network, totalling over 9 kilometres in length, connects to three existing trail systems outside the plan area: the Tynehead Perimeter Trail and Tynehead Overpass, the Green Timbers Greenway, and the Golden Ears Greenway. The NCP trail system will accommodate a range of users, provide seating areas, signage and trail markers and at key points, and offer significant views out to the ALR.

A major riparian area is located along the Serpentine River on the western side of the plan. Other riparian areas are located in three park areas, and cluster residential areas.

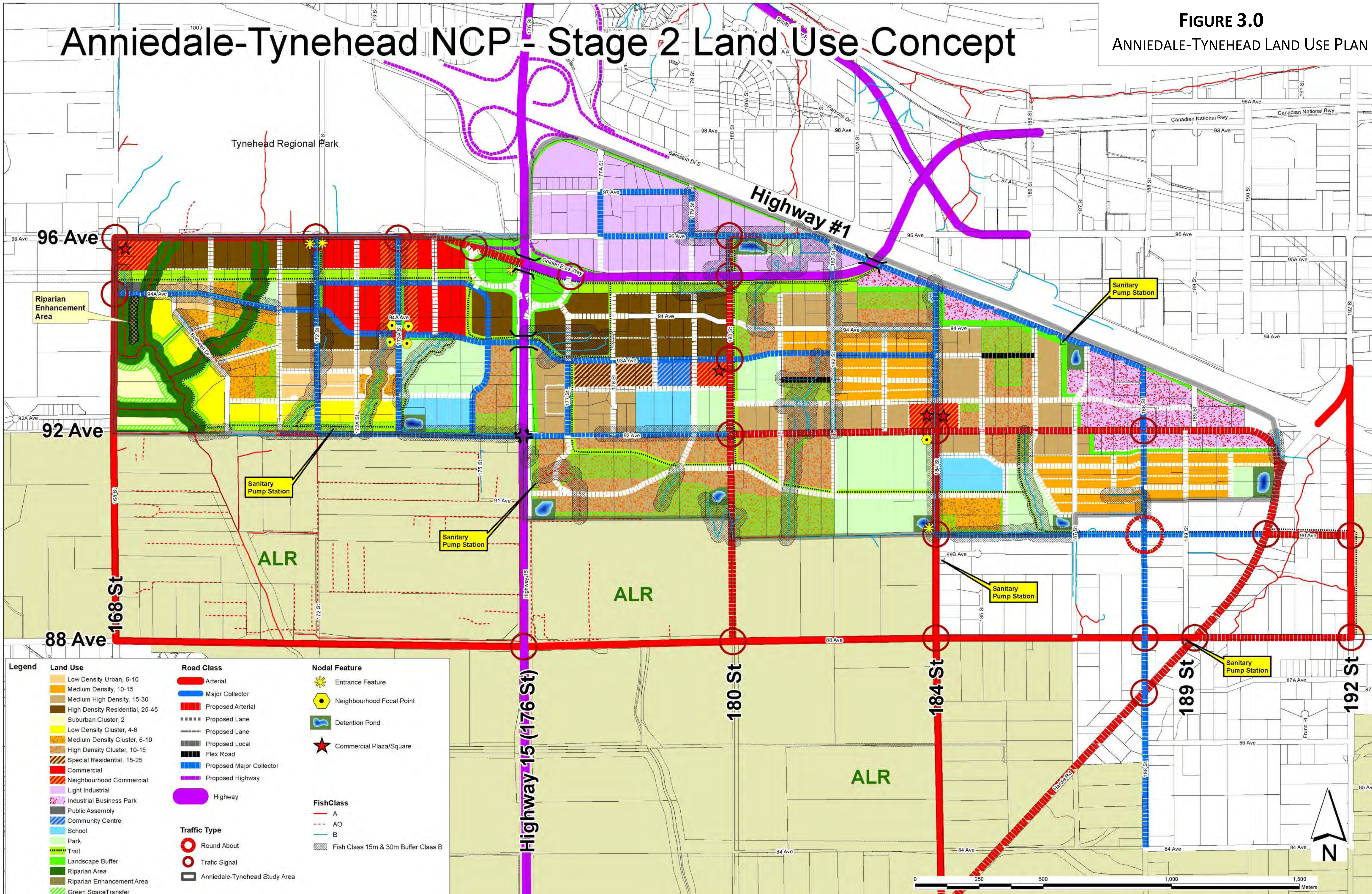
Three elementary school sites are proposed in the plan area. These sites have been co-located with neighbourhood parks and the community centre in order to allow sharing of amenities.

Entrance features are planned in three areas of the plan. One will be located at 172 Street and 96 Avenue to mark the entrance into Tynehead Park, another at 176 Street and 96 Avenue as an entrance into the northern end of neighbourhood, the third feature at 184 Street and 90 Avenue as the southern entrance into the community park.

The overall street structure of the plan is based on a grid pattern to promote connectivity for pedestrians, cyclists, and automobiles. Two overpasses are proposed in order to provide east-west connectivity in the plan area, and to maintain efficient regional traffic movement along Golden Ears Way and Highway 15.

A series of drainage ponds are located along the southern and northern boundaries of the plan; these ponds will also serve as an amenity for the community.

FIGURE 3.0
ANNIEDALE-TYNEHEAD LAND USE PLAN



Land Use Designation		Density or Intensity Range	Maximum Building Height	Description
Residential Designations				
	Low Density Residential	6-10 UPA 0.4 – 0.55 FSR	2 Stories and Basement where feasible	Includes primarily single-family development, characterized by individual homes constructed in subdivisions with lot sizes ranging from (306m^2 to 418 m^2, or custom units built on slightly larger lots. Minimum Lot Depth of 12 meters. One Secondary suite per unit may be permitted.
	Medium Density Residential	10-15 UPA 0.5 – 0.6 FSR	2 Stories and Basement where feasible	Includes single-family oriented development characterized by individual single-family homes, or zero lot line-single family houses (with or without secondary suites), duplexes, and triplexes. Quadplex development or *Manor Homes* may be appropriate on Corner lots. Minimum lot width for single family dwellings of 9 meters. Coach houses may be considered on single family lots, with a minimum lot depth of 35 meters. Parking access provided by rear lanes.
	Medium-High Density Residential	15-30 UPA 0.6 – 0.9 FSR	2-3 Story (11 m) Rooftop Gardens are permitted	Includes ground oriented Townhouses and Row house units in areas with access to major circulation routes, business districts and public amenities. Typical developments may consist of two-or-three story buildings that house multiple dwelling units and may provide some form of indoor and outdoor amenity spaces. Parking access provide by rear public or private lanes.
	High Density Residential	25-45 UPA 0.9 - 1.3 FSR	4-6 Stories (22.5 m) (With Underground Parking)	Apartments with Townhouse base and underground parking. Includes high-intensity stacked Townhouses and Low-Rise Walk-up apartment units surround central retail or transit areas with convenient access to neighbourhood amenities. Walk ability and pedestrian access are key considerations.
Cluster Residential Designations (Green and Open Space Preservation)				
	Suburban Cluster	Maximum 2 UPGA 15 - 30% Open Space	2 Stories Basement where feasible	Larger Lot single-family oriented development, surrounding western edge of Serpentine River floodplain. Flexibility of lot size is provided, (no less than 557 m^2 for detached housing and no smaller than 278 m^2 for attached housing), to allow for clustering of lots near existing roads, and away from Riparian and Flood Plain to reduce fill and preserve and enhance riparian area features.
	Low Density Cluster	4-6 UPGA 30 -40% Open Space	2 Stories and Basement where feasible	Includes primarily single-family oriented development, on bare land strata lots adjacent to 92 Avenue and the ALR Edge, or along the eastern edge of the Serpentine River. Flexibility of lot size is provided to allow for smaller urban lots, or attached housing clustered together away from Riparian areas or the ALR edge.
	Medium Density Cluster	6-10 UPGA 35 -45 % Open Space	2 Stories and Basement where feasible	Includes a mix of single-family, zero lot line single family lots, duplex and triplex buildings clustered away from riparian, ALR edge, or environmental features. Fee Simple and Strata Row house development may be considered along City Roadways and Transit Corridors.
	High Density Cluster	10-15 UPGA 40 -50% Open Space	3 Stories	Includes ground oriented Townhouses and Row house units clustered away from the ALR Edge or environmentally significant features, steep slopes, or unstable soils. Flexibility of lots sizes is provided to allow for a mix of smaller urban lots, attached housing, and townhouse/row house development along city road right-of-ways.
Mixed Use Designation				
	Special Residential-Mixed Use	15-25 UPA 0.6–0.9 FSR	3 Stories	Primarily residential area made ground oriented triplex, or row houses with the option of small scale, low impact retail or service commercial business along public streets. Live-work unit areas are to incorporate no more than 30% of the unit, and are to be located at the ground floor with direct access to a public street with a minimum 32 m^2 of commercial space. Parking for residential units will be accessible from the rear with on-street parking provided for business and commercial components along Ridgeline Drive, or 177 street.
Commercial Designation				
	Large Format Commercial	0.5 to 1.0 FSR	1 to 2 Stories	Provides for a larger building in a unified grouping, in one or more buildings, of retail shops, grocery stores, and offices which are planned and developed as an operating unit intended for the conduct of business which serves the immediately surrounding residential neighbourhoods and the larger trade region.
	Neighbourhood Commercial	0.6 to 1 FSR	1 to 2 Stories	A Neighbourhood oriented commercial area which promotes a mix of commercial, retail, restaurant, and office uses which serve the day-to-day needs of surrounding residents. It caters to shoppers in the immediate neighbourhood for convenience items, such personal care, groceries, dental and medical offices, etc.
Industrial Designations				
	Light Industrial	0.5 to 0.75 FSR	2 Stories (12 m)	Employment lands which allows for manufacturing, processing, warehousing and distribution of goods in an industrial park development.
	Industrial Business Park	0.5 to 1.0 FSR	4 Stories (15 m)	Employment lands which allows for manufacturing, processing and distribution of goods in conjunction with Low-rise office and professional office park development. High tech, and Industrial Supportive services and commercial uses are also permitted as necessary to service industrial office park.
Institutional Designations				
	School	Max 0.3 FSR	1 to 3 Stories (12 m)	Provides for public, quasi-public and institutional uses, including elementary or high schools.
	Public Assembly	Max 0.3 FSR	1 to 3 Stories (12 m)	Provides for places of religious worship and associated assembly halls. May also include community and social centres, clubs, or fraternal lodges.
	Community Centre	Max 0.5 FSR	2 to 4 Stories (15 m)	Public location where members of a community tend to gather for group recreational activities, social support, and public information programming. Majority of parking is provided underground or at the rear of the building.
Parks & Green Infrastructure Network				
	Public Park	N/A	N/A	Public lands used for passive and/or active recreation. Includes all park lands to be acquired and maintained by the City, acquired through Parkland DCC contributions and parkland dedication.
	Public Trail	N/A	N/A	Public urban multi-use pathways or trails, provided for active and/or passive recreations and pedestrian or bike connections.
	Landscape Buffer	N/A	N/A	A combination of built, natural or planted perennial system in a position in the landscape to mitigate any of a number of undesirable environmental impacts such as noise, trespass, dust, runoff etc), separating adjacent land uses or roadways with a combination of fencing, berms, trees and vegetation.
	Riparian Area Reserve	N/A	N/A	Public city lands acquired through riparian area dedication as determined by the Federal Department of Fisheries and Oceans through development. Limited outdoor recreation opportunities may be provided along outer edge of development in the form of passive hiking trails and wildlife viewing stations.
	Green Space Transfer Areas	Transfer Density Varies	N/A	Ecologically significant areas, Steep hillsides >15% slope, creeks, ecosystem management hubs, ALR Buffers, creek buffers, sensitive soils, and significant ridgelines that should not be developed; but provide a density bonus/transfer as determined by the underlying cluster designation density. Lands in this area must be provided as permanent open 'green space', as public/semi-public passive parks, or private strata maintained parks, or alternative green infrastructure.
	Ecological Compensation Area (ECA)	N/A	N/A	Area is adjacent to a Serpentine and other streams that links aquatic to terrestrial ecosystems and includes both existing and potential riparian vegetation and existing and potential adjacent upland vegetation that exerts an influence on the streams. Candidate Lands intended for Riparian area ecological restoration, and enhancement from other compensation. City to acquire lands.

TABLE 3.0 - ANNIEDALE-TYNEHEAD LAND USE CLASSIFICATION SUMMARY

Land Use Plan Statistics

Table 3.1 provides a breakdown of the land uses with regard to land area, and population and employment projections at full build-out.

Table 3.1 - Breakdown of Land Uses

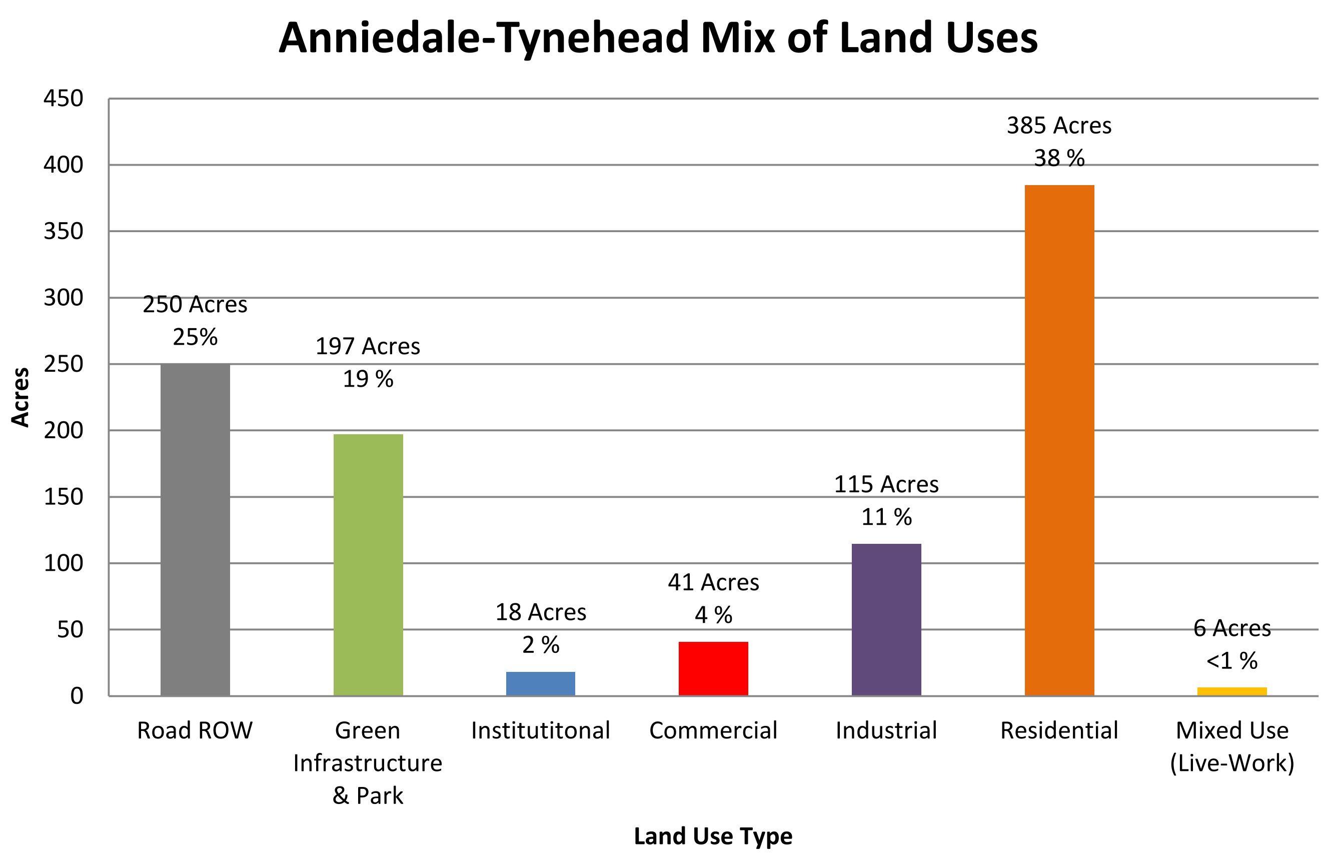
Anniedale-Tynehead NCP - Breakdown of Land Use						
Land Use	**Acres**	**Projected Units (Low)**	**Projected Unit (High)**	**Projected Population (Low)**	**Projected Population (High)**	**Projected Employment**
Road Way	250.1	0	0	0	0	0
Landscape Buffer	42.8	0	0	0	0	0
Multi-Use Trail	44.0	0	0	0	0	0
Riparian Reserve	31.7	0	0	0	0	0
Park	78.4	0	0	0	0	0
School	14.7	0	0	0	0	84
Community Centre	2.9	0	0	0	0	38
Public Assembly	0.7	0	0	0	0	3
Commercial	24.1	0	0	0	0	997
Neighbourhood Commercial	16.6	0	0	0	0	942
Light Industrial	73.6	0	0	0	0	2,465
Industrial Business Park	41.0	0	0	0	0	2,163
Suburban Cluster Residential	7.4	15	15	48	48	0
Low Density Residential	5.4	33	54	101	168	0
Low Density Cluster Residential	23.9	96	144	296	445	0
Medium Density Cluster Residential	35.0	210	350	650	1,083	0
High Density Cluster Residential	136.8	1,368	2,052	4,232	6,348	0
Medium Density	48.0	480	720	1,485	2,227	0
Medium-High Density	74.8	1,123	1,871	3,473	5,789	0
High Density Residential	53.4	1,419	2,403	3,038	5,144	0
Special Residential	6.3	94	157	201	336	0
Total	**1,011.6**	**4,836**	**7,765**	**13,525**	**21,588**	**6,691**

Mix of Uses

The NCP Plan proposes a wide range of uses. The figure below illustrates the amount of land dedicated to each of the uses. The largest component of the land area is comprised of residential uses (38 %). To ensure the plan is walkable, and transit friendly, twenty-five percent (25%) of the land area is dedicated to road-right-of-way. This percentage includes land area for cars, bikes, sidewalks and treed boulevards.

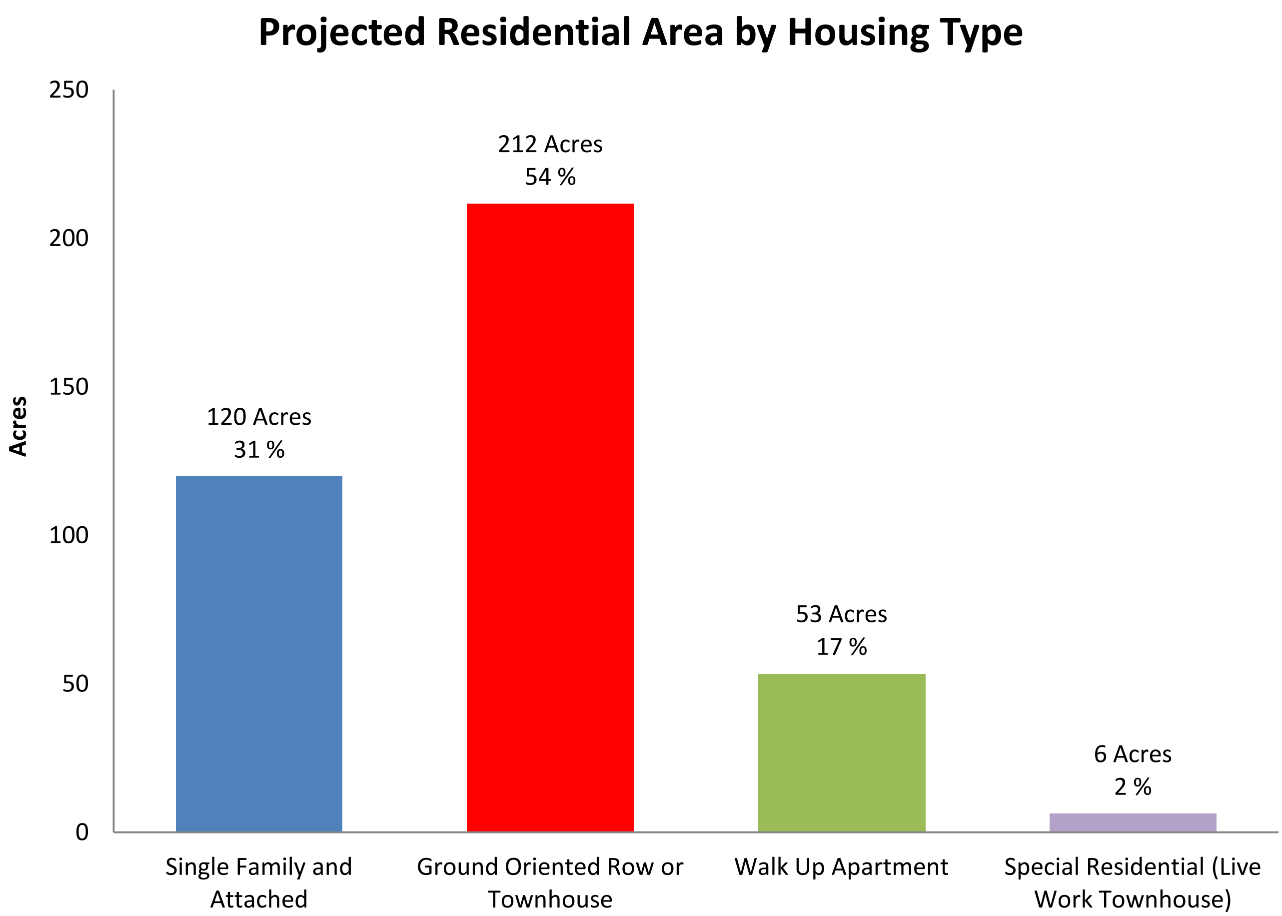
Nineteen percent (19%) of the land base in the plan area is designated as the following uses: Parks, Trails, Riparian Areas, and Public Open Space.

In order to create a complete community, where residents can work close to home, various employment uses are provided in the plan area, and account for 18% of the land area. Thirteen percent (13%) of the land area accounts for Industrial, Business Park and Institutional uses, four percent (4%) for commercial uses, and 1% of the land area for mixed-use live-work areas.



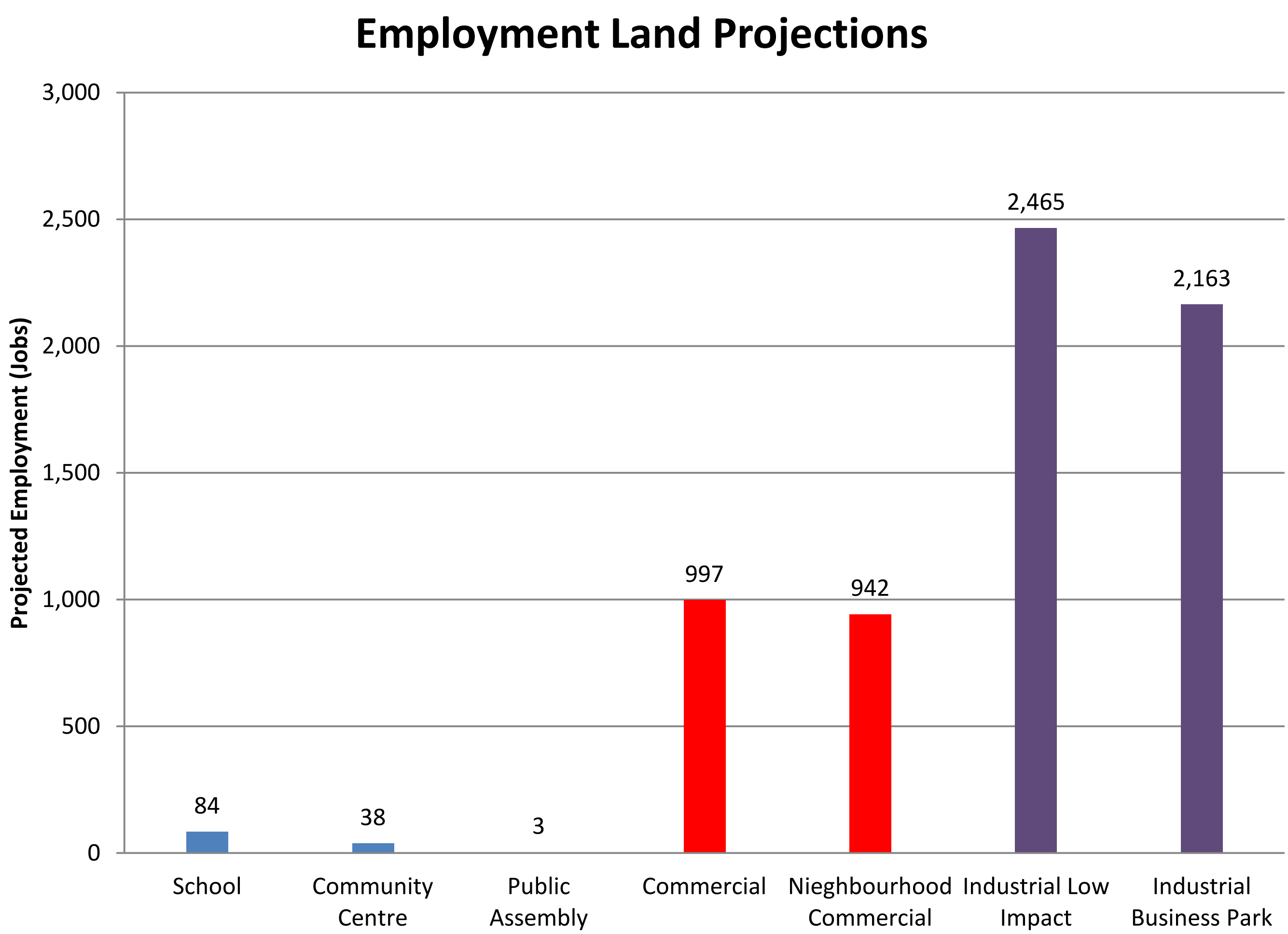
Residential Land Use Composition

The plan area offers a variety of residential densities. Over 70% of the residential designations are in the form of multi-family housing, 54% as ground-oriented row houses or townhouses, and 17% as apartment densities. These higher residential densities, are still family oriented, and also help to support transit.

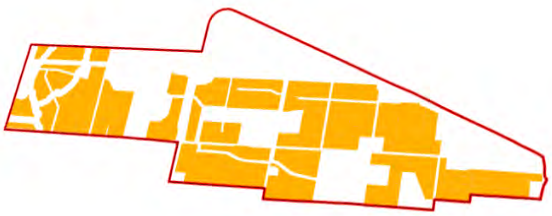


Employment Projections

This plan area will provide approximately 5,750 jobs at full build-out. The figure below shows the breakdown of the projected employment by land use types.



3.1 RESIDENTIAL AREAS



Residential Areas in Anniedale-Tynehead NCP

Residential areas are expected to achieve a strong and cohesive overall urban residential character and reinforce the relationship of the residential units to the public street. It is expected that the various residential densities and housing types proposed in the plan can be accommodated in the neighbourhood based on a typical residential block as a basic module.

The intent of the residential area policies and development design guidelines are to encourage the development of a variety of housing types, densities, and forms that will provide a variety of housing options while still ensuring a strong and unified residential character for Anniedale-Tynehead while preserving environmental significant features.

These guidelines support the sustainable planning principles of the Surrey Sustainability Charter and those previously outlined in this plan, with a special emphasis on the following Guiding Principles:

Principle 1	• Provide a variety of housing types, densities and forms to accommodate a range of lifestyle and housing choices for people across the spectrum of family type, age and income levels.
Principle 2	• Protect the character and quality of life of existing established residential areas
Principle 3	• Locate higher density residential development adjacent to commercial areas, especially near centres and mixed uses areas.
Principle 4	• Designate densities that make servicing feasible while also respecting environmentally sensitive and ALR transition areas.

Residential Planning Principles

The Anniedale-Tynehead Land Use Plan identifies ten (10) separate designations allowing for primarily residential use, three (3) of which describe primarily single family densities, four (4) which describe multiple family densities ranging from attached housing to townhouse and rowhouse development, and two (2) which describe multifamily development consisting of low-rise apartment developments. Approximately 156 hectares (385 acres) of the Anniedale-Tynehead land area is proposed for exclusive future residential use.

The Residential Land Use Policy standards and design guidelines are organized into the following five (5) land use categories which include:

Apartment

Townhouse

Detached and Semi-Detached

Cluster Residential

Live Work

Example of Upper-floor areas have private roof decks or balconies with underground parking

Apartment Residential (25-45 UPA)

The High Density Residential (25-45 upa) designation is intended to provide the majority of the apartment type residential uses. The designation is located in such a manner as to support Anniedale-Tynehead's commercial and employment areas and be close to existing and future transit routes along 93A (Ridgeline Drive) and 96 Avenue.

Permitted uses include four to six storey apartments, with six stories adjacent to transit and commercial uses, and four storey next to townhouses. In the context of the Anniedale-Tynehead Plan, all apartments will be required to provide townhouses at the base of apartments to promote a pedestrian friendly ground-oriented interface.

Public access along all riparian areas will be encouraged to promote walking connections for local residents.

Summary of Development Guidelines for High Density Residential (25-45 UPA) Designation:

	APARTMENT RESIDENTIAL (25-45 UPA)
MAXIMUM DENSITY	25 to 45 Units Per Acre 0.9 – 1.3 Floor Space Ratio (adjustments to FAR may be considered for 6 storey developments and heritage preservation)
FORM OF DEVELOPMENT	Apartments with Townhouse base. (4 to 6 Stories)
POSSIBLE ZONES	RM-45, RM-30, RM-23, CD
MINIMUM LANDSCAPED PERMEABLE SURFACES	*No less than 25% *(May be reduced to 15% if Green Roof or Enhance Rain water management system is provided on-site) Meet the requirements listed in **Table 3.3–5**; developers may choose from among a variety of LID measures to meet the requirements, some examples of which are provided in **Table A.2** in **Appendix C**
SETBACKS	Public interface setbacks along streets to be 4.5 m, additional setbacks along trails, greenways, buffers, and multi-use paths. Reduction in side yard provided that units orient to front and back, and the upper floors of the building step back.
TRAIL INTERFACE	May be required. (see Special Design Cross- sections)
RIPARIAN AREAS	Maximize retention of trees and natural features. Specific compensation may be required, see **Part 4.2** - Environmental Management
MINIMUM LAND ASSEMBLY	Required. Refer to Land Consolidation Areas **Part 4.0** of this document for more information.
HERITAGE	Incorporation of heritage resources (Witzer Residence) into the larger comprehensive development site. (see Heritage **Part 4.5**)
DESIGN CONSIDERATIONS	Incorporate lumber theme, consider views corridors. See Design Guideline for Apartment Residential Areas and Placemaking and Identity in **Part 2.6**

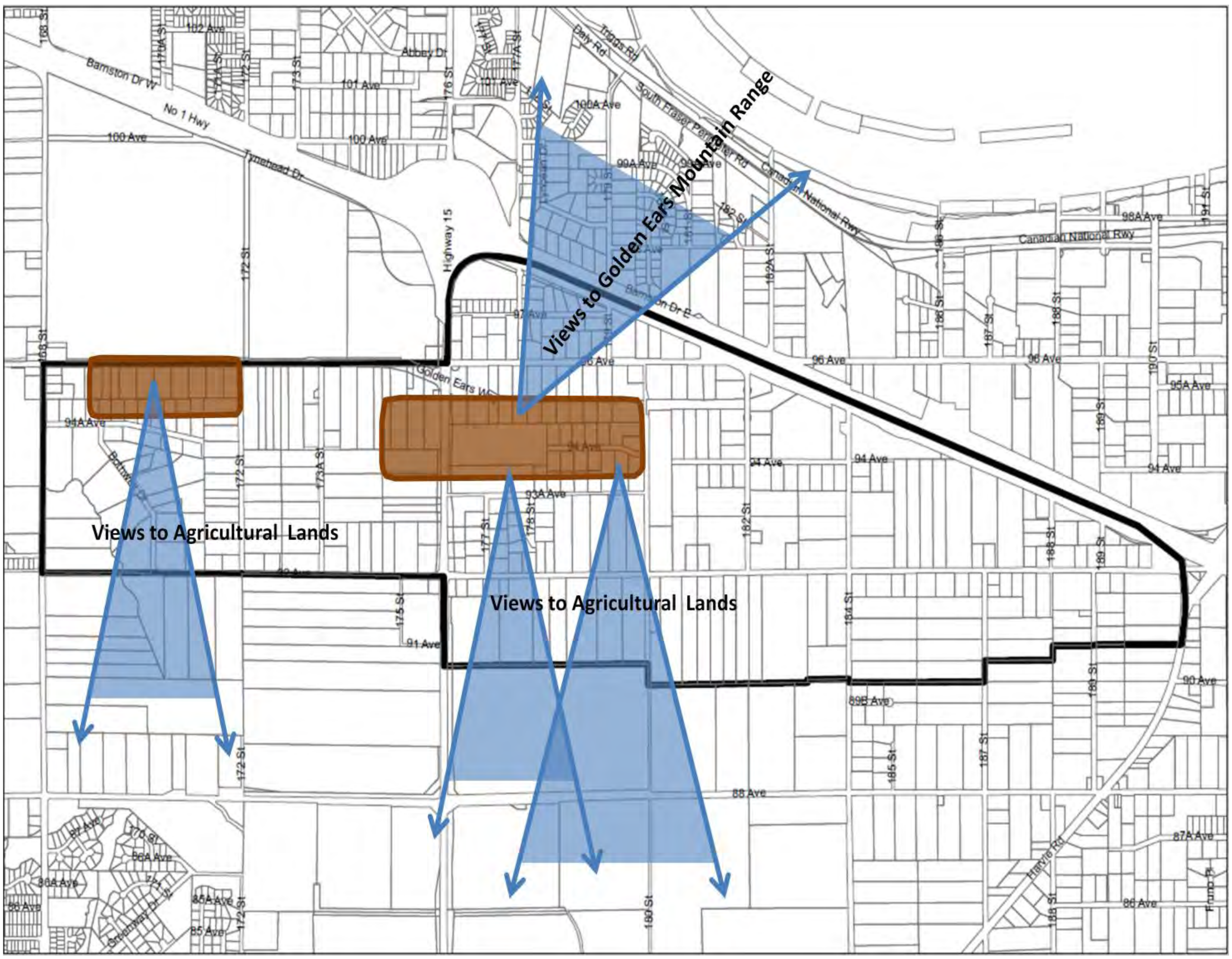
Design Guidelines for Apartment Residential Areas

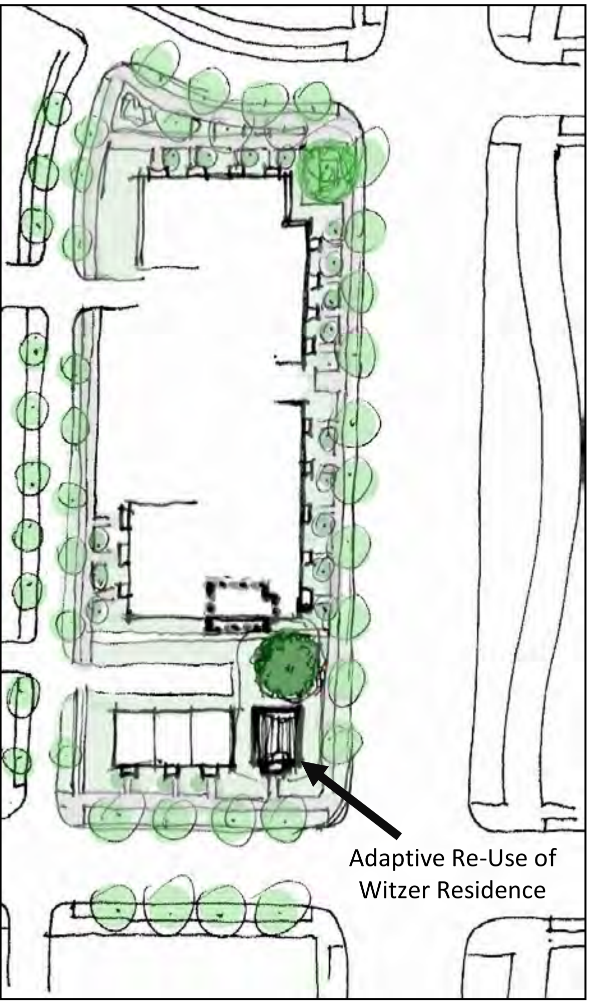
In addition to the OCP Guidelines, the following apply to Apartment Residential developments:

I: Context and Neighbourhood Character

Views

- Each development site should seek opportunities to provide a public viewpoint by analysing the site for possible views of the pastoral agricultural and river valleys, the north mountains particularly the northeast Golden Ears Range.





History and Identity

- Where heritage resources are located on development sites, they should be rehabilitated on site where possible and integrated into the overall site development (refer to **Part 4.5** Heritage Area Guidelines). This can be achieved by;

  - locating the heritage building prominently and along streetscapes,
  - stepping down massing to relate to the scale of the heritage building and;
  - incorporating similar material details and treatments into the architectural design.

- **The Witzer Residence** (9367180 Street), a historic building, has been determined to have recognizable heritage significance through the Heritage Register evaluation process.

- Development on the Harbidge House site should not occur until the protection and restoration of the building is secured in a manner satisfactory to the City (e.g., heritage revitalization agreement).

- The Witzer Residence should be incorporated into the design of the site. Adaptive re-use could include uses such as an amenity building, commercial retail or community service use.

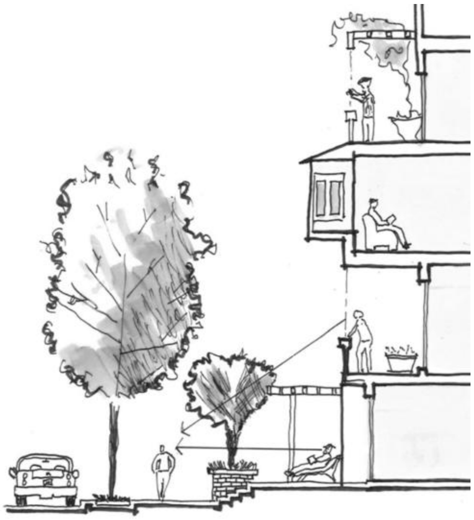
  - A Heritage Revitalization Agreement (HRA) should be entered into for this site. Relaxations for setbacks and use can be incorporated into the HRA.

  - Consolidation with adjacent property should be considered to allow sharing of Costs and comprehensive development of the sites (See **Part 4.0**).

  - Transfer of density would allow flexibility with overall Floor Area Ratio for the site.

Image and Character

Historically, the northern portion of the Tynehead area was home to several sawmills. A plank road was located along portions of the current hydro and gas corridor. Incorporation of the plank road theme and lumber elements will be required in the development of apartments units.



II: Site Design

- Sites with sloping grades should step with the natural grades. This can be achieved by;
  - establishing the site grades at the early stages of design, and
  - incorporating a gradual transition so that retaining walls are avoided.
- Parking should be located underground.
- Visitor parking adjacent to lanes can be considered provided outdoor amenity for residents has been achieved.
- Driveway ramps should be provided from the lane to preserve the street frontages as safe and walkable for all users.
- Private and public space should be clearly delineated, without sacrificing opportunities for casual observation of public spaces.
- Public Rights of Passage through development site should be considered that connect Public Streets.
- Adequate bicycle parking and storage areas should be provided.
- For sites located on the escarpment (south of the 94A/93A or Ridgeway Drive) a 7.5m yard should be maintained to provide a 5m significant tree row along the south property line: The tree row should be predominantly native conifers;
- Underground parking should be setback from the south property line to allow for tree growth.
- Where a site is adjacent to a riparian area, provide a 2m walkway along the riparian frontage and connect to walkway system on adjacent sites for the use of the local residents. (See **Part 4.3** Riparian Areas)

III: Public Realm and Street Interface

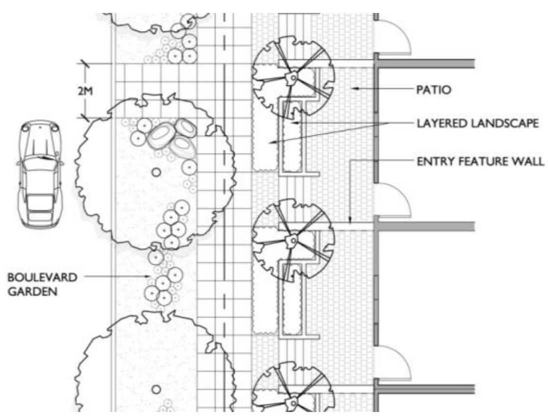
- Units should be located close to a public street (4.5 metre setback) with a principal façade and ground oriented entry facing a street or public open space. For building's interior to the site, the main entrance should be oriented toward the interior driveway and where applicable, the amenity area(s).

- Architectural design on all elevations should be consistent with the massing and proportions of the buildings contributing to a human-scaled street edge through providing townhouse units at ground level, as well as use of porches, entryways, cornices and overhangs.

- Units developed in the Tynehead portion of the plan should be designed to face the Hydro-gas right-of-way and multiuse trail. (See **Figure 3.1**)

- Each development site should seek opportunities to provide public open space along streets or at corners where associated with the building entrances.

- Express individual front yards:
  - Stepping planters up to raised patios with a maximum of 0.6 m height of wall faced with high quality, durable material facing such as masonry (stone or brick) or specialty concrete and low planting in front of the wall.
  - Enhance each townhouse entrance with a tree planted in-ground and specialty treatments such as gate markers.
  - Enrich the interface with distinctive character elements such as art features and historical references.



Landscaping and Fencing

- Provide for a minimum 5m landscape Buffer directly adjacent to Commercial Areas. (See **Figure 3.3**)

- The planting of edible plants and fruiting trees is encouraged in outdoor amenity areas.

- Provide high quality and low maintenance vegetation by: maximizing native species, and planting fruiting trees and shrubs that support pollinator species.

- Fences are not desirable in the front yard areas; shrubs, trees and hedges are recommended. If fences are unavoidable, an open-style fence in combination with landscaping and a low stone or brick faced wall as a base is encouraged. Front yard fences should not be higher than 1 metre (3 feet).

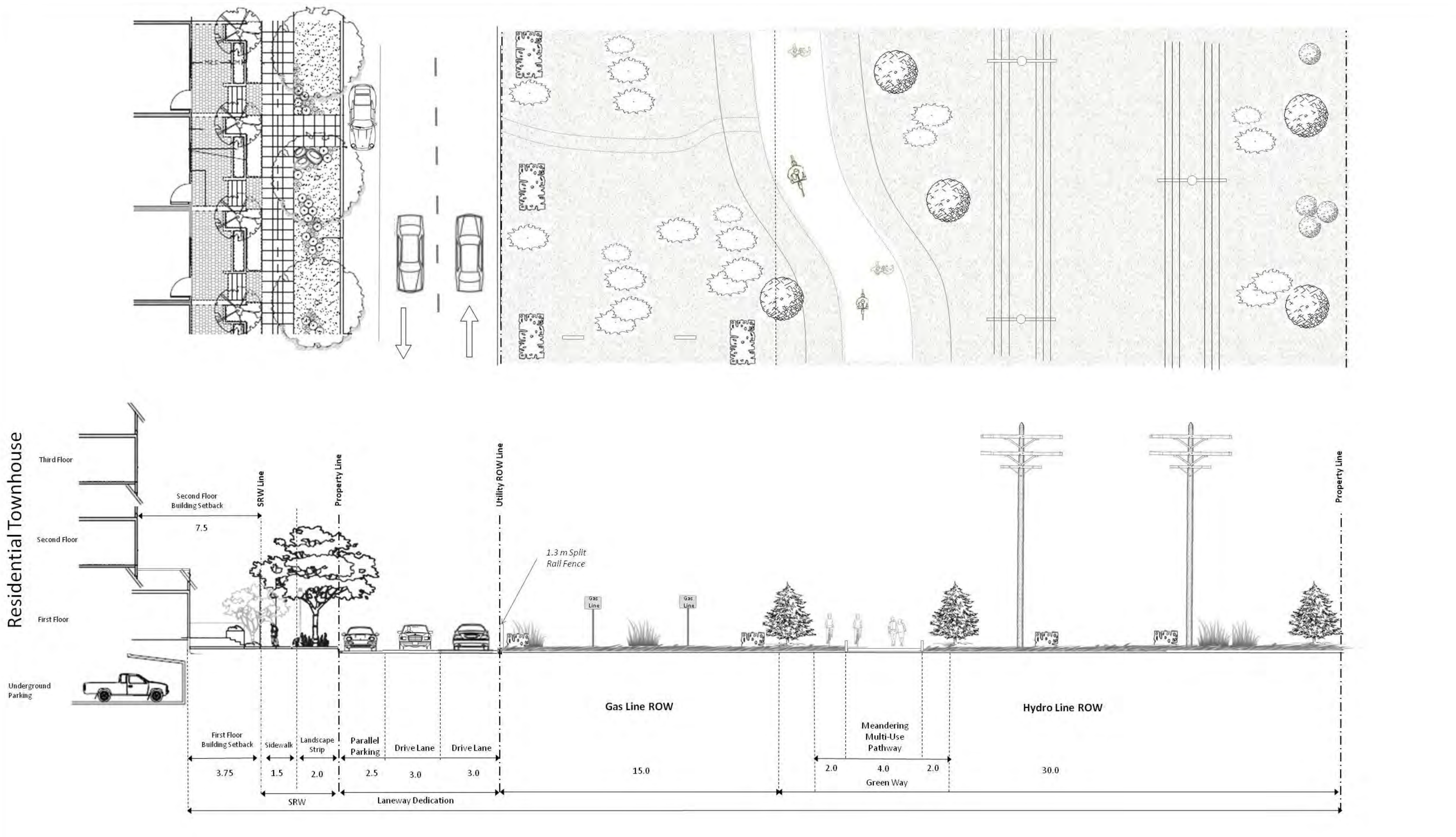


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FIGURE 3.1

APARTMENT INTERFACE AGAINST HYDRO AND GAS RIGHT-OF-WAY (TYNEHEAD)

Street Furnishings

- Draw on the street furnishings palette in **Part 3.9** to provide a coordinated group of furnishings including benches, waste receptacles and tree grates to match the overall character of the development and other site features such as bike racks, signage and service enclosures.

Vehicles and Parking

- Off-street Parking should not be permitted between the street and the principal façade of the building.
- Off-street Parking areas should be screened from the public street through landscaping.
- On-Street parallel parking is encouraged on public roadways in Apartment Residential Areas.

Services and Utility Areas

- Where possible, utility elements and equipment should be located away from publicly exposed views, and are discouraged from being located in the front yard or flankage yard of a corner lot.
- Where utilities are required to be located in the front or flankage yards, the utilities should be located in a discreet area or screened from public view through landscaping or other screening mechanisms.

IV: Building Form and Character

- Create building forms with a strong street enclosure particularly at corners.
- Orient building forms to line the streets including curved streets and the edges of open spaces.
- Incorporate two storey townhouses into the base of the building:
  - Front yard setback 4.5m along streets and lanes.
  - Step the main floor levels with the adjacent (sidewalk) grade and set a minimum of 0.6 m and a maximum of 1.5 m above grade.

- Create a 2 storey townhouse expression integrated into the overall building form:
  - Express a strong sense of individual entry porch at the street level with weather protection over each entrance.
  - Orient front doors and porches to face the streets with steps aligned with the front door and straight from the street (not turned).

- Incorporate durable and high quality materials such as brick masonry which address weathering and maintenance issues.
- Use muted buff colours with natural wood accents to blend into the hillside.
- Scale down facades into smaller scale elements through the use of windows, bays, balconies and dormers.
- Avoid large areas of one material i.e. vinyl siding.
- Incorporate specialty material treatments such as wood finishes on roof overhang soffits

V: Sustainability Features

- Promoting green certification and green building practices including: LEED certification, sustainable site development, water and energy efficiency, materials selection and indoor environmental quality.
- Composting and community gardening facilities are encouraged.
- Investigate opportunities for introducing geo-exchange heating and cooling systems or other alternative.

Townhouse Residential Areas (15-30 upa)

Residential densities of 15 to 30 units per acre (upa) in the form of townhouses and row-houses are proposed to be located adjacent to High Density Areas in the plan area. The housing form built under the Medium-High designation provides a suitable transition between the higher density multi-family areas and the lower density areas to moving south west and south east.

Medium-high density development may comprise of fee-simple row houses, and at the higher density range, integrated townhouse developments, are permitted between the ranges of 20 and 25 units per acre (Gross Density).

Emphasis is on recognizing the ground oriented neighbourhood character of this area of Anniedale-Tynehead, ensuring a good relationship of the units to the street and compatibility of design with other residential areas, and promoting a high number of ground-oriented units. Access to parking is provided via rear lanes or internal driveways; the units front and have direct pedestrian access from the street.

Summary of Development Guidelines for Medium-High Density Residential (15-30 UPA) Designation:

	MEDIUM-HIGH DENSITY RESIDENTIAL (15-30 UPA)
MAXIMUM DENSITY	15- 30 Units Per Acre / 0.6 – 0.9 Floor Space Ratio
FORM OF DEVELOPMENT	Townhouse or Row-houses. (2 to 3 Stories)
POSSIBLE ZONES	RM-30, RM-15, CD
MINIMUM LANDSCAPED PERMEABLE SURFACES	*No less than 25% *(May be reduced to 15% if Green Roof or Enhance Rain water management system is provided on-site) Meet the requirements listed in **Table 3.3–5**; developers may choose from among a variety of LID measures to meet the requirements, some examples of which are provided in **Table A.2** in **Appendix C**
SETBACKS	Reduction of setbacks encouraged along trails and local streets to provide visual surveillance. Use of varied setbacks encouraged to provide articulation
TRAIL INTERFACE	May be required. Provide a 4m walkway adjacent to riparian areas (see **Figure 3.3**)
GREEN INFRASTRUCTURE MANAGEMENT	May be required. Tree Retention/ Parkland Dedication See Green Space Area Guidelines **Part 4.3 and 4.4 and Figure 4.12**
RIPARIAN AREAS	See Environmental Management **Part 4.2**
MINIMUM LAND ASSEMBLY	May be Required. Refer to Land Consolidation Areas **Part 4.0** of this document for more information.
DESIGN CONSIDERATIONS	See Design Guideline for Townhouse Residential and Placemaking and Identity in **Part 2.6**

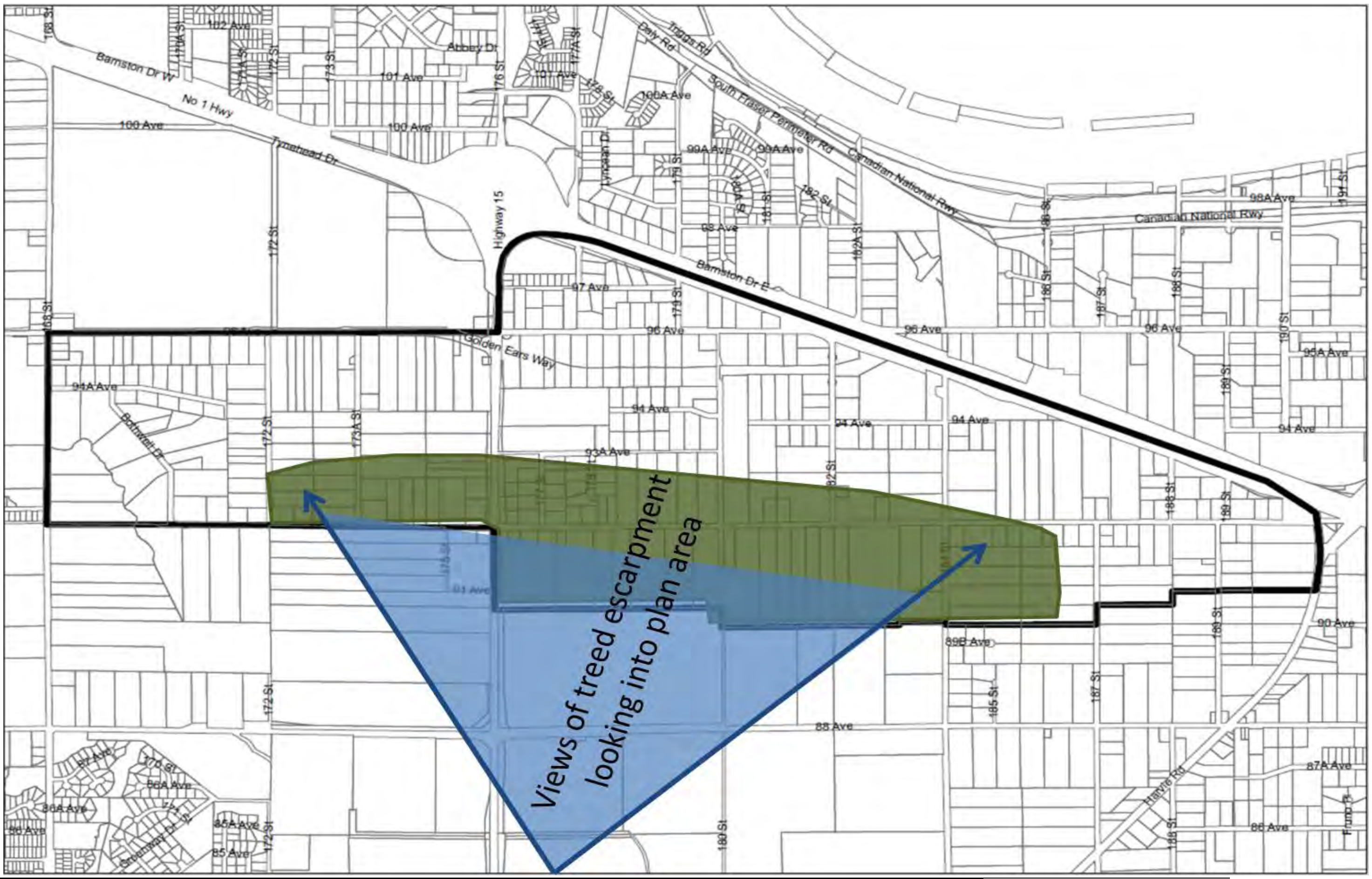
Design Guidelines for Townhouses Residential Areas

In addition to the OCP Guidelines, the following apply to Townhouse (medium density) residential developments:

I: Context and Neighbourhood Character

Views

- Public views of the agricultural lands to the south and Golden Ears Mountain Range to the north should be sought on each development site.
- Views of the treed escarpment, looking into the plan area, should be preserved and enhanced.
- The Cluster designations and tree buffers in yards along east/west property lines will be used as strategies for enhancing views and protecting the green hillside.
- Each development site should seek opportunities to provide a public viewpoint by analysing the site for possible views of the pastoral agricultural and river valleys, the north mountains particularly the northeast Golden Ears Range.



History & Identity

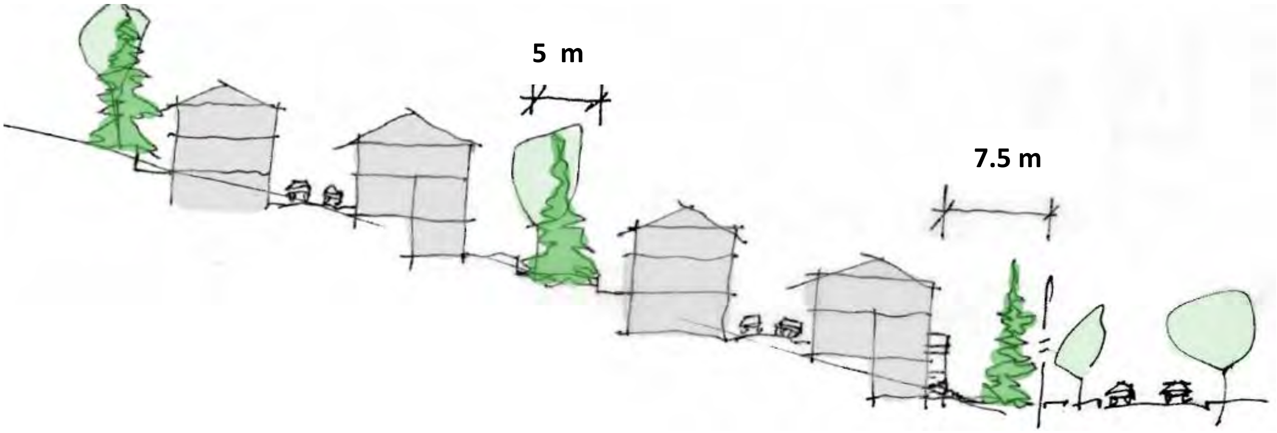
- Where heritage resources are located on a development site, rehabilitation on site and integration into the overall site development should be sought.

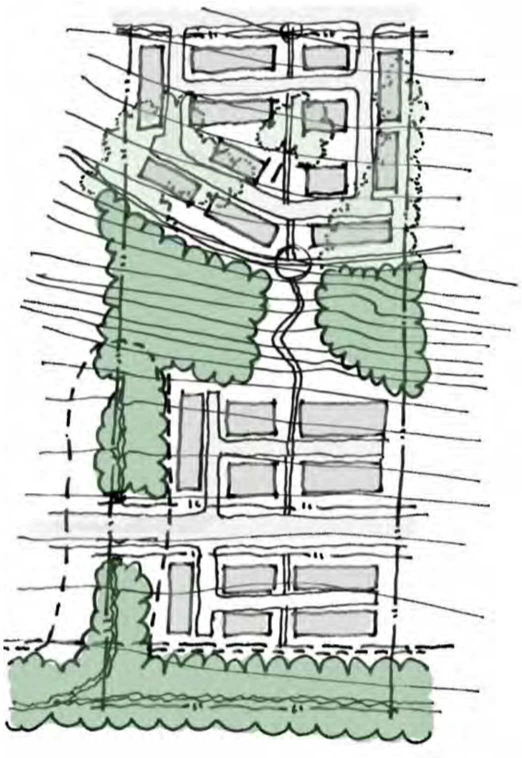
Image & Character

- Historically, farming made up a large part of the landscape in the Anniedale Area.
- The farming and pastoral theme should be integrated into redevelopment.

II: Site Design

- Sites with sloping grades and should step new development with the natural grades. This can be achieved by;
  - establishing the site grades at the early stages of design, and
  - incorporating a gradual transition so that retaining walls are avoided.
- Where a site is adjacent to a riparian area, provide a 4m walkway along the riparian frontage and connect to walkway system on adjacent sites for the use of the local residents.
- On sites with fewer existing trees:
  - stands of trees should be infilled with trees, and
  - townhouse buildings should be spaced more widely to incorporate lines of conifer trees in front yards (7.5m front yard setback) and between townhouse yards (5m)
- For sites located on the escarpment (south of the 94A/93A (Ridgeline Drive), a 7.5m yard should be maintained to provide a 5m significant tree row along the south property line. The tree row should be predominantly native conifers.





Escarpment Areas

- In hillside areas, such as those lands south of 92 Avenue, in Anniedale (if development with "flat-land" approaches to neighbourhood design can result in significant disruption to the natural terrain and views in an out of the NCP area.

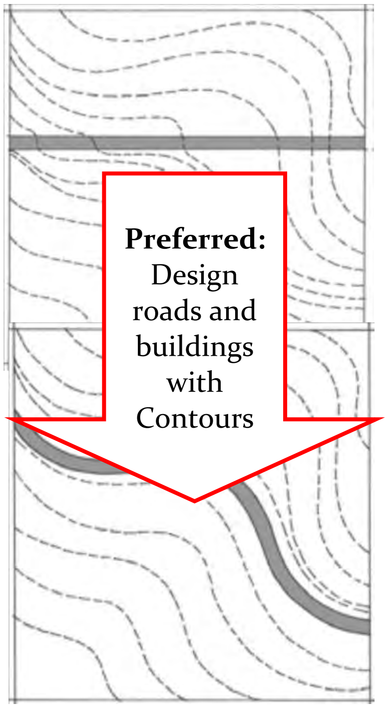
- The purpose of Escarpment and Viewscape preservation is to protect the scenic and ecological resources associated with lands characterized by steep slopes, scenic ridgelines and ALR edge transition areas in a manner that allows for carefully designed, low-impact development. There are two compatible, alternative approaches that work with the natural landscape and preserve unique features in Anniedale-Tynehead:

    - Larger consolidation of lots (See **Part 4.1**) in steep slope areas along ALR edge: This approach facilitates the retention of natural slope conditions in all areas aside from the driveway and building envelope, and/or

    - Cluster development approach involves the clustering of development in flatter areas and the retention of remaining land as permanent open space through dedication to the City as parkland as proposed in **Figures 4.12** and **4.14**. This serves to protect steeper slopes and the natural integrity of hillside areas while also providing a greater variety of building forms. Using the clustering approach, there is typically more flexibility in terms of housing forms and tenure options, with consideration for multi-family dwellings (e.g. townhouses), small lot single detached development, and single-detached strata development. The overall intent is to permit similar development yields as may occur in a conventional subdivision, but to "cluster" these yields in flatter areas.

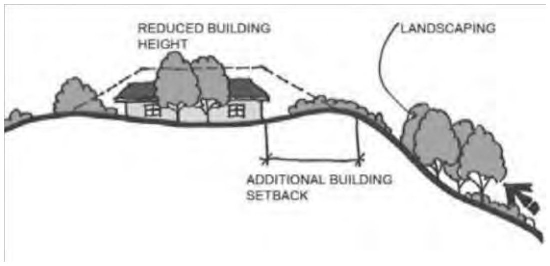
- For sites with clusters of trees on the hillside, the developable area should be focused away from the steeper treed slopes, and density transferred to the remaining portion of the site. Lands transferred as to the City for Park purposes. (See **Part 4.3**)

- For cluster townhouse developments, existing stands of trees on each site should be retained for the benefit of ecosystem management and for preserving the visible escarpment.



Development on the hillside can dominate views from below. Additional setbacks, landscaping and reduced building height may be used to mitigate view impacts towards ridgelines.

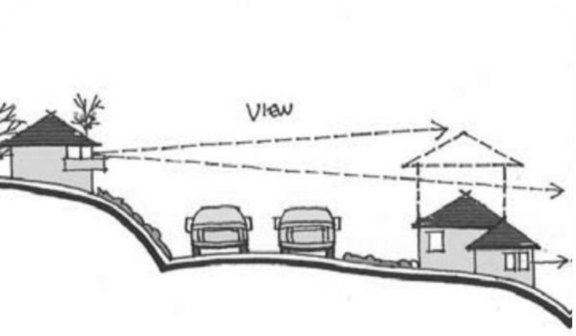
- Increase lot consolidation size as slope increases, to minimize the need for site grading works and to provide greater opportunities to protect unique hillside features through cluster development. In general, lots consolidation should be a minimum of 4 acres.
- Encourage the clustering of development onto flatter areas (e.g. slopes of 10% or less) as a means of minimizing site disturbance, protecting open space in steeper areas, and protecting the natural environment.
- Direct higher density development (e.g., townhouses, low rise apartments) towards road public road edges and away from the ALR.
- Locate development in areas with natural slopes of less than 15%, and preserve open space in areas with natural slopes of 15% or more.
- Consider alternative lot configurations (e.g. wide/shallow lots) to reflect unique site conditions

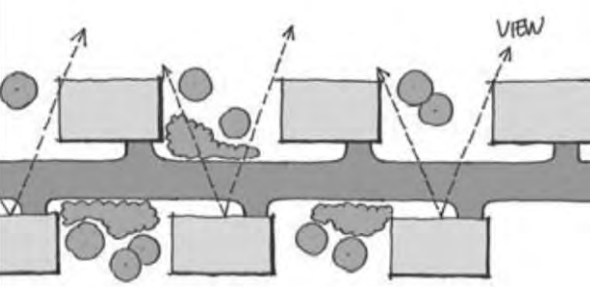


Ridgelines:

Preserve the natural qualities of ridgelines for the benefit of the community-at-large. To minimize view impacts to the ridgeline, development should:

- provide additional setbacks from the top of ridgeline; and/or
- preserve tree clumps or plant trees and vegetation to screen development; and/or
- reduce building height to ensure that new development has a low profile on the ridgeline.
- Ensure adequate trees to preserve vegetation at top of ridge.





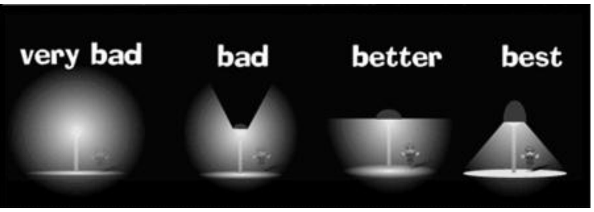
Building Siting and Orientation:

In hillside areas buildings should be oriented to minimize view impacts and grading requirements.
Guidelines:

- Orientate buildings so that they run parallel with the natural site contours to reduce the need for site grading works and to avoid high wall facades on the downhill elevation.
- Reduce front yard setbacks as a means to alleviate the need for steep driveways.
- A generally consistent building line should be preserved along street frontages, and any reductions in setbacks should not result in large differences between the setbacks of adjacent homes.
- Site buildings to minimize interference with the views from nearby (uphill) buildings.

Colours, Reflectivity and Lighting:

- In hillside areas, all structure and accessory uses should be constructed and maintained so that predominate exterior wall colours (including the colours of basement walls on the downhill side of the structure) and roof surfacing materials:
  - Repeat the colours found most commonly in the land and vegetation around the building (earth tone);
  - Reflective materials and bright colours that contrast dramatically with colours of the land and vegetation around them should not be used as predominant colors on any fence, wall or roof surface.
- Floodlighting should not be used to light all or any portions of any primary or accessory structure façade, and all outdoor light sources mounted on poles, buildings or trees to illuminate streets, sidewalks, walkways, parking lots, or other outdoor areas should use full cut-off light fixtures.



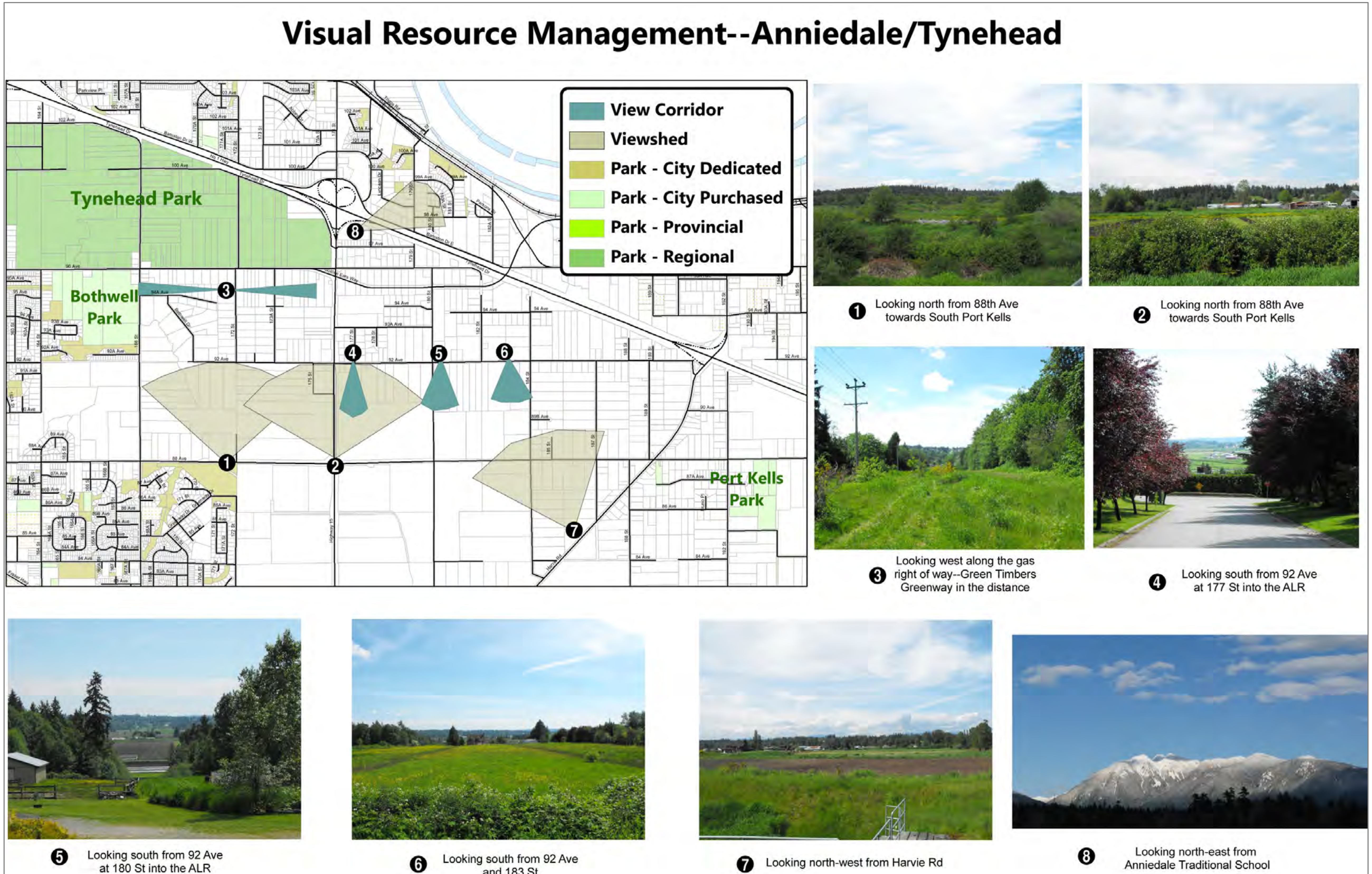


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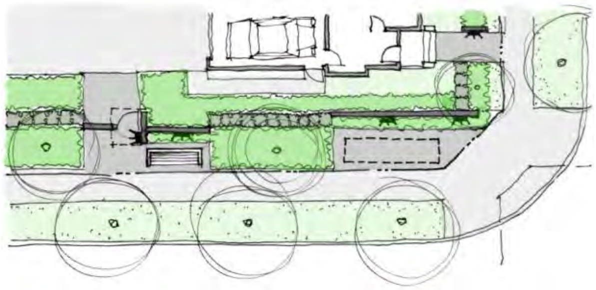
FIGURE 3.2

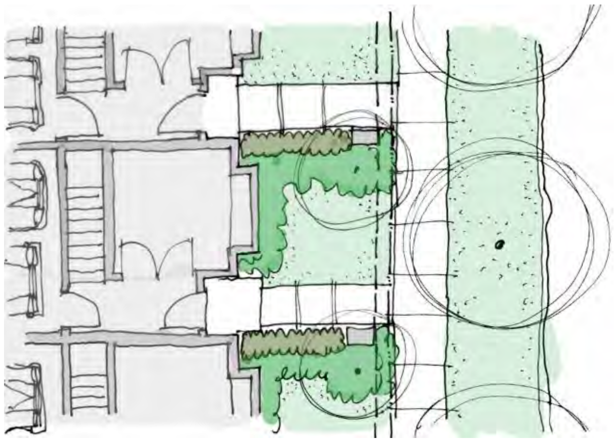
View Corridors and Viewsheds – Anniedale Tynehead NCP

III: Public Realm and Street Interface



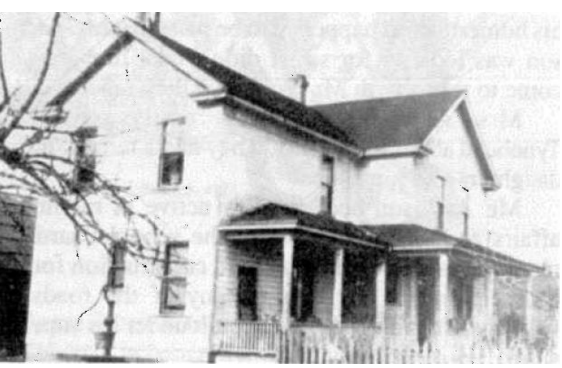
- Each development site should seek opportunities to provide public open space at corners.

- Define the street interface by incorporating low hedge landscaping and/or open fencing in yards along streets and other public areas set back a minimum of 0.5 m from the property line with additional setback articulation for added visual interest such as at entrances.



- Where fencing is proposed, it should also be in character with the history of the area using wood detailing such as open rail or picket.
- Enhance each townhouse entrance with a tree planted in-ground and specialty treatments such as gate markers.

- Draw on the street furnishings palette in **Part 3.9** to provide a coordinated group of furnishings including benches, waste receptacles and tree grates to match the overall character of the development and other site features such as bike racks, signage and service enclosures.

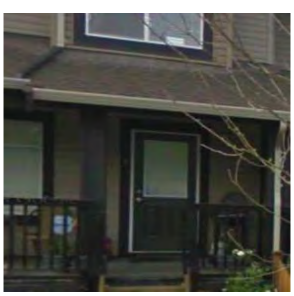


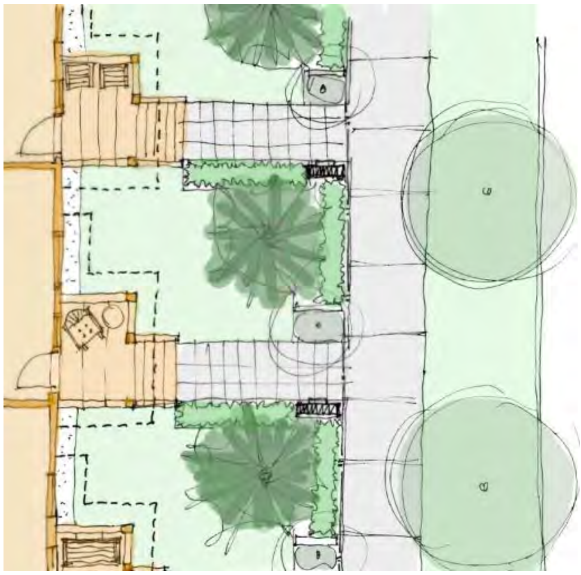
V: Building Form and Character

- Colours and materials of building should muted to blend into the hillside.

- Express a strong sense of individual entry porch at the street level with weather protection over each entrance in character with history of the area;
- Provide a porch element at individual entrances along the street,

- Use a low slope hip and shed style roof for porches.





- Buildings should have higher slope gable end elements on the facades and creating a street rhythm with the porch elements.

- Windows can reflect historic sizes and proportions in the walls.

- Use durable and high quality materials which address weathering and maintenance issues. This can include materials in character with the history of the area such as wood or cementitious horizontal siding or shingles. Large areas of vinyl siding should be avoided.

Medium Density (10-15 upa)

This designation allows for a variety of housing forms but with a primarily single small single family residential character. The designations allowing for a wide range of housing types including small lot single family homes with secondary units or couch homes, two-family units (Duplex), triplex units or quadplex units such as manor homes (On corner lots)– all within the same block and all maintaining a strong single family residential feel.

A mix of housing unit types is encouraged throughout a block.

Access to parking is provided via rear lanes and/or internal driveways, and units have direct pedestrian access from the street.

Summary of Development Guidelines for Medium Density Residential (10-15 UPA) Designation

	MEDIUM DENSITY RESIDENTIAL (10-15 UPA)
MAXIMUM DENSITY	10- 15 Units Per Acre / 0.5 – 0.6 Floor Space Ratio
FORM OF DEVELOPMENT	Small lot Single Family, Duplex, Triplex, or quadplex such as Manor Homes on corner lots, and potential for fee-simple Row-houses in 15 UPA range (2 to 3 Stories)
POSSIBLE ZONES	RF-9, RF-9C, RF-SD, RF-12, RF-12C, CD
MINIMUM LANDSCAPED PERMEABLE SURFACES	*No less than 15% *(May be reduced to 10% if Green Roof or Enhance Rain water management system is provided on-site) Provide 300 mm of amended growing media ("top soil") for all yard area; discharge roof leaders directly to yards, not to the storm sewer
SETBACKS	Reduction of setbacks encouraged along trails and local streets to provide visual surveillance. Use of varied setbacks encouraged to provide articulation
RIPARIAN AREAS	See Environmental Management **Part 4.2**
TRAIL INTERFACE	May be required. Provide a 4m walkway adjacent to riparian areas (see **Figure 3.3**)
HERITAGE GUIDELINES	Rae House should be incorporated into the redevelopment of the site. Density bonus may be considered. See Heritage policy Objectives in **Part 4.5**
MINIMUM LAND ASSEMBLY	May be Required in **Part 4.0**. Refer to Land Consolidation Policy section of this document for more information.
DESIGN CONSIDERATIONS	See Design Guideline for Detached and Semi-Detached and Place Making and Identity in **Part 2.6**

Low Density Urban (6-10 upa)

This designation allows for single family homes (with or without secondary suites and/or coach house units) and duplexes on standard and shallow/wide lots of approximately 320 m^2 to 560 m^2 (3,440 to 6,000 sq. ft) with and without lanes.

Development in this zone should provide as many lots as possible having rear land access to a garage. Achieving this objective may not always be feasible in all sites as existing subdivision pattern and terrain conditions change throughout the neighbourhood. However, all lots with a coach house must have rear lane access and a minimum of 60% of all lots should have rear lane access.

	LOW DENSITY RESIDENTIAL (6-10 UPA)
MAXIMUM DENSITY	6 to 10 Units Per Acre / 0.5 – 0.6 Floor Space Ratio
POSSIBLE ZONES	RF12, RF12C, RF, CD
MINIMUM LANDSCAPED PERMEABLE SURFACES	Provide 300 mm of amended growing media ("top soil") for all yard area; discharge roof leaders directly to yards, not to the storm sewer
SETBACKS	Reduction of setbacks encouraged along trails to provide visual surveillance.
RIPARIAN AREAS	See Environmental Management **Part 4.2**
TRAIL INTERFACE	May be required. Provide a 4m walkway adjacent to riparian areas (see **Figure 3.3**)
MINIMUM LAND ASSEMBLY	May be Required in **Part 4.0**. Refer to Land Consolidation Areas section of this document for more information.
DESIGN CONSIDERATIONS	See Design Guideline for Detached and Semi-Detached Place Making and Identity in **Part 2.6**

Rae House (9153-189 Street)

Design Guidelines for Detached and Semi-Detached Residential Forms

I: Context and Neighbourhood Character

History & Identity

- **The Rae House** (9153 189 Street) an historic building, has been determined to have recognizable heritage significance through the Heritage Register evaluation process.
- Development on the Rae House site should not occur until the protection and restoration of the building is secured in a manner satisfactory to the City (e.g., heritage revitalization agreement).
- Adaptive re-use and density bonus could be used as strategies for preservation. Setbacks can be varied with through an HRA.

II: Streetscape and Built Form

- Houses on corner lots will be architecturally unique, and shall face the street on both sides.
- Manor Houses on corner lots are encouraged.
- Units shall have articulated facades and architectural features such as bay windows, roof projections and gable ends facing a public street. Entries should retain a human scale and relate to the street.
- Steep gable roofs and dormers are encouraged.
- Utilize high quality materials and finishes (ie. wood, stone, and masonry). Vinyl siding as the primary cladding material is not permitted.
- Front porches and verandas with overhangs that define a semi-private area in front of the unit are strongly encouraged.
- Front yards should clearly delineate public and private space through the use of natural low landscaping, and low, open-style fencing.
- Dwelling units should be designed to ensure a maximum amount of natural light to penetrate the unit.

III: Vehicles and Parking

- Garages, ancillary dwellings (coach houses) and structures must be accessed by a rear lane.


Wheel strips provide a stable base for vehicles; an unpaved driveway allows for increased infiltration.

Coach houses provide appropriate Building setbacks and lot depth to accommodate on site yard space.

IV: Landscape and Environment

- Front yards should clearly delineate public and private space through the use of natural low landscaping, and low, open-style fencing.
- Identify, preserve and incorporate existing trees where possible.
- Promoting high quality and low maintenance vegetation by: maximizing native species and drought resistant material, and planting fruiting trees and shrubs that support pollinator species.
- Sites abutting riparian areas with trail refer to **Figure 3.3** for cross section detail.

V: Sustainability Feature

- Use of permeable surfaces for driveways and other paved areas is strongly encouraged.

- Promoting green building including: sustainable site development, water and energy efficiency, materials selection and indoor environmental quality.

VI: Coach Houses

- Where coach houses are permitted, the following apply:

  - A minimum lot depth of 35 metres (115 feet) and lot width of 10 meters 32 (feet) is achieved in order to ensure sufficient on-site parking and outdoor amenity space.
  - One additional parking space is provided for the coach house occupant on site.
  - The coach house is setback 1.2 metres (4 feet) from the lane in order to provide additional on-site parking opportunities and in order to avoid a canyon effect in the lane.
  - Additional outdoor space, such as balconies are required for the inhabitants of the coach house.
  - Steep gable roofs and dormers are encouraged. Most of the habitable space of the coach house should be contained within the roof gable to minimize massing.
  - A minimum separation of 6 metres (20 feet) should be provided between a coach house and the principal unit. Breezeway connections to the principal building are not permitted.
  - Where a coach house is situated near a public street or entrance to a lane, the façade should be articulated to address both the public street and the lane. The number and size of windows should be maximized. The lots at the intersection of a public street should be 13 metres (43 feet) wide in order to allow sufficient landscaping and articulation of facade.

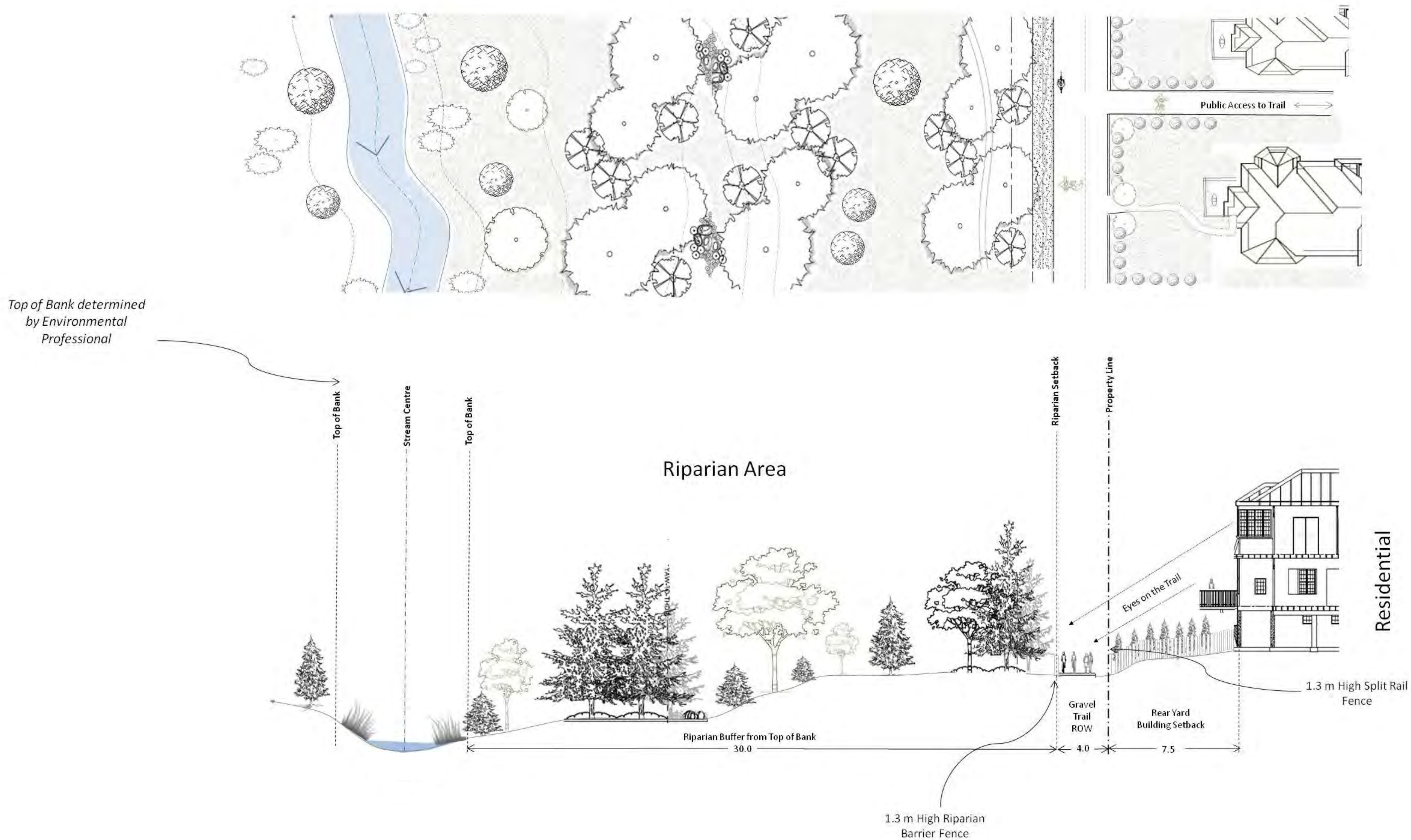


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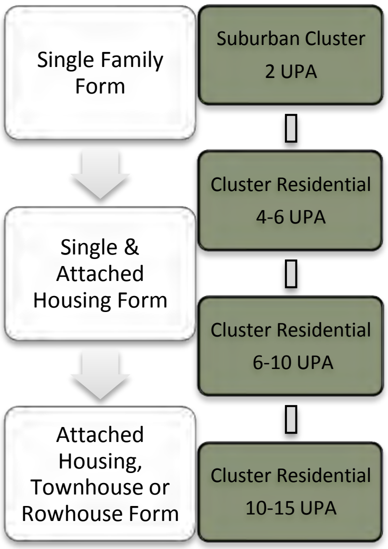
FIGURE 3.3

Residential Interface along Riparian Areas with adjacent trails. (Tynehead)

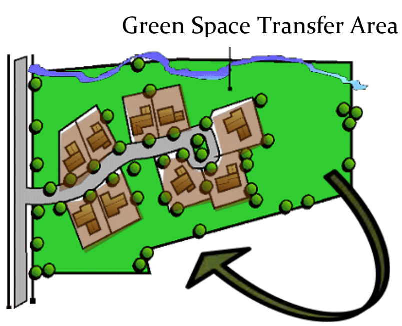
3.2 CLUSTER RESIDENTIAL AREAS



The Cluster Designation allows for the development value (unit density) associated with one section of a property to be transferred and added to the amount of units available on another section of a property. These designation areas are for the redirection of development potential from one location to another in a way that is fair and equitable to landowners, while supporting community development, agricultural, urban planning and environmental goals.

The four (4) "Cluster Designation" areas enable the transfer of development potential at rezoning from "Green Space Transfer Areas" the City seeks to conserve/enhance or as Agricultural Buffer Areas the City seeks to improve and protect, to areas specifically designated to be developed.

Depending on the specific Cluster housing gross densities, there are a diversity of housing forms can be achieved by a combination of various housing types and densities depending on the amount of green space transfer (development units) available and site constraints. This combination of various housing types may be especially evident in residential cluster designation areas.



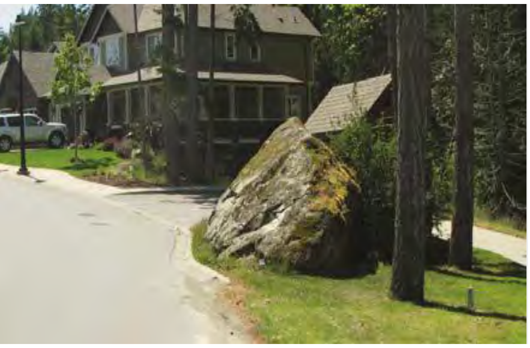
Transfer of Density from Green Area or Agricultural Buffer to Development Site

Cluster Residential Designated Areas in Anniedale-Tynehead NCP

Cluster Housing Objectives

- Serves as a mechanism that permanently protects ecologically significant areas (Riparian areas, Significant Tree Patches, and Green Infrastructure) or agricultural buffer areas without the expenditure of public funds or long term enforcement of landscape maintenance;
- Is applied at a NCP level within prescribed Cluster Designation Areas;
- Provides a mechanism that restricts building on portions of land while providing equity to the private landowner in correlation with that restriction;
- Promotes preservation of green areas while allowing development to occur in predefined designated areas and near service infrastructure.

Refer to Cluster Development Guidelines for Density Calculations **(See Part 4.4)**



Suburban Cluster (2 upa)

The lowest residential densities, of 2 units per acre (upa) (gross densities) are proposed along the Southwest edge of the plan area in Tynehead between 168 Avenue and the Serpentine River in what is currently the 200 year flood plain area, to reduce environmental degradation and excessive fill.

Flexibility of lot size is provided to allow for single family lots which clustered together near existing roads, and away from Riparian and Flood Plain areas along the serpentine river. Green space transfer of densities for lands preserved outside Park dedication areas is accepted to reduce site disturbance and overall site coverage.

	SUBURBAN CLUSTER RESIDENTIAL (2 UPA)
MAXIMUM DENSITY	2 Units Per Acre (Gross Density) Refer to Cluster Development Guidelines **Part 4.4**
POSSIBLE ZONES	RC, RH-G, CD
MINIMUM LANDSCAPED PERMEABLE SURFACES	Not less than 15 percent of the site shall be conveyed as common open space. Provide 300 mm of amended growing media ("top soil") for all yard area; discharge roof leaders directly to yards, not to the storm sewer
GREEN INFRASTRUCTURE MANAGEMENT	May be required. Tree Retention/ Parkland Dedication See Green Space Area Guidelines **Part 4.3 and Figure 4.12**
BUFFER	May be Required. See Agricultural Edge Guidelines **Part 4.1**
TRAIL INTERFACE	May be required. Provide a 4m walkway adjacent to riparian areas (see **Figure 3.3**)
MINIMUM LAND ASSEMBLY	May be Required. Refer to Land Consolidation Areas **Part 4.0** of this document for more information.
DESIGN CONSIDERATIONS	See Design Guidelines for specific building form.
RIPARIAN MANAGMENT	May be required See Environmental Management **Part 4.2**

Residential Cluster (4-6 upa)

The 4-6 units per acre (upa) gross density cluster areas are located along the South East edge of the plan area between Bothwell drive and the Serpentine River, as well as the properties near the Tynehead ALR edge.

Flexibility of lot size is provided to allow for smaller urban lots clustered together away from Riparian areas and the Agricultural Land Reserve Edge. Green space transfer of densities for lands preserved outside Park dedication areas is accepted to reduce building and site coverage.

The techniques used to concentrate buildings may include, but shall not be limited to, reduction in lot areas, setback requirements, and/or bulk requirements, with the resultant open space being devoted to park land, or open space/amenity space for one or more uses.

	CLUSTER RESIDENTIAL (4-6 UPA)
MAXIMUM DENSITY	4-6 Units Per Acre (Gross Density) See Cluster Development Guidelines **Part 4.4**
POSSIBLE ZONES	CD
MINIMUM LANDSCAPED PERMEABLE SURFACES	Not less than 30 percent of the site shall be conveyed as common open space. Provide 300 mm of amended growing media ("top soil") for all yard area; discharge roof leaders directly to yards, not to the storm sewer
GREEN INFRASTRUCTURE MANAGEMENT	May be required. Tree Retention/ Parkland Dedication See Green Space Area Guidelines **Part 4.3 and Figure 4.12**
BUFFER	May be required. See Agricultural Edge **Part 4.1**
MINIMUM LAND ASSEMBLY	May be Required. Refer to Land Consolidation Areas See **Part 4.0** of this document for more information.
DESIGN CONSIDERATIONS	See Design Guidelines for specific building form.
RIPARIAN MANAGMENT	May be required See Environmental Management **Part 4.2**

Residential Cluster (6-10 upa)

The 6-10 units per acre (upa) gross density cluster areas are located to the east of 184 street and around riparian areas in the Tynehead area of the plan.

Flexibility of lot size is provided to allow for smaller urban lots, attached housing, and manor homes (quadplex) clustered together away from ecosystem hubs, Riparian areas and the Agricultural Land Reserve Edge. Green space transfer of densities for lands preserved outside Park dedication areas is accepted to reduce building and site coverage.

The techniques used to concentrate buildings together may include, but shall not be limited to, reduction in lot areas, setback requirements, and/or bulk requirements, with the resultant remnant space provided as open green space being devoted to a green belt, park land, or open space/amenity space for one or more uses.

	CLUSTER RESIDENTIAL (6-10 UPA)
MAXIMUM DENSITY	6-10 Units Per Acre (Gross Density) See Cluster Development Guidelines **Part 4.4**
POSSIBLE ZONES	CD Zone based on RM-15, RF-12, RF(net)
MINIMUM LANDSCAPED PERMEABLE SURFACES	Not less than 35 percent of the site shall be conveyed as common open space. Provide 300 mm of amended growing media ("top soil") for all yard area; discharge roof leaders directly to yards, not to the storm sewer
GREEN INFRASTRUCTURE MANAGEMENT	May be required. Tree Retention/ Parkland Dedication See Green Space Area Guidelines **Part 4.3 and Figure 4.12**
BUFFER	May be required. See Agricultural Edge **Part 4.1**
MINIMUM LAND ASSEMBLY	May be Required. Refer to Land Consolidation Areas Part 4.0 of this document for more information.
DESIGN CONSIDERATIONS	See Design Guidelines for specific building form.
RIPARIAN MANAGMENT	May be required See Environmental Management **Part 4.2**

Residential Cluster (10-15 upa)

The 10-15 units per acre (upa) gross density cluster areas are intended to allow flexibility of housing form and lot size including a mix of smaller urban lots, attached housing (duplex/triplex/quadplex), and larger townhouses away from the agricultural land reserve but within the same site. Green space transfer of densities for lands preserved outside Park dedication areas is accepted to reduce building and site coverage.

The techniques used to concentrate buildings may include, but shall not be limited to, reduction in lot areas, setback requirements, and/or bulk requirements, with the resultant remnant space provided as open green space being devoted to a green belt, park land, or open space/amenity space for one or more uses.

	CLUSTER RESIDENTIAL (10-15 UPA)
MAXIMUM DENSITY	10-15 Units Per Acre (Gross Density) See Cluster Development Guidelines **Part 4.4**
POSSIBLE ZONES	CD based on RM-30, RM-15 (net)
MINIMUM LANDSCAPED PERMEABLE SURFACES	Not less than 40 percent of the site shall be conveyed as common open space. Meet the requirements listed in APPENDIX C Table 3.3–5; developers may choose from among a variety of LID measures to meet the requirements, some examples of which are provided in **Table A.2** in **Appendix C**
MINIMUM LAND ASSEMBLY	May be Required. Refer to Land Consolidation Areas **Part 4.0** of this document for more information.
GREEN INFRASTRUCTURE MANAGEMENT	May be required. Tree Retention/ Parkland Dedication See Green Space Area Guidelines **Part 4.3 and Figure 4.12**
BUFFER	May be required. See Agricultural Edge **Part 4.1**
RIPARIAN MANAGMENT	May be required See Environmental Management **Part 4.2**
DESIGN CONSIDERATIONS	See Design Guidelines for Townhouse and Detached Semi-detached.

3.3 MIXED USE AREAS (LIVE-WORK)

The Special Residential (live-work) designation is located along 93A-Avenue (Ridgeline Drive), between Highway 15 and 180 Street. This segment of the street is envisioned as a "main street" area within the plan. The street will include the Live-work designation, along with a Community Centre, neighbourhood commercial, and High Density Residential.

The densities between 15 to 30 units per acre will allow the option to permit the small business use at grade within a townhouse form of development. The intent of the live-work area is to provide opportunity for individuals to run a small business from their homes, by allowing up to 30% of the floor area to be used for work-related uses.

Types of business may include: artist studios, small scale retail stores, personal service uses such as hair-salons, custom tailors, cafes, restaurants and professional office uses such as interior designers, law offices, accounting offices etc.

Objectives

- To encourage walking and cycling to local destinations and neighbourhood services;
- To encourage building design that emphasizes the pedestrian realm;
- To provide a form of affordable housing by allowing home owners to live and work at home;
- To provide homeowners opportunity to increase their quality of life by reducing or eliminating community times; and
- To support small-owner run businesses.

Ground floor businesses with direct access to the Street.

Row Housing containing ground floor retail and office space

Special Residential (15-25 upa) Mixed Use

A primarily residential area made up of triplex, quadplex, townhouses or row houses with the option of a small-scale, low impact retail or service commercial or other businesses as part of the residential units, between 15-30 units per acre. The small-scale neighbourhood businesses/commercial uses or providing 'Live-Work' areas are to be located at the ground floor of the residential units with direct access to the public street.

Flexibility of use will be encouraged at the ground level which will accommodate either residential or business uses associated with a residence.

Parking for residential units will be accessible from the rear with on-street parking provided for the businesses and commercial units along 93 A Avenue, and 177 Street.

	SPECIAL RESIDENTIAL (15 - 25 UPA)
MAXIMUM DENSITY	15-25 Units Per Acre
POSSIBLE ZONES	CD
MINIMUM COMMERCIAL SPACE	"live-work" space will be permitted to incorporate up to 30% of the ground floor area or a minimum 32 square meters) of each dwelling unit for small scale business/commercial purposes. The minimum size of the live-work area of 32 sq meters ensures space is large enough for a business to feasibly occur.
MINIMUM LANDSCAPED PERMEABLE SURFACES	Meet the requirements listed in **Table 3.3–5**; developers may choose from among a variety of LID measures to meet the requirements, some examples of which are provided in **Table A.2** in **Appendix C**
MINIMUM LAND ASSEMBLY	May be Required. Refer to Land Consolidation Areas **Part 4.0** of this document for more information.
DESIGN CONSIDERATIONS	See Design Guideline for both Townhouses and Design Guidelines for Special Residential Townhouses.


Continuous street frontage


Windows and doors face the street.


Low landscaping delineates public and private space

Design Guidelines for Mixed Use "Special Residential" Townhouses

In addition to the OCP Guidelines, and the Townhouse Guidelines in this document, the following apply to Special Residential developments:

I: Streetscape and Built Form

- Buildings that are located at the street edge and provide a continuous street frontage are strongly encouraged.
- Live-Work Entrances should be clearly defined and visible from the street with appropriate business signage space.
- Ground floor spaces should have windows and door which face directly onto the street.
- Entries should retain a human scale and relate to the street.
- The scale of special residential buildings should relate and be compatible to adjacent development.
- Corner buildings should be sited to address both streets with similar architectural treatments.
- Front porches and verandas with overhangs that define a semi-private area in front of the unit are strongly encouraged.
- Utilize high quality materials and finishes (i.e. wood, stone, and masonry). Vinyl siding as the primary cladding material is not permitted.

II: Living Space

- Dwelling units should be designed to ensure a maximum amount of natural light to penetrate the unit.

III: Work Space

- Incorporate up to 30% of the ground floor area or a minimum 32 square meters) of each dwelling unit for small scale business/commercial purposes.

- The minimum size of the work area is 32 sq meters to ensure the space is large enough for a business to feasibly occur.

IV: Vehicles and Parking

- Garages, ancillary dwellings (coach houses) and structures must be accessed by a rear lane.

On street-parking along live-work areas is encouraged.

V: Pedestrians and Cyclists

- Pedestrian and vehicle access and circulation within, an individual site should provide safe and well-defined routes.

VI: Landscape and Environment

- Front yards should clearly delineate public and private space through the use of natural low landscaping, or low, open-style fencing.
- Promoting high quality and low maintenance vegetation by: maximizing native species and drought resistant material, and planting fruiting trees and shrubs that support pollinator species.

VII: Services and Utility Areas

- Where possible, utility elements and equipment should be located away from publicly exposed views, and are discouraged from being located in the front yard or flankage yard of a corner lot.
- Where utilities are required to be located in the front or flankage yards, the utilities should be located in a discreet area or screened from public view through landscaping or other screening mechanisms.

VIII: Sustainability Features

- Use of permeable surfaces for driveways and other paved areas is strongly encouraged.
- Promoting green building including: sustainable site development, water and energy efficiency, materials selection and indoor environmental quality.

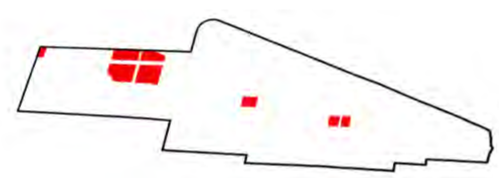


Figure 1 - Commercial Areas in Anniedale-Tynehead NCP

3.4 COMMERCIAL AREAS

The intent of the commercial areas are to encourage a mix of neighbourhood oriented commercial and regional commercial development of appropriate densities and forms so as to meet the needs of the residents of Anniedale-Tynehead and surrounding region, within the neighbourhood context of Anniedale Tynehead community.

The design and development guidelines provide direction for the development of commercial buildings that convey a neighbourhood character that will support pedestrian activity and connectivity to surrounding residential neighbourhoods.

The intent of the commercial area policies and development design guidelines are to:

- achieve interesting, high-quality architectural design for retail buildings which animate the street;
- enhance landscaping, public open space, and environmental performance of such developments;
- create comfortable and attractive pedestrian environments;
- enhance the streetscape along public streets and contribute to a high quality public space;
- protect and enhance the character and quality of neighbourhood where there is retail development;
- promote development patterns that may allow for future intensification of large format retails sites;
- incorporate the history of the area through the built form

These guidelines support the sustainable planning principles of the Surrey Sustainability Charter and two principles previously outlined in this plan, with a special emphasis on the following two Commercial planning Principles:

Principle No 1

- Provide local shoping opportunities in village centres in each neighbhourhood to provide locally accessible neighbourhood services.

Principle No 2

- Create opportunities for smaller scaled, pedestrican oriented commercial spaces and designations where people can meet, such as cafes, coffee shops, and corner stores, during different parts of the day into the evening.

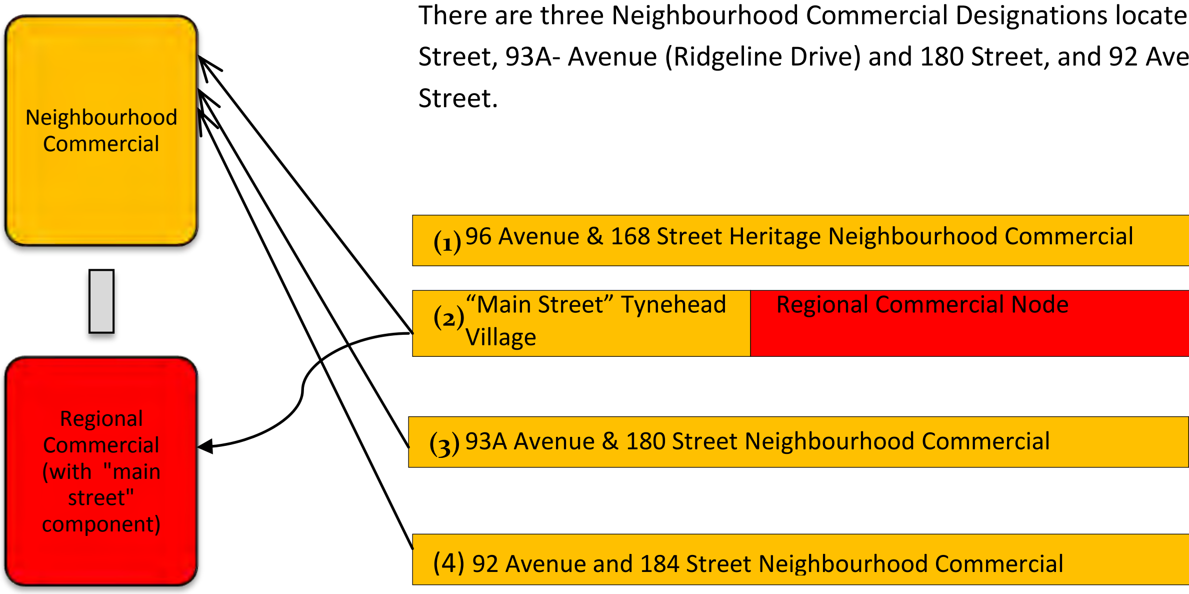
Figure 2 - Commercial Planning Principles

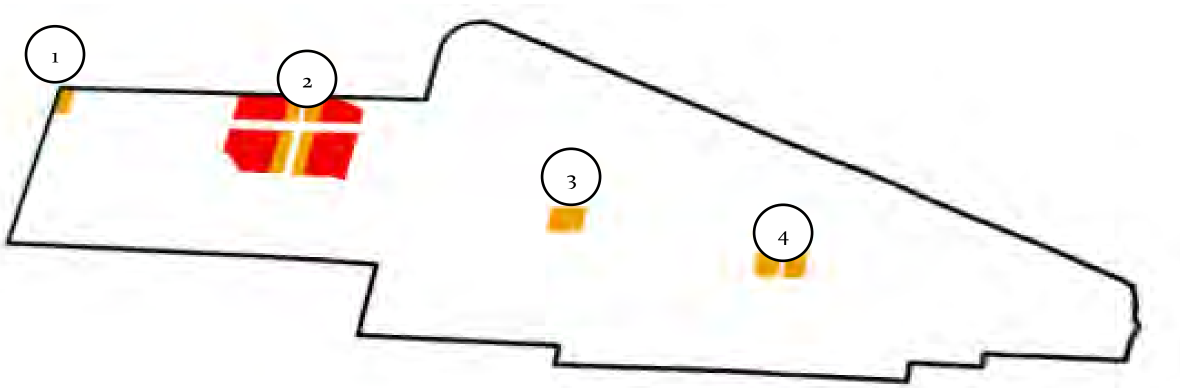
The Anniedale-Tynehead Land Use Plan identifies two (2) types of commercial designations allowing for primarily commercial use:

- Neighbourhood Commercial
- Regional Commercial with "Main Street" component

The Regional Commercial designation is located on the west side of Highway 15, south of 96 Avenue. This designation provides for a variety of commercial land uses including large format retail, grocery stores, restaurants, service commercial and other retail uses. The Commercial designation also allows for office uses. Commercial uses may be contained in a multi-tenant complex or in a freestanding building occupied by a single tenant. The Regional Commercial area will contains a "main street" village commercial component.

There are three Neighbourhood Commercial Designations located at 96th and 168 Street, 93A- Avenue (Ridgeline Drive) and 180 Street, and 92 Avenue and 184 Street.





Commercial (Large Format Retail)

The Land Use Plan proposes four major commercial nodes south of 96 Avenue surrounding a main street commercial area along 173 A Street (Tynehead Boulevard). Given this location's proximity to regional transportation routes, this commercial designation is intended to accommodate a larger, regional shopping centre.

As a gateway to the Tynehead residential area to the, west, east and south, careful attention must be given to the integrated planning and design of new development within these quadrants.

The development could also other uses such as Institutional (child care etc.) or Office.

The large format retail area will also include a "main street" shopping area, where the scale of the shops will be smaller.

Parking requirements for this retail format shall be as follows:

- Surface parking is limited to 3.0 spaces per 100 sq.m. of gross floor area .Additional parking beyond the 3.0 stalls per 100 sq.m. is permitted provided that it is contained below or above a building (roof-top) or in a parking structure.

	COMMERCIAL (LARGE FORMAT RETAIL)
MINIMUM LANDSCAPED PERMEABLE SURFACES	Meet the requirements listed in Table 3.3–5; developers may choose from among a variety of LID measures to meet the requirements, some examples of which are provided in **Table A.2** in **Appendix C**
MINIMUM LAND ASSEMBLY	Land Consolidation will be required for the development of a regional shopping centre.
DESIGN CONSIDERATIONS	Incorporate Lumber and Sawmill Theme into development. See Design Guideline for Commercial Areas and Placemaking and Identity in **Part 2.6**
TRAIL INTERFACE	Incorporate Plank Road theme into Hydro ROW
BUFFER	See Commercial Design Cross- sections (**Figure 3.4**) 10m Planted Buffer along Apartment Site and Hedgerow Planting along street with non-residential interface

Neighbourhood Commercial

Lands designated as Neighbourhood Commercial provide a location for pedestrian oriented retail and service uses not readily available elsewhere in the nearby large format retail centre. The Neighbourhood Commercial area limits the size of the stores and provides specific policy guidelines along the Neighbourhood Commercial nodes as well as the main street village commercial frontage along 173A Street.

With the future growth of the Anniedale-Tynehead area, a Heritage Village area is also designated at the existing commercial corner of 96 Avenue and 168 Street. It is planned that this intersection will continue to evolve as a viable neighbourhood commercial centre, with a strong Heritage component linked to Tynehead Park, and the natural and built heritage components.

	NEIGHBOURHOOD COMMERCIAL
MINIMUM LANDSCAPED PERMEABLE SURFACES	Meet the requirements listed in Table 3.3–5; developers may choose from among a variety of LID measures to meet the requirements, some examples of which are provided in **Table A.2** in **Appendix C**
MINIMUM LAND ASSEMBLY	May be Required. Refer to Land Consolidation Areas Part 4.0 of this document for more information.
DESIGN CONSIDERATIONS	Incorporate Lumber and Sawmill Theme into development. See Design Guideline for Commercial Areas and Place Making and Identity in **Part 2.6**
HERITAGE	Incorporation of Tynehead Community Hall into comprehensive development See Development Guidelines **Part 4.5**

Design Guidelines for Commercial Areas:

I: Context and Neighbourhood Character

Historically, logging was a key industry in the area. The Rideout Sawmill was located on future commercial (large format retail) site. Lumber was transported along skid roads to transport lumber from the sawmill up to the Fraser River. As land was cleared, agricultural practices became important as well.

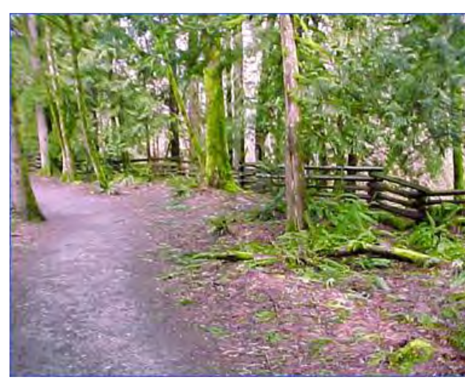
Drawing from the history of the area, the large-scale retail format will incorporate distinctive and authentic historical and cultural elements into the design of the development.

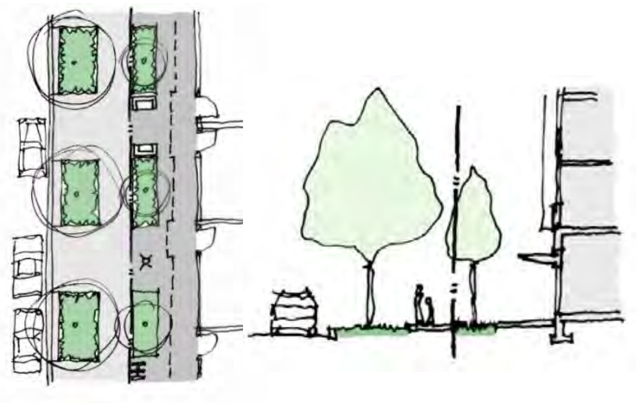
The use of a lumber and sawmill theme into the form of the commercial site allows the use of these elements in a contemporary way will help to give this commercial development a unique sense of place that is rooted in the history of this community.

A “plank road” was also located in the vicinity of what is now the gas/hydro right-of-way. This theme can be enhanced along the greenway proposed on the right-of-way.

The agricultural history can be included through the use of hedgerow plantings where buffers are required.

The Tynehead Community Hall is located at the proposed Neighbourhood commercial area at 96th Avenue and 168 Street. The development at this location is required to incorporate the Heritage Hall into the site design for the redevelopment of the future commercial site.



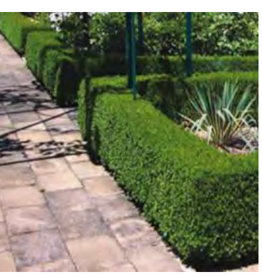


II: Site Design and Public Realm Interface

- Locate buildings along the street with parking located behind.
- Two storey buildings are encouraged particularly at corners to create a sense of street enclosure.

Commercial Street Interface:

- Provide a 3m setback along streets to achieve an inner row of trees on private property with in-ground planter panels.
- Provide specialty paving and details on the setback area (private property).
- Incorporate contemporary landscaping for in-ground planter panels such as rows of grasses and dwarf shrubs.



Where surface parking is located adjacent to roads:

- Create a small scale hedgerow along street frontages to reference the existing area and to screen views of parking areas

- Between breaks in the hedgerows and at corners, punctuate with low walls or defining fencing elements in character with the area.
- Incorporate stormwater management features into surface parking areas.

- Landscape the area in front of a blank wall that faces public streets, and use projections, recesses, arcades, awnings, colour and texture to reduce the visual size of any unglazed walls.

Provide public open spaces:

- Create widened setbacks along streets rather than carved out corner spaces,
- Locate on sunny areas of streets,
- Take advantage of views such as looking over the agricultural valley,
- Incorporate specialty paving, features and art.

- A design feature (Gathering Amenity Space) will be provided as a focal point at the corners of 173A Street and 94 A Avenue (Round-about) and may take the form of an urban plaza, town square, and draw on the lumber and sawmill theme.

Regional Commercial with Main Street:

- The site layout should reinforce the street grid pattern such that future redevelopment to higher intensity can evolve along the future streets.
-
- The large format retail stores can back onto roads that do not have residential such as 96th Avenue.

- The greenway should continue on the gas right-of-way (coordinated with the utility surface treatment requirements) across the commercial site with a "Plank Road" character to reference the original road approximately in this location.

- Vehicular parking areas should provide direct driveways through the site to allow filtering of commuter traffic in addition to the "Main Street" and other public roads.

- Where back of the larger commercial faces non-residential streets, provide a significant landscape buffer of 6m.
  - Incorporate a hedgerow with significant trees to reference existing street character in the area,
  - The hedgerow can be an opportunity for ornate carving to create a distinctive character.

Create a Main Street and Village Centre

- Locate the street closely connected to the adjacent residential neighbourhood,
- Back of Main Street retail should not face residential streets, rather can back onto residential sites with a 6m landscape buffer,
- Locate retail on both sides of the street and on all four corners of blocks,
- Create walk-throughs to parking behind,
- Wrap retail windows and entrances around the street corners and walk-throughs,
- Coordinate walkthroughs with pedestrian crossing on streets,
- Provide angled parking along streets,
- Provide a 5.5m setback from the curb: 1.m at parking curb, 1.5m in-ground planter panel, and a 3m sidewalk to the face of the building,
- Locate active uses at grade, such as restaurants, specialty in-store boutiques, food concessions and waiting,
- Provide site furnishings, such as benches, bike racks and shelters, at building entrances and amenity areas. (see Public Realm Furnishings Part 3.9)

Neighbourhood Commercial:

- Treat the utility right-of-way as a public frontage,
- Include Public Plaza areas with seating and amenities,
- Incorporate a 2m walkway along the outside of the riparian edge to facilitate non vehicular traffic through the area and connecting to the greenway on the utility right-of-way.

At the 168th Tynehead node;

- Locate future buildings with similar setbacks to the Tynehead Community Hall (kept in situ),

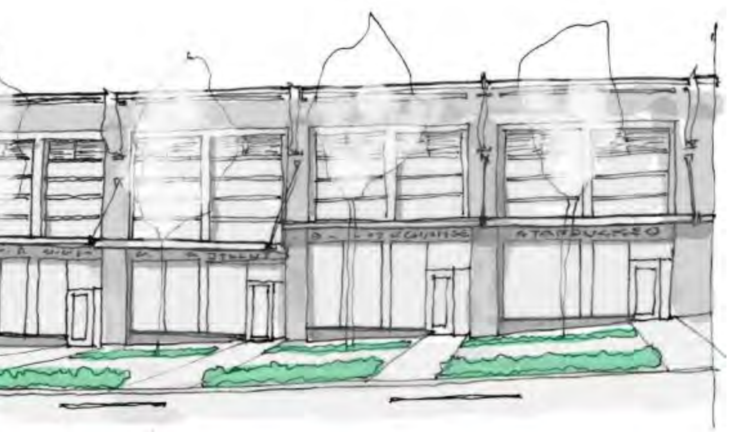
III: Building Form and Character

- Create an architectural vocabulary which draws upon the history of the area,
    - Provide a full roof expression for smaller commercial buildings,
    - Streetscapes image of grouping of simple roof forms
    - Open and closed building forms,
    - Heavy timber features
- Continuous weather protection with a depth of at least 1.5m to encourage all season protection and particularly at transit stops.
- Scale down long facades into smaller grain retail frontages.
- Locate interior uses such as seating areas, employee rooms, offices, waiting areas and lobbies, which have the potential for clear windows, along street-facing walls.
- Orient the front façade to face the public street and locate front doors to be visible, and directly accessible, from the public street.
- Design the façade of buildings with multiple uses so that each use is defined separately through individual signage, individual entrances and individual canopies.

Step the ground floor levels to match the adjacent sidewalk grades on sloping sites.

Express the individuality of each retail frontage with unique architectural details and features.

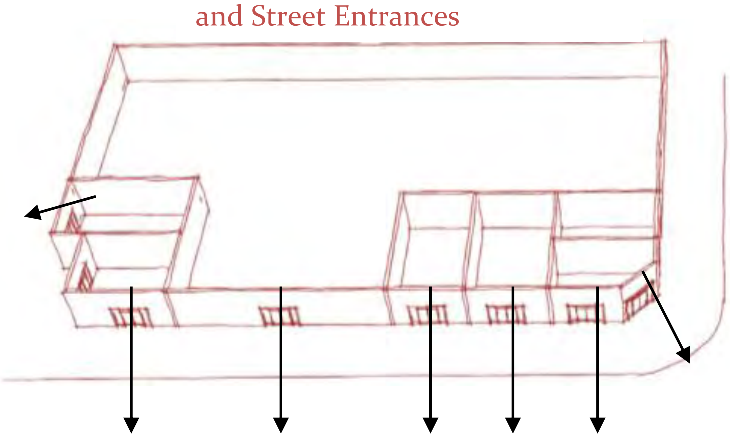
- Maximize the retail/commercial glass at the street frontage and avoid overhanging building arcades.



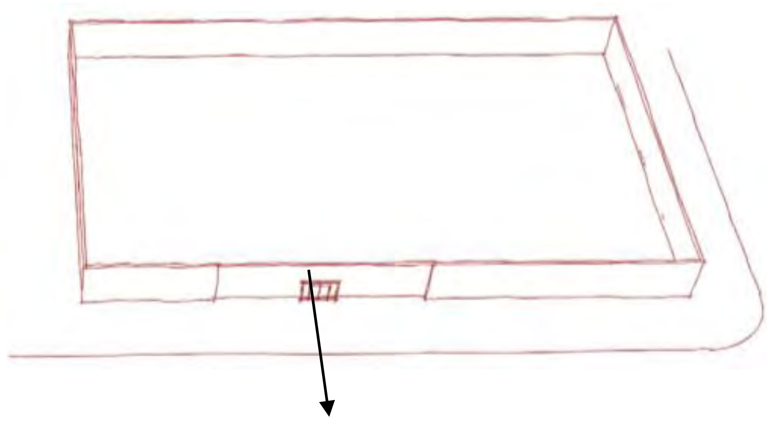
Regional Commercial including Main Street:

- Follow the theme for image and character focusing on authentic character based on the history of the area such as sawmills, timbers and plank roads throughout the development.
- Treat wrap around facades on corners and at walkthroughs as fully detailed front facades.
- Walkthroughs should be clearly visible without alcoves or backwater areas.
- Infill smaller units in the fronts of large format retail,
- Break-up the long facades of large commercial units with small shops addressing the public realm that wrap the larger commercial unit.

Do This: Multiple Small shops and Street Entrances



Don't Do This: Single Entrance and creation of Blank Walls



IV: Signage

- Create a coordinated signage concept for the site including specialty backing such as timber or brushed metal grille for mounting backlit channel lettering or neon.

- Blade signs mounted to the building should be considered along streets.

Regional Commercial including Main Street:

- Signage along major streets – 96th Ave can promote the awareness and image of the village and the major retailers at the corners of streets 172 and 173A.

- Freestanding signs should be low marker type signs with stencilled letters, a pediment and using high quality materials.

V: Pedestrians and Cyclists

- Provide direct, safe, continuous and clearly defined pedestrian access from public sidewalks, parking areas and transit stops to building entrances.

- Connect pedestrian walkways between adjacent properties in order to facilitate circulation between sites.

- Distinguish walkways from driving surfaces by using varied paving treatments and by raising walkways to curb level.

- Provide weather protection at building entrances, close to transit stops, and in areas with pedestrian amenities.

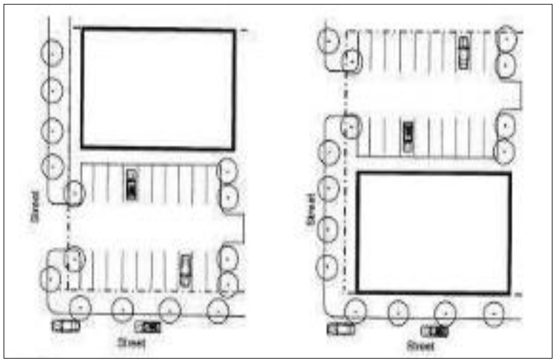
- Provide sheltered bicycle parking in visible locations near building entrances and pedestrian walkways. Ensure that these locations do not conflict with pedestrian circulation.

- Design the internal circulation pattern with direct connections to the surrounding streets.

VI:Vehicles and Parking

Don't Do This

Do This



- Link access drives and parking lots of adjacent properties in order to allow for the circulation of vehicles between sites.
- Share vehicular access to parking areas between adjacent properties in order to reduce the extent of interruption along the sidewalk and the streetscape.
- Design the site circulation to minimize the conflict between pedestrians and vehicles. This can be achieved by orienting car parking spaces to minimize the number of traffic aisles that pedestrians must cross.
- Locating off-street surface parking spaces at the side or rear of buildings.
- Surface parking is limited to 3.0 spaces per 100 sq.m. of gross floor area. Additional parking beyond the 3.0 stalls per 100 sq.m. is permitted provided that it is contained below or above a building.

Provide Site Circulation

VII: Sustainability

- Base new development on an internal circulation pattern that allows logical movement throughout the site that will accommodate, and not preclude, intensification over time.
- Incorporate a broad strategy for environmental sustainability including energy and greenhouse gas, site design, water, landscaping, passive solar.
- Incorporate green roofs on commercial buildings
- Incorporate rain gardens, infiltration swales, pervious pavements, reduced street widths and other low impact development strategies into the development.

Green Roof

V: Landscape and Environment

- Plant on street trees in accordance with the City of Surrey street tree requirements along public streets and between 7.0 and 10.0 metres apart along the length of internal pedestrian walkways. Plant trees in permeable surface areas, with a minimum of 10.0 square metres of soil area per tree at a depth of at least 30 centimetres. Street trees will be planted with an initial planting trunk diameter of not less than 5 centimetres measured 1.4 metres above finished ground. Tree selection and spacing is subject to final determination by the City of Surrey, Parks, Recreation and Culture Department.

- Select trees, shrubs and other vegetation considering their tolerance to urban conditions, such as road salt and drought. Give preference to native species outlined in the Surrey tree protection bylaw.

- Divide large parking areas into smaller and well-defined sections using soft and hard landscaping in order to minimize the amount of paved, non-permeable areas.
- Landscape any area between the building and the sidewalk with foundation planting, trees, street furniture, and walkways to public sidewalks.

- Define pedestrian walkways within parking areas with continuous planting areas consisting of trees and shrubs.

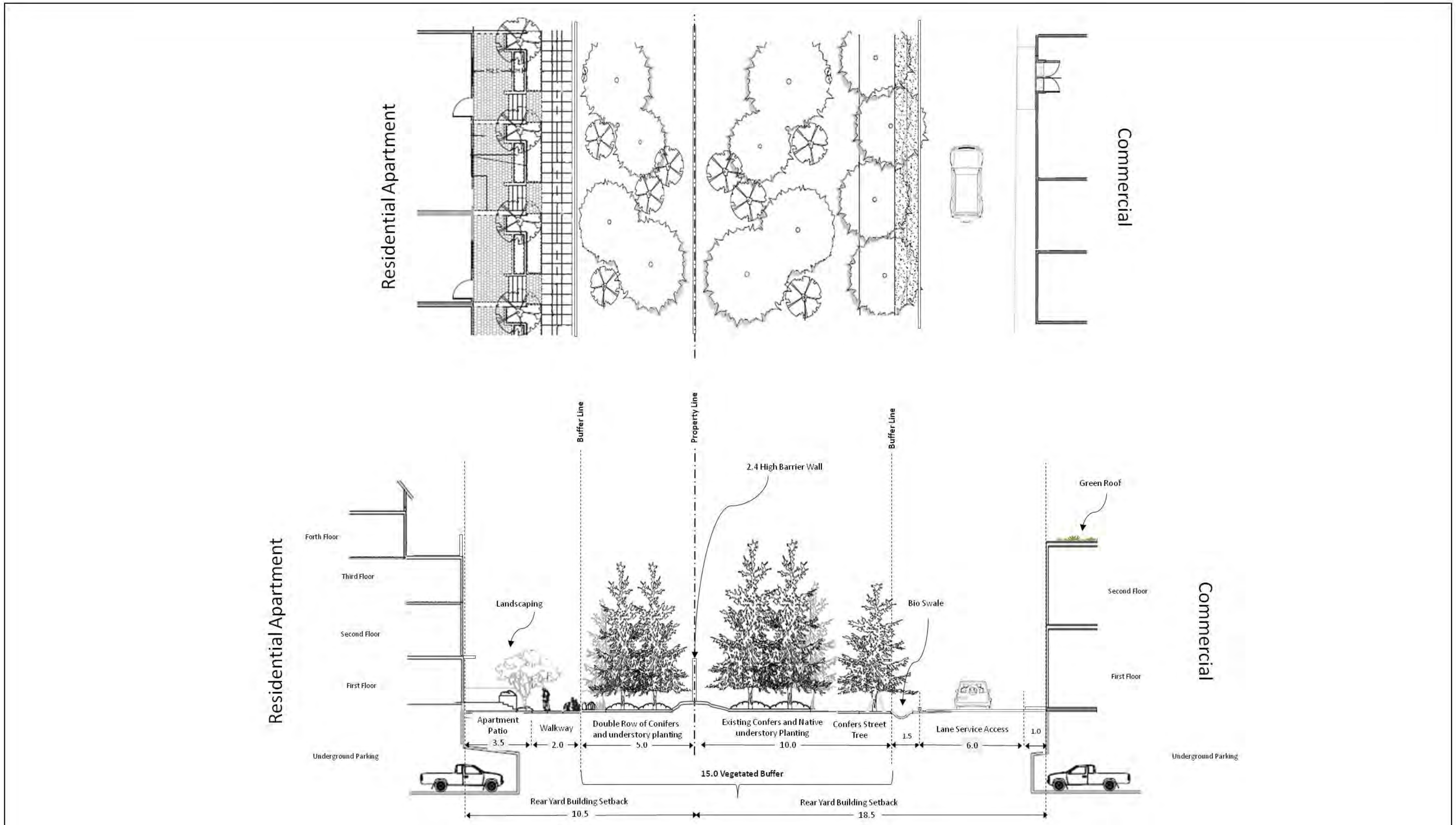
- Whenever possible catchment areas including, rain gardens, sodded areas and shrub beds should be constructed within parking areas to collect, store and filter stormwater on site in order to improve groundwater recharge.

- Install and maintain oil/water separators to prevent transportation of hydrocarbons from paved areas.

- Plant trees, shrubs, ground cover on any un-built portions of the site that are not required to meet minimum parking requirements. This includes any areas reserved for future long term phases of development.

- Use green building technologies such as green roofs, drip irrigation, and other Leadership in Energy and Environmental Design (LEED) approaches.

- Install 10 m planted landscape buffer where commercial uses directly abut residential uses. (see **Figure 3.4** for cross section details).



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the future lives here.

FIGURE 3.4

Typical Landscape Buffer along a direct Commercial -Residential Apartment Interface

VII: Loading/Services and Utility Areas

- Enclose all utility equipment within buildings or screen it from both the public street and private properties to the rear and ensure that noise is managed. This includes utility boxes, garbage and recycling container storage, loading docks and ramps and air conditioner compressors.

- Share service and utility areas between different users within a single building or between different buildings, to maximize space efficiencies.

- Design garbage enclosures that are external to the building with the same materials as the building and ensure that the wall height is sufficient to completely conceal garbage dumpsters.

- Provide lighting that is appropriate to the ground floor use and focuses on pedestrian areas.

- Use efficient white light sources on site to reduce energy costs and to create a natural colour balance for safety and security.

- Design secondary doors, such as emergency exit doors, to blend in with the building façade.

3.5 INDUSTRIAL AND BUSINESS PARK AREAS

The Industrial and Business Park areas are located along the north side of the plan area. Close proximity to regional transportation routes such as Highway 1, Highway 15 and Golden Ears Way makes this area a desirable location for these types of uses.

The Light Industrial is bound by Highway 1, Highway 15, and Golden Ears Way, is referred to as the "triangle". Access into the triangle is restricted because it is surrounded by regional transportation routes. As a result, the uses with the triangle are limited to Light Industrial. Stand alone retail; including large-format retail would not be supported within the triangle.

The Business Park designation is located to the south of Highway 1, outside of the "triangle" area. Since the access points to this designation are not limited, Business Park uses can be supported.

Business Park uses include Technology Park (high technology, science-based industries with significant research and development components), Office Development, Warehouses and Service Uses.

While Business Park designation allows light impact industrial, high-tech industrial, warehouse, office and service uses, these uses are to be carried out in enclosed buildings forming part of a comprehensively designed development. Office buildings are encouraged along 92 Avenue.

Landscaped buffer of 7.5 m wide will be required for sites adjacent to residential uses, and 3.5 metres along property lines that abut a local road.

Principle

- Create opportunities for residents to work close to home by accommodating business and industrial development in the Anniedale triangle and other industrial business park lands.

Light Industrial

The overall development concept for the Anniedale Industrial area located in the Anniedale-triangle envisions a high quality light-industrial park that reflects the natural characteristics inherent in its setting, and builds on and extends the existing road and servicing infrastructure found to the North. Land uses within the business park will emphasize high quality industrial uses including a mix of light manufacturing, distribution, warehouse, research and development, and similar uses.

Outdoor storage and display is not allowed under this designation. Both single tenant and multi-tenant buildings could be located on these lands. Green pedestrian and habitat connections to the detention pond and park area on 96 Avenue will be encouraged.

	LIGHT INDUSTRIAL
MINIMUM LANDSCAPED PERMEABLE SURFACES	Meet the requirements listed in **Table 3.3–5**; developers may choose from among a variety of LID measures to meet the requirements, some examples of which are provided in **Table A.2** in **Appendix C**
MINIMUM LAND ASSEMBLY	May be Required. Refer to Land Consolidation Areas **Part 4.0** of this document for more information.
DESIGN CONSIDERATIONS	Incorporate Sawmill and Lumber Theme. See also Placemaking & Identity **Part 2.6**
HERITAGE	Incorporation of Harbidge House into development. See **Part 4.5** Heritage Area Guidelines
BUFFERING	Required along Highway and Residential Interfaces. Incorporate 7.5 m landscape buffer adjacent to Residential lands.
RIPARIAN AREAS	See **Part 4.2** Environmental Management

Business Park Industrial

The Anniedale Business Park areas are located on the south side of Highway 1, to the east of 184 Street.

The Business Park designation provides for business parks consisting of office uses and service uses as well as warehouse and distribution uses that are comprehensively designed with extensive landscaping and high quality urban design.

Business park development may include multi-tenant complexes or freestanding single tenant buildings established in an attractive, clean and quiet campus setting. No outside storage is permitted.

Office uses are encouraged along 92nd Avenue.

	BUSINESS PARK
MINIMUM LANDSCAPED PERMEABLE SURFACES	Meet the requirements listed in Table 3.3–5; developers may choose from among a variety of LID measures to meet the requirements, some examples of which are provided in **Table A.2** in **Appendix C**
MINIMUM LAND ASSEMBLY	May be Required. Refer to Land Consolidation Areas section of this document for more information.
DESIGN CONSIDERATIONS	Incorporate Sawmill and Lumber Theme. See also **Part 2.6** Placemaking & Identity Office uses encouraged along 92nd Avenue.
MINIMUM LAND ASSEMBLY	May be Required. Refer to Land Consolidation Areas **Part 4.0** of this document for more information.
BUFFER	May be required. Incorporate 7.5 m landscape buffer adjacent to Residential lands.
RIPARIAN	See **Part 4.2** Environmental Management

Design Guidelines for Industrial and Business Park Areas:

In addition to the OCP Guidelines, the following apply to Industrial and Business Park developments:

I: Context and Neighbourhood Character

Views

The northern plan area offers significant views to the Golden Ears Mountain Ranges.

- Development needs to consider public view corridors to the north.

History & Heritage

- Sawmills and the lumber industry were prevalent in the late 1860's. The future building form and character should draw on this theme when redevelopment of the site occurs.

- There are a number of historic buildings in the plan area. Through a Heritage Register evaluation process. the Harbidge House (17633 96 Avenue) is one of the sites that has been determined to have recognizable heritage significance and has been recommended to be added to the Heritage Register.

    - Development on the Harbidge House site should not occur until the protection and restoration of the building is secured in a manner satisfactory to the City (e.g., heritage revitalization agreement).

    - This building is intended to remain in private ownership with an adaptive use that respects the heritage value and encourages a viable future.

II: Site Design

- On corner sites, the principal building shall be anchored at the corner and be designed to be visually attractive from both abutting streets.

- Clear pedestrian paths to and from building entrances shall be provided.

- On-site walkways should be linked to the public sidewalks by well defined paths to minimize conflict with vehicular traffic.

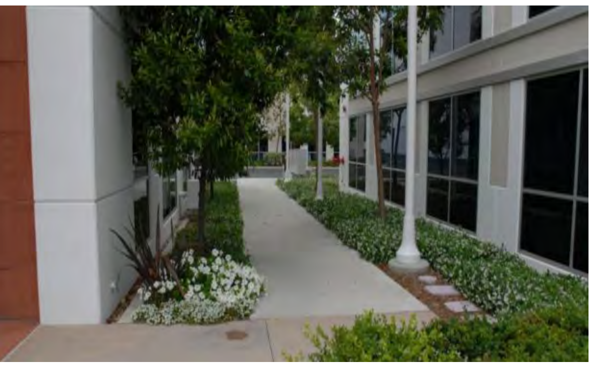
- Landscaped buffer of 7.5 m wide will be required for sites adjacent to residential uses, and 3.5 metres along property lines that abut a local road.

- Site planning and building design should make the provision for interesting outdoor urban spaces.

Business Park

- Office uses are encouraged along 92nd Avenue,

- Strong architectural edges will be created along 92 Avenue and 188 Street, by providing minimum building street setbacks in combination with rear and side yard parking.



Site Access

- Common easements for shared entrances and access between lots may be required for lots fronting arterial roads.

- Drop curb openings must not be located within 3.5 metres of the side property line, except in a shared access arrangement. City of Surrey driveway access standards are 9 metres from an intersection on a local road, 25 metres on a collector road, and 50 metres on an arterial road Additional separation may be required on a site specific basis.

- The transportation objective is to minimize access along 92 Avenue & 188 Street corridors. However, a minimum 50-metre interval between driveways may be considered.

- A single point of entry to individual sites is preferred. Where high volume heavy truck access is required, provisions may be made for a separate service entry point, provided it is clearly identified as such and is separated from visitor / on-site parking area subject to review and approval of the City of Surrey Engineering Department.

Exterior Lighting

- Lighting along pedestrian pathways is required and should not exceed 4 metres (13 ft.) in height.

- Fixtures and poles should be in a colour that compliments the building architecture and parking lot lighting.

- Lighting should be directed away from residential areas.

Signage

- The design of the signs should relate to the architectural character of the buildings on the same site.

- Free-standing signs should be integrated into the site landscaping.
- Single pole free-standing pylon signs are not permitted.

- Facia signs facing the street may be permitted provided they are integrated and coordinated with the architecture of the building and overall design of the development.

III: Public Realm and Street Interface

- Buildings along streets should be designed to include glazing and high quality finishing materials,

- High quality landscaped frontage is required along public streets,

- Install street trees within boulevards at 7 to 10 metres on centre, with minor variations to suit entry driveways and site servicing. Street trees will be planted with an initial planting trunk diameter of not less than 5 centimetres measured 1.4 metres above finished ground. Tree selection and spacing is subject to final determination by the City of Surrey, Parks, Recreation and Culture Department.

- Provide landscaping and trees within the centre medians of 96 Avenue and 188 street,

- Blank walls facing streets are generally not permitted. Where they are unavoidable, substantial landscaping should be used to mitigate their visual impact.

- Parking within front yard setback is generally discouraged. However, where it is proposed, it must be visually screened from the street by a combination of berming and high quality landscaping.

IV: Building Form and Character

- To reinforce the Sawmill and Lumber Theme, the use of the following is encouraged: the use of wood and heavy timber construction, sawmill paraphernalia such as saw blades and metal tools, repetition of logs, tree rings.

- Variations in massing and changes in height and horizontal planes are encouraged, Long and non-articulated buildings should be avoided.
- The main entrance to each building should be easily recognizable from the street.
- All exterior mechanical units or equipment including roof top units that may be visible from the streets should be enclosed.

V: Loading and Service Areas

- Along 188 Street and 92 Avenue, loading areas are not permitted in the area between the building and the street. Where a loading area is permitted to face a street, overhead service doors must be integrated into the overall building design,

- Locate service garbage and recycling areas behind buildings or on the sides of buildings if the site is not visible from a street,

- Loading areas shall be screened by buildings, a landscape screen, a solid decorative fence, or a combination thereof.

3.6 INSTITUTIONAL AREAS

Sites for public institutional uses such as Elementary schools and the Community Centre have been identified on the Land use Concept. Private Schools, Assembly Halls and other such institutional uses have not been specifically located. Rather, general, criteria for such uses are as follows:

- Uses may be considered in High Density Residential Areas, Commercial Designations, and portions of areas designated for Business Park;

- Daycares would be suitable in residential areas, as well as areas in close proximity to schools

- Locate institutional uses:
  - along transit routes
  - on arterial or collector roads when possible
  - close to commercial nodes

- Include public amenities such as benches and seating, plaza areas, public art as part of the development where appropriate.

Design Guidelines for School Areas:

- School buildings should be located close to the public street with main entrances visible from the street.
- Where practical, gathering or plaza areas should be included in front of the main entrance of the school.
- Parking areas are discouraged from being located in front of the school building.
- School elevations should be designed with a high level of architectural character and materials.
- Bus drop-off areas should be located away from the main entrance of the school, preferably at the side of the building to avoid conflict with other vehicles.
- Bus drop-off areas for elementary school may also be located on local streets, where appropriate.
- Pedestrian connections should be provided from sidewalks, parking areas, and bus loading areas to school buildings.
- Lighting for school buildings and parking areas should be directed away from adjacent properties.
- Service areas should be screened from public view.
- Signage should be integrated into the landscape treatments or building architecture.
- Where possible, utility elements and equipment should be located away from publicly exposed views, and are discouraged from being located in the front yard or flankage yard of a corner lot. Where utilities are required to be located in the front or flankage yards, the utilities should be located in a discreet area or screened from public view through landscaping or other screening mechanisms.

3.7 PARKS RECREATION AND TRAILS

Parks

The NCP area is comprised of approximately 79.7 hectares (197 acres) of active, passive, forested and riparian park area that serve the local populations need for active park space while retaining significant and valuable environmental features.

This includes one main Community Park, seven active and passive Neighbourhood Parks, riparian parkland and forested areas all connected by a network of greenways and trails. The parks are located so that they incorporate the protection of significant ecosystems and are designed so that they are accessible by residents of all ages and abilities.

The amount of parkland in the NCP is determined by following the guidelines of the Parks, Recreation and Culture Strategic Plan. It calls for an average of 4.2 hectares per 1000 people of active and passive parkland. This is in addition to environmentally sensitive areas that are acquired for their intrinsic value as natural areas.

Principle 1

- Retain significant environmental features including creeks, important vegetation and Green Infrastructure (Ecosystem Hubs, Sites and Corridors):
  - i. Consider Park locations which incorporate protection of significant and/or valuable ecosystems;
  - ii. Minimize clear cutting vegetation and clearing lands during development and encourage the planting and replanting of trees;
  - iii. Encourage cluster development which enables density transference and site specific design that responds to the area's natural features

Principle 2

- Create parks and recreation opportunities that are interconnected, both active and passive, which are accessible by residents of all ages and abilities on foot or by bicycle.

In the NCP area, there is one large Community Park. It will be located at the south-west of corner 184th Street and 92nd Avenue and be just over 14 hectares (35 acres) in size. It is likely to include soccer and baseball fields, a water park playground, washrooms and passive lawn areas with paths throughout. It protects and maintains the natural beauty of the area by offering fantastic views into the agricultural lands and is connected by the main Lakiotis Greenway running east-west through the NCP area. The final plan for the park will be subject to community consultation and detailed planning.

There are several smaller neighbourhood parks in the NCP. As a focal point of each neighbourhood, they provide a local gathering and recreational space for nearby residents. They are of varying sizes but generally located in the centre of each neighbourhood within approximately a 10 minute walking distance for most residents. Each neighbourhood park will incorporate a variety of active recreational opportunities such as children's play areas, sports boxes, dog off-leash areas, disc golf courses, pedestrian walkways and seating areas as well as areas for passive recreation. The programming of each park is to be determined through consultation with future residents.

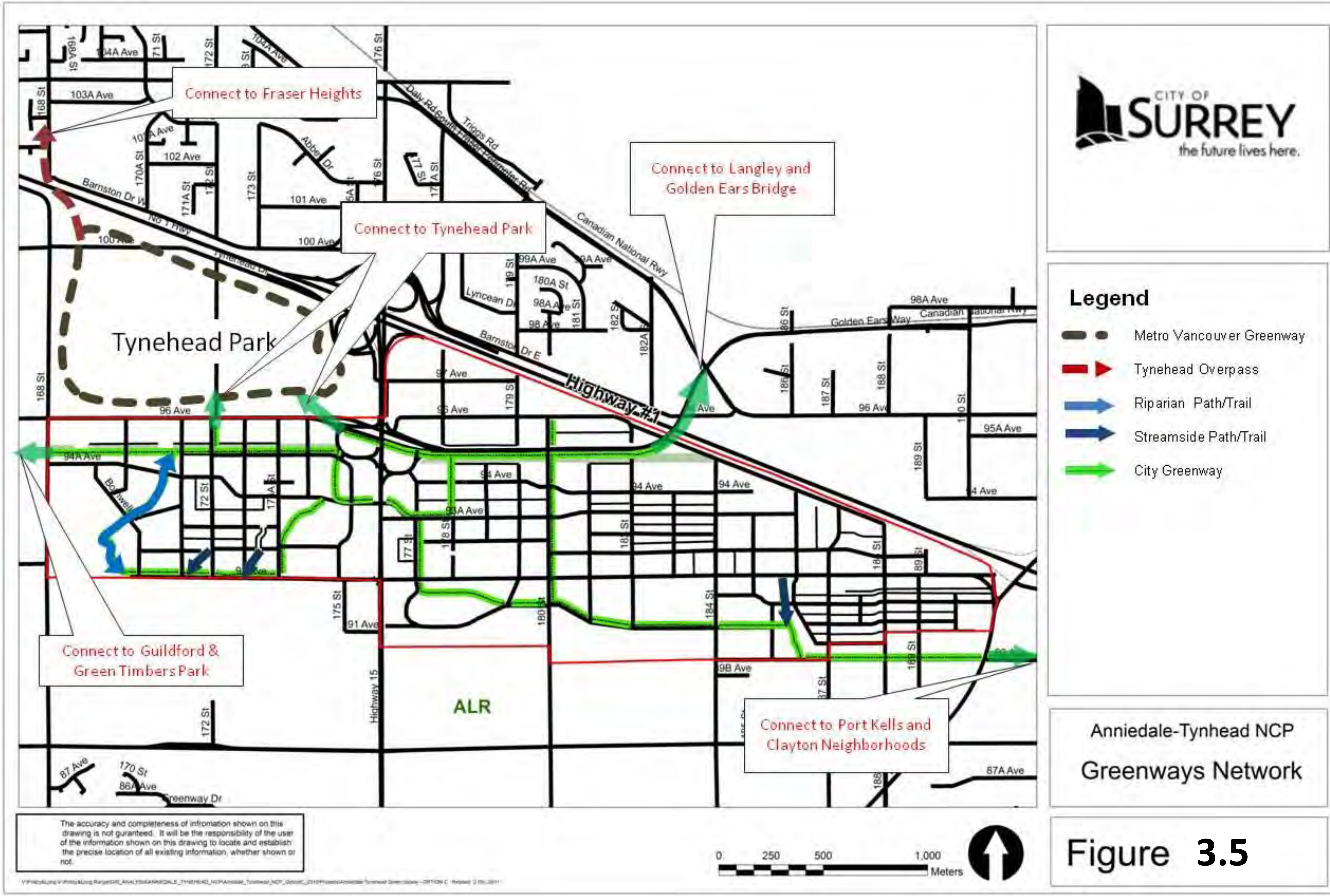
There are also several areas in the NCP that are protected for their value as natural areas. The park site at 180th Street and 93A Avenue in particular is a highly sensitive wetland area and the adjacent cluster developments shall ensure the functionality and performance of the park land is undisturbed and/or improved. These include the headwaters of the Serpentine River, other riparian areas, wetland and forested lands. These lands are highly valuable as habitat for amphibians, numerous birds, mammals and fish species as identified by the 2011 Ecosystem Management Study and the 2009 Anniedale-Tynehead Madrone Environmental Study.

Trails

The multi-use trails are a fundamental component of the Anniedale-Tynehead Community. The NCP is comprised of five main trails connecting the parks, major points of interest and adjacent destinations outside the NCP (see **Figure 3.5**). The trails in this NCP range from urban paths to forested areas and gravel trails adjacent to the headwaters of the Serpentine River. They are designed to accommodate and be accessible by residents of all ages and abilities.

There are two main trails running east-west through NCP. The first comes from the west and is the continuation of the Green Timbers Greenway that originates in City Centre. It connects across 176th to the existing Golden Ears Greenway creating a continuous connection from Langley to the City Centre. It travels primarily along the BC Hydro right of way and runs adjacent to parkland commercial and residential areas. The second east-west trail, the Lakiotis Ridge Trail, runs along the Serpentine River headwaters south to the ALR buffer. It heads west to a neighbourhood park before crossing 176th Street and heading back down along the ridge line. Here it offers great views into the ALR before connecting with the large Community Park. It continues east connecting to the Port Kells community and beyond.

Running north-south there are several connecting trails that link neighbourhood parks, commercial areas, schools, residential areas and the recreation centre. These connections also link to Tynehead Regional Park where a new overpass connects across Highway 1 to the community of Fraser Heights.



Anniedale-Tynehead NCP

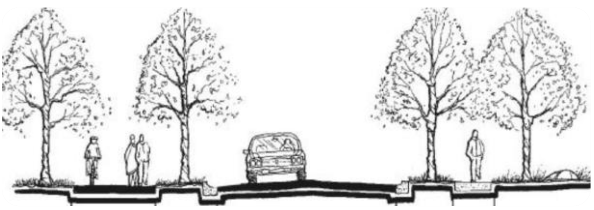
Greenways Network

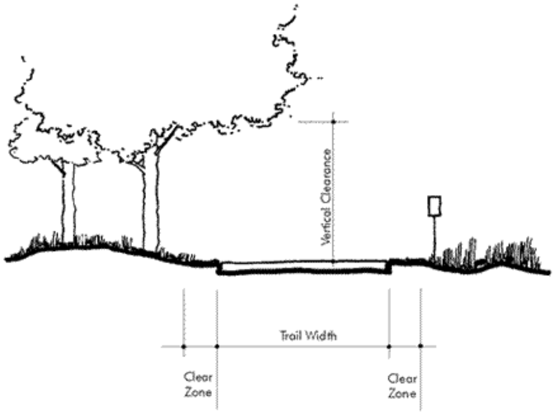
Figure 3.5

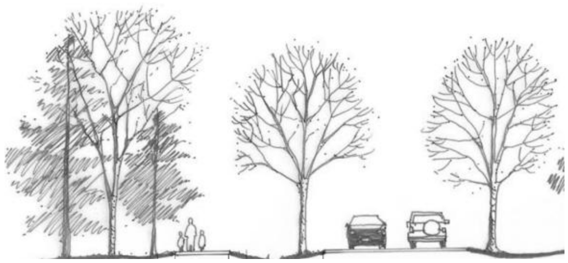
Design Guidelines for Parks and Trail Areas:

Detailed design will be completed in consultation with the future community, however common design features for each park include:

- Trails, and pedestrian/cycling connections to other neighbourhood amenities and greenways;
- Circuit trails around the park's perimeter, wherever feasible;
- Active areas such as playgrounds or sitting areas located in highly visible locations, either near entrances to the park or along the perimeter of the park, visible from surrounding streets;
- Tree plantings that emphasize a strong vegetated edge surrounding an open interior space, while permitting views into the park from surrounding streets and homes.
- Where residential units are adjacent to parkland and/or linear greenways there should be low fences, with active rooms facing the public space to create 'eyes on the park';
- Where multi-family developments front onto parkland, the connecting path to front doors must be on private property.
- Playgrounds will be located within 400 meters, or a 10 minute walk from all residential areas.
- Pedestrian connections should be provided to sidewalks and other pedestrian walkways.
- Neighbourhoods parks should be exposed to local streets to provide good visibility and accessibility.
- Crime Prevention through Environmental Design (CPTED) will be considered in the design of the park.
- Neighbourhood parks may be used as part of, or associated with the function of the rainwater management system but areas for storm water management must be clearly defined and effectively separated from active parkland uses.







Trail Design Guidelines:

- Where trails are planned adjacent to multi-family development, the trail should be built by the developer on private property with a SROW for public passage and maintained by the strata. The path should look and feel like a public space.

- Where trails are planned fronting single family developments, the trail should be built by the developer as part of the road frontage construction.

- Pedestrian and multi-use pathways and bicycle facilities are provided within the Anniedale-Tynehead Community and linked to the City-wide trail network and follow the City's trail standards.

- Pathways should be included mid-block along long residential streets to provide convenient pedestrian access.

- Pedestrian pathways and bicycle facilities should be accessible to a range of users.

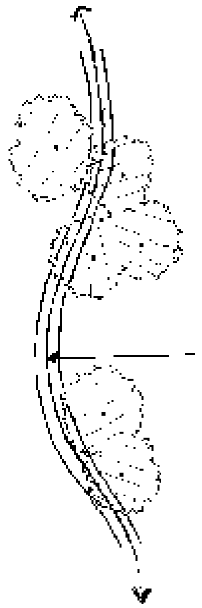
- Amenities, such as seating, lighting, signage, and garbage and recycling containers should be provided along the trails.

- Pathways will be designed to reduce the negative impacts on open space and natural features and habitats.
- Pathways should incorporate public art where possible.

- Pathways should incorporate wayfinding as per City standards or allow for future wayfinding to be installed.

Hydro and Gas Transmission Corridors:

- Pedestrian walkways and recreational pathways should be provided within the hydro transmission and gas corridors, where possible, and integrated into the community trail network. Plans are to be submitted to BC Hydro and/or Fortis for review and comment.



Meander Trail within Utility Corridors

- Pedestrian and multi-use pathways shall be carefully located to avoid the potential for adverse impacts on existing natural features and habitats within the Transmission corridors. Pathways should not be constructed in between the poles and guy wires/anchors.

- Parking and roads may be provided within the hydro transmission corridors for commercial, and transportation uses located adjacent to the Corridor.

- Parking located within the hydro transmission corridor should be visually screened from the public streets and pedestrian pathways through the use of landscape treatments.

- **See Part 9** for Utility Agency Comments for Utility Corridors

3.8 PUBLIC REALM FURNISHINGS

Street furnishings for the Anniedale-Tynehead NCP area will incorporate the lumber and sawmill industrial theme in a contemporary way. Use of natural wood material combined with industrial metal materials will reinforce the history in a contemporary way.

The following are examples of the type of public realm furnishings that should be used in developments that require these components:

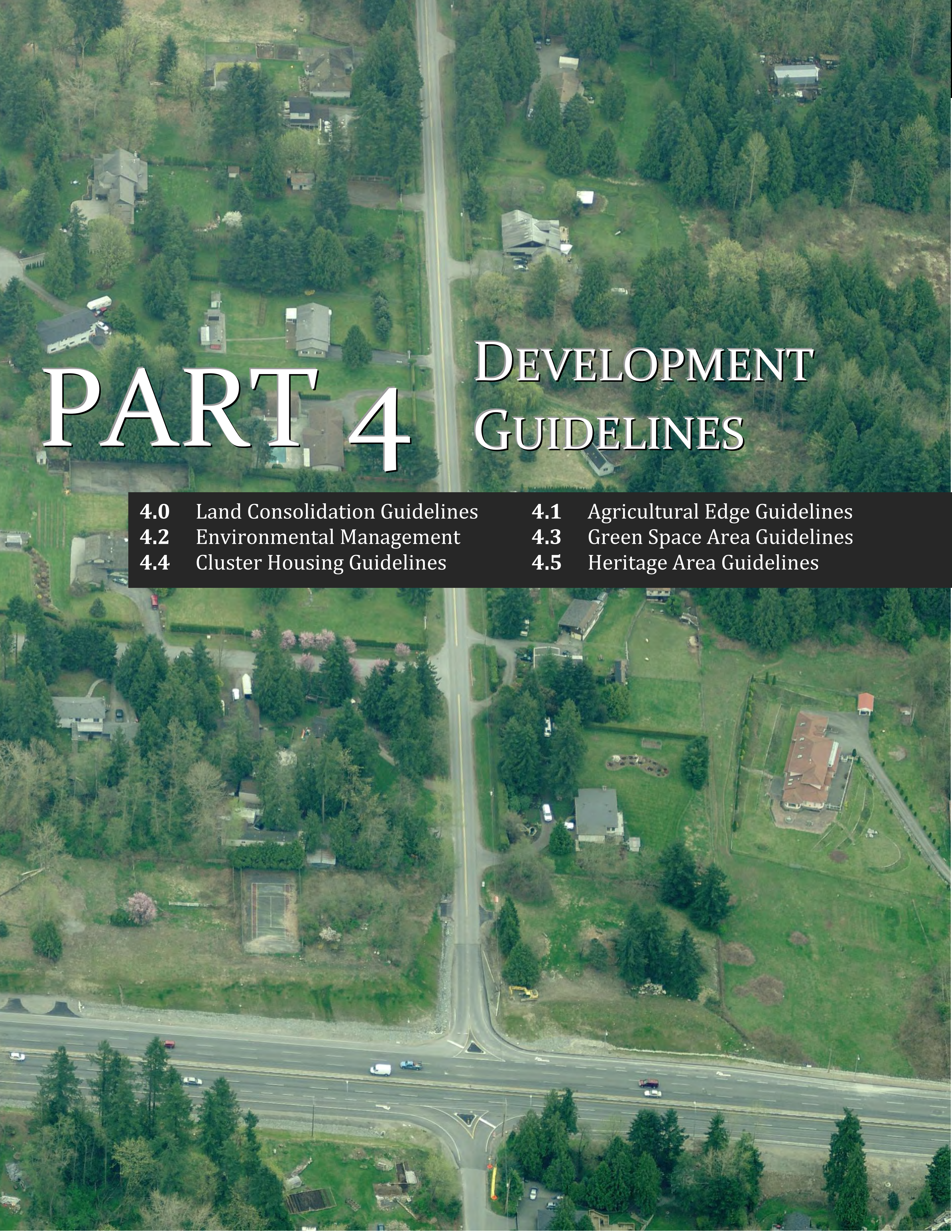
Overall Materials
- Wood, timber, tree rings
- Metal Finishes: Silver metal & metal grey
- Concrete

Benches
- Contemporary wood with grey metal finishes

Lighting
- Contemporary style, grey metal

Waste Receptacles
- Grey metal, simple contemporary design

Paving
- Rectilinear pattern
- Sawcut concrete joints
- Granite feature strips
- Large size stone or concrete pavers



PART 4 Development Guidelines

PART 4: DEVELOPMENT GUIDELINES

4.0 LAND CONSOLIDATION GUIDELINES

Land consolidation areas have been identified to advise future developers of consolidation requirements and to ensure feasible development areas which achieve an equitable distribution of road dedication, land development, and construction costs. Land consolidation may be required for:

- small acreage parcels;
- irregular shaped lots;
- encumbered properties with little development potential;
- cluster designation areas;
- sharing road construction costs;

Within the plan area there are a number of smaller acreage parcels and irregular shaped lots including several areas where lot consolidation is required in order to develop. These land consolidation opportunities can often be determined on a case-by-case basis at development application stage. In some cases, however, pre-determined consolidation requirements are identified in the Land Use Plan in order to avoid creating remnant pieces that could not develop on their own. These particular properties should be developed together through consolidation and land assemblies or through coordinated development.

Land consolidation areas also allow for a more equitable distribution of road dedication and construction costs amongst properties.

If land consolidation is not possible during the development process, the developer must:

- Demonstrate that the development potential of the excluded property is not compromised; and

- Share road construction costs amongst properties shown in the land consolidation area.

Consolidation areas are identified in **Table 4.0**, and shown in **Figure 4.0**; but not shown for Large Format retail areas which will also require lot consolidation on a site specific basis.

TABLE 4.0 - ANNIEDALE-TYNEHEAD NCP – LAND CONSOLIDATION AREAS

Parcel Information			Consolidation Objective(s)								Specific Site Considerations
*Consolidation (Figure 4.0) Area	# of Parcels	Total Area (Ha)	Small Acreage Parcel(s)	Irregular Shaped Lots	Encumbered Property	Cluster Housing	Sharing Road Costs	Limited Road Access	Park	Works & Services Sharing	
1	12	4.28	Y				Y			Y	Works and Services for Construction of 97 Avenue. Small lots Consolidated for Equitable Road Construction Costs.
2	5	2.23								Y	
3	3	1.94								Y	
4	3	1.38								Y	
5	3	1.55								Y	
6	5	1.82						Y		Y	
7	3	1.62	Y		Y				Y	Y	Maximize Density.
8	2	1.03								Y	
9	2	1.50						Y		Y	
10	2	1.53								Y	
11	2	1.62					Y	Y		Y	Arterial and Collector
12	3	2.86						Y		Y	Access from 180 Street
13	3	1.94								Y	Access from 182 Street
14	2	1.50		Y	Y					Y	
15	2	0.84			Y				Y		Multiuse Pathway in Hydro Corridor
16	3	1.25			Y		Y		Y		Road widening, and Small Lots
17	2	0.85								Y	
18	3	1.65			Y		Y	Y		Y	
19	2	2.15								Y	Statutory Right of Way, Works
20	2	6.00				Y					Tree and natural area preservation
21	2	4.49			Y	Y					Natural and Riparian Area Preservation
22	5	2.66	Y			Y	Y			Y	Tree and natural area preservation. Road construction and Access
23	2	1.62					Y			Y	Three road Frontages
24	6	2.81					Y			Y	Paired Lots, Double Frontage
25	4	1.85					Y			Y	
26	2	4.06				Y	Y			Y	Tree and natural area preservation.
27	2	4.06				Y	Y			Y	Tree and natural area preservation.
28	3	3.59					Y				
29	2	0.96					Y				Collector Road. Industrial Service Road
30	3	3.72			Y	Y					Riparian / Flood Plain Protection
31	2	4.75			Y	Y					Riparian / Flood Plain Protection
32	2	4.12				Y					Riparian / Flood Plain Protection
33	2	2.05				Y				Y	Riparian / Flood Plain Protection
34	3	1.62					Y				Construction of Road Frontage along 172 Street
35	2	1.87			Y	Y					Riparian Protection
36	4	3.83				Y	Y		Y	Y	Tree and natural area protection, and collector Road construction.
37	4	2.05					Y	Y			

Parcel Information			Consolidation Objective(s)								Specific Site Considerations
*Consolidation (Figure 4.0) Area	# of Parcels	Total Area (Ha)	Small Acreage Parcel(s)	Irregular Shaped Lots	Encumbered Property	Cluster Housing	Sharing Road Costs	Limited Road Access	Park	Works & Services Sharing	
38	2	2.02				Y	Y			Y	Ag Buffer / Density Transfer / 92 Ave
39	3	1.62			Y	Y	Y			Y	Ag Buffer / Density Transfer / 92 Ave / Riparian Protection
40	3	1.84				Y	Y			Y	Ag Buffer / Density Transfer / 92 Ave
41	2	2.02			Y	Y	Y			Y	Ag Buffer / Density Transfer / 92 Ave / Riparian Protection
42	4	3.43					Y			Y	Ag Buffer / School Site / Shared Road Costs
43	2	1.73				Y	Y				Ag Buffer / Tree Protection / Road Access
44	3	3.18				Y	Y			Y	Ag Buffer / Tree Protection / Road Cost
45	4	1.37						Y			
46	3	1.23					Y	Y			
47	4	1.64					Y	Y			
48	3	1.22					Y	Y			
49	2	1.98	Y				Y				
50	3	5.73	Y		Y	Y	Y				Tree Protection / Riparian Areas / Soils
51	3	3.68	Y				Y				
52	4	1.80					Y				Arterial and Collector Roads
53	3	1.53					Y	Y			
54	5	2.00					Y	Y		Y	Industrial Service Road (Collector)
55	5	6.07				Y	Y	Y		Y	Density Transfer for Ag Buffer / Tree Protection / Steep Slopes / Access
56	3	6.29				Y	Y	Y		Y	Density Transfer for Ag Buffer / Tree Protection / Steep Slopes / Access
57	2	5.95				Y	Y	Y		Y	Density Transfer for Ag Buffer / Tree Protection / Steep Slopes / Riparian
58	2	6.04				Y	Y	Y		Y	Density Transfer for Ag Buffer / Tree Protection / Steep Slopes / Riparian
59	2	4.99				Y	Y	Y		Y	Density Transfer for Ag Buffer / Tree Protection / Steep Slopes
60	2	4.44				Y	Y	Y		Y	Density Transfer for Ag Buffer / Tree Protection / Steep Slopes
61	3	6.06				Y	Y	Y		Y	Density Transfer for Ag Buffer / Tree Protection / Steep Slopes / Riparian
62	2	0.86			Y	Y	Y				Riparian Area / Tree Protection / Access
63	2	1.29			Y	Y	Y				Special Road / Riparian Area / Tree Protection
64	3	1.62					Y				
65	2	4.05					Y	Y		Y	School Site Access
66	3	2.00	Y				Y			Y	
67	2	4.04				Y	Y				Road Costs
68	2	0.81					Y			Y	
69	2	0.81					Y			Y	
70	3	1.66					Y			Y	

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Legend

AnnidaleTynehead StudyArea

Land Consolidation Areas

Anniedale-Tynehead NCP

Lot Consolidation Strategy

Figure 4.0

0 250 500 1,000 Meters

The accuracy and completeness of infromation shown on this drawing is not guranteed. It will be the responsibility of the user of the information shown on this drawing to locate and establish the precise location of all existing information, whether shown or not.

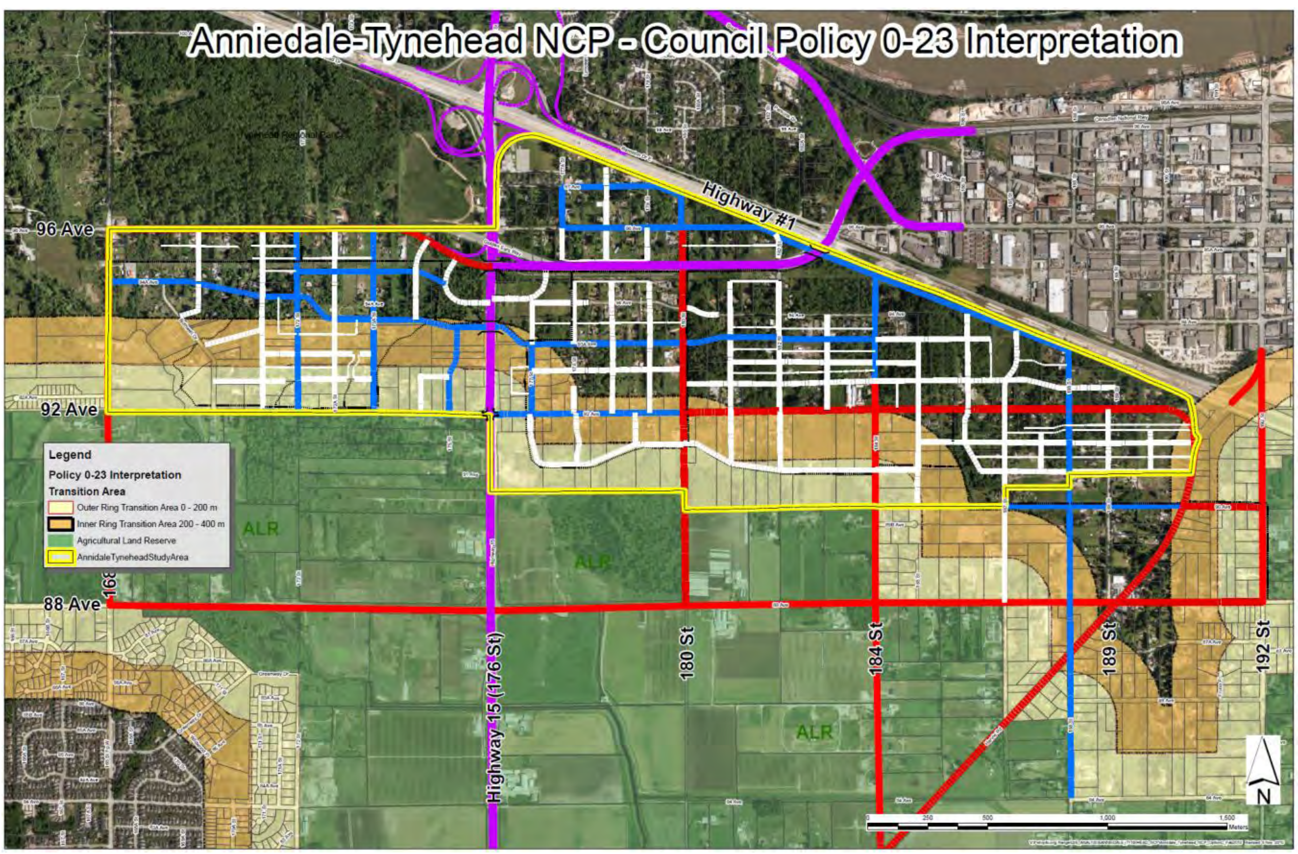
V:\Policy&Long V:\Policy&Long Range\GIS_ANALYSIS\ANNIEDALE_TYNEHEAD_NCP\Annidale_Tynehead_NCP_OptionC_2010\Projects\Anniedale Tynehead Green Space - OPTION C Revised 3 Oct. 2011

4.1 AGRICULTURAL EDGE GUIDELINES

The City of Surrey's Official Community Plan (OCP), designates a development permit area (DPA) for "the protection of farming" to improve land use compatibility, containing regulations and policies for screening, landscaping, fencing and siting of buildings or structures near the Agricultural Land Reserve (ALR). These regulations provide for buffering or separation of development from farming areas.

City Policy number O-23, "Residential Buffering Adjacent to the ALR/Agricultural Boundary", identifies a typical transition area and provides for base densities of 1-2 units per acre within the Outer Ring Transition Area of 200 metres from the ALR boundary and densities of approximately 4 units per acre within the Inner Ring Transition Area of at least 400 metres of the ALR boundary as identified below; however, densities have been bonused to 4-6 units per acre cluster for areas in Tynehead transition area along 92 avenue, and 10-15 units per acre cluster below 92 avenue in Anniedale for future extended green space amenities and larger landscape buffers.

Given the specific topographical conditions and configuration of this part of the NCP, densities are proposed to be increase proportionally with ALR buffering and increased green space preservation requirements (40-50%) in these areas. This change in elevation between the proposed urban properties and the ALR creates a natural physical separation between the two areas. As a result the net densities were increased somewhat for long properties extending from the ALR above the ridgeline.



Urban-Agricultural Edge Development Guidelines

Objective:

Different Urban-ALR interface conditions require specific design solutions in order to mitigate potential for edge conflicts between farm and non-farm uses. Several buffer areas within the Plan are shown in **Figure 4.1**. The buffer requirements in these areas are based on Surrey's Official Community Plan Specifications, as well as landscape buffer types developed by the Agricultural Land Commission and Ministry of Agriculture, published as the Landscaped Buffer and Edge Planning Specifications, but modified to fit the specific land use and site conditions in the Anniedale-Tynehead NCP area.

Application

Prior to beginning a subdivision or development on lands adjoining the ALR or separated by a right-of-way, a statutory right-of-way or a dedicated road, the owner must:

1. Obtain a development permit in accordance with the Surrey's Agricultural Development Permit Area (DPA) Guidelines.

2. Include an assessment of the site, substantiate the need for a buffer and provide design measures that are most appropriate for the site, considering the type and intensity of the urban use and its relationship to farm uses.

3. Provide a plan to the Surrey Agriculture and Food Security Advisory Committee (AFSAC) regarding agricultural viability, issues, and plans to mitigate potential conflict between farm and non-farm uses near the ALR Boundary related to the specific development application.

General Development Guidelines

1. Retain and enhance natural buffer features along the urban side of the ALR boundary (eg. Riparian areas, Ravines, treed areas, steep slopes >15%, wetlands, floodplain areas and high value vegetation through means such as cluster housing and parkland dedication.

2. Where natural buffers are not identified or feasible, create buffers and/or compatible uses on the urban side of the ALR boundary (eg. Roads, railways, hydro right-of-ways, berms, fences, open space and rain-water management facilities and features.

3. Where appropriate, and where it is unlikely to create conflicts with farming; consider incorporating passive recreation such as parks, and trails into the landscape buffer. With this approach the depth of the buffers should be increased to a minimum 20 meters in width.

Subdivision and Building Design

Buildings and structures may not be built within buffer areas;

- Road endings and road frontages next to the ALR should be avoided except as may be needed for access by farm vehicles.

- Subdivision layout and construction should minimize erosion,
- Maintain ground water quality and levels through adequate rain-water management, both during and after construction.
- Residential and institutional building construction will include triple pained windows within 300 m of the Agricultural Land Reserve.
- Consider Clustering buildings and structures away from the ALR to provide larger continues landscape buffers in return proportional density transfer.

Buffer Width and Building Setbacks

See Table 4.1 for detailed minimum Buffer width and Building Setback Requirements for specific special buffer areas identified in **Figure 4.1**. If not otherwise indicated in **Table 4.1** , the minimum separation distance between Residential and Institutional uses and the ALR boundary shall be as indicated in the Land Use Plan in the Cluster Residential Areas as Green Space Transfer Areas, but in no case should the building setback be less than a be 37.5 m and the buffer width be less than 30 m.

Buffer Design

- The buffer design type that is appropriate at each development site will be determined on a case-by-case basis, based on each site's interface conditions. In general however Landscape Buffers should:
  - Be designed for mature height of a minimum 6 m and a minimum crown density of approximately 60% and contain a minimum of 60% native conifers to collect dust and/or spray drift.;

- Contain a majority of the plant material that is low maintenance, indigenous vegetation that can survive with little or no fertilizers.

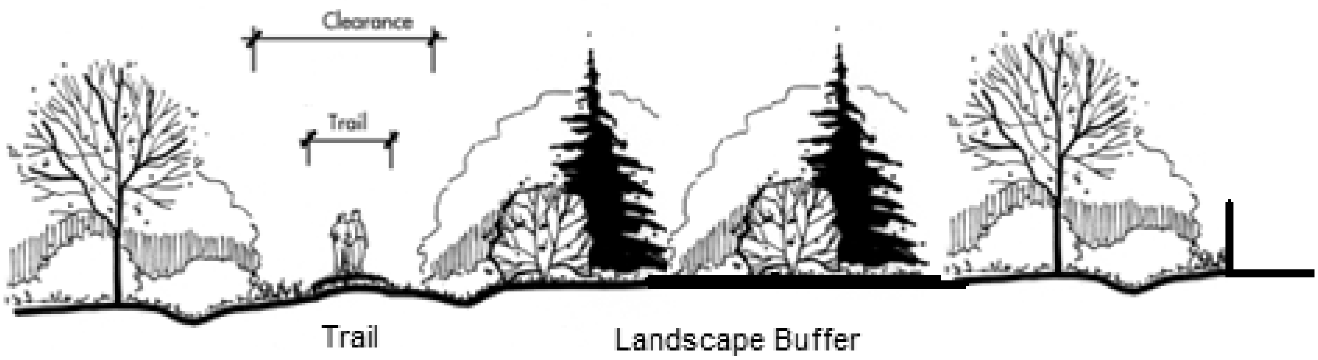
- Buffer planning and layout will follow Schedule A of the MOA Edge Planning Guide:
  - No gaps in buffer, about 50% of screen is air space;
  - Fence design will follow Schedule D of ALC Landscape Buffer Specifications;
  - Plant material may be selected from lists in Schedules C of the MOA Edge Planning Guide;
  - Wherever feasible buffer is installed prior to commencing building construction;
  - Buffer maintenance plan developed and signed off by a registered landscape architect or professional biologist and the developer must provide security for at least 5 years to maintain the planting.

- A Section 219 covenant and appropriate financial security agreements are required to maintain the buffer on private lands until trees and plants are free growing (Minimum 5 Years);

- Rain water management facilities and features such as Detention ponds, ditches, swales and other similar elements must be designed and approved by an appropriately qualified professional.

Recreation and Trail Design

- Where walkways or bikeways form part of the landscape buffer, they may occupy no more than one fifth of the buffer width or no more than 4 meters, and must be located a minimum 16 meters away from the edge of the agricultural land to not reduce the effectiveness and primary purpose of the landscape buffer.

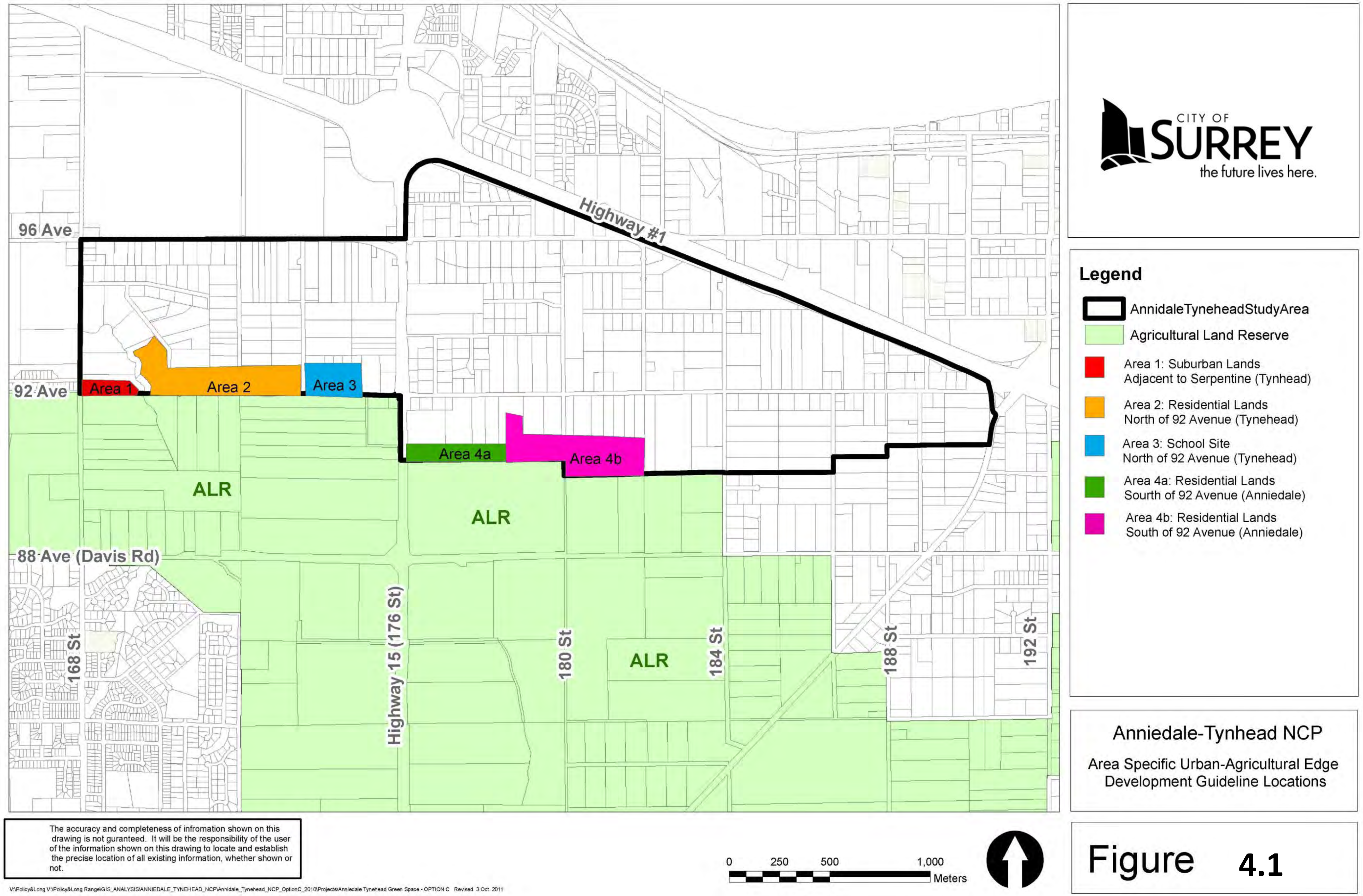


Communication

- Register a Covenant on property titles within 300 m of the ALR to inform potential home purchaser that farm operations are in the area and that farm practices such as noise, odour and dust should be expected during certain times of the year as part of acceptable farm practices.

- Develop subdivision agreement as part of development approval requiring the Registering of a Restrictive Covenant on lots adjacent to ALR to advise of Agricultural practices and "Right-to-Farm Act" legislation: "The develop agrees to advise the purchaser, and future tenants, that noise, dust and odour associated with nearby farm operations my occasionally affect some activities of dwelling occupants".

- In addition to disclosure statements, consider using signage along the ALR boundary that informs residents and prospective purchasers of the proximity of farm operations within the immediate area and the possible activities associated with farm operations: "You are next to an active farming area. This buffer has been planted for the benefit of both you and our farmers. The buffer helps to:
  - lessen the impacts from farming activities;
  - protect farmers' property from trespass & litter; and
  - provide wildlife with a source of food & shelter.


96 Ave
92 Ave
88 Ave (Davis Rd)
Highway #1
Highway 15 (176 St)
168 St
180 St
184 St
188 St
192 St
Area 1
Area 2
Area 3
Area 4a
Area 4b
ALR
ALR
ALR
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Legend
AnnidaleTyneheadStudyArea
Agricultural Land Reserve
Area 1: Suburban Lands Adjacent to Serpentine (Tynhead)
Area 2: Residential Lands North of 92 Avenue (Tynehead)
Area 3: School Site North of 92 Avenue (Tynehead)
Area 4a: Residential Lands Sourth of 92 Avenue (Anniedale)
Area 4b: Residential Lands South of 92 Avenue (Anniedale)
Anniedale-Tynhead NCP
Area Specific Urban-Agricultural Edge Development Guideline Locations
Figure 4.1
The accuracy and completeness of infromation shown on this drawing is not guranteed. It will be the responsibility of the user of the information shown on this drawing to locate and establish the precise location of all existing information, whether shown or not.
0 250 500 1,000
Meters

AREA SPECIFIC URBAN-AGRICULTURAL EDGE: DEVELOPMENT GUIDELINES

SITE LOCATION	MINIMUM BUILDING SETBACK	MINIMUM BUFFER WIDTH	BUFFER DESIGN / OWNERSHIP	ROAD INTERFACE DESIGN	RESIDENTIAL DENSITY
Area 1: Suburban Lands Adjacent to Serpentine (Tynehead)	• Minimum Residential Building Setback 37.5 m from ALR Boundary *See Design Cross Section Figure 4.2s*	• 10 m planted unopened ROW along ALR Boundary • 6 m planted landscape forming part of 16 m local Road (92 Avenue).	• Landscape Buffer component planted according to MOA – Agricultural Edge Planting Guidelines. • Landscape Buffer Component within existing and future City owned Road Right-of-way.	• 10 m unopened Road ROW • 16 m Local Road with Rural Cross section adjacent to ALR with Ditch or drainage swale and 7.5 m vegetated buffer designated as parkland.	• Suburban Cluster 2 UPA
Area 2: Residential Lands North of 92 Avenue (Tynehead)	• Minimum Residential Building Setback 53.5 m from ALR Boundary *See Design Cross Section Figure 4.3*	• 21 m 92 Avenue Collector Road ROW adjacent to ALR • 7.5 m Planted Landscape Buffer adjacent to 92 Avenue ROW (Parkland) • 20 m Green Open Space Area adjacent to 7.5 Landscape Buffer (Parkland)	• 7.5 m Landscape Buffer component planted according to MOA - Agricultural Edge Planting Guidelines. • Inside 20 m of buffer area in Green Space Transfer Location may be used for Passive Recreational activities such as walkways, parks and/or garden as part of City Linear Park System. • Green Open space could be designed with water retention capacity or adequate rainwater management systems.	• 21 m Collector Road with Rural Cross section adjacent to ALR with Ditch or drainage swale. • Consider a 4 m wide Greenway and additional street trees in Road-Right-of-way forming part of buffer.	• Low Density Cluster 4-6 UPA • Locate highest density units away from ALR edge.
Area 3: School Site North of 92 Avenue (Tynehead)	• Minimum School Building Setback 37.5 m from ALR Boundary	• 21 m 92 Avenue Road ROW 92 adjacent to ALR; • 7.5 m Planted Landscape Buffer adjacent to 92 Avenue ROW	• Landscape Buffer component planted according to MOA – Agricultural Edge Planting Guidelines. • Buffer planted and maintained by School District.	• 21 m Collector Road with Rural Cross section adjacent to ALR with Ditch or drainage swale. • Consider a 4 m wide Greenway and additional street trees in Road-Right-of-way forming part of buffer.	• N/A
Area 4a: Residential Lands South of 92 Avenue (Anniedale)	• Minimum Residential Building Setback 37.5 m from ALR Boundary *See Design Cross Sections Figure 4.4 and 4.5*	• 30 m Planted and/or Natural Landscape Buffer (Parkland)	• Buffer provided as Parkland and provided as Green Space through (Density Transfer). • Cost allocation for Park Maintenance securities and ensure capital funds for Buffer installation and maintenance.	• N/A	• High Density Cluster 10 – 15 UPA; • Locate highest density units away from ALR edge.
Area 4b: Residential Lands South of 92 Avenue (Anniedale)	• Minimum Residential Building Setback varies depending on amount of Green Space Transfer Area. Minimum 107.5 m towards the west, and up to maximum 207.5 m towards the east. Reference Planning map for details. *See Design Cross Section Figure 4.6*	• Between 100-200 m Planted and/or existing natural vegetation as identified by Green Space Transfer Area Mapping.	• Open space components of Buffer could be designed with water retention capacity or adequate rainwater management systems. • Prioritize preservation of existing high value vegetation.	• 20 m Local (Lakiotis Road) may form a portion of the Buffer Area in certain Areas.	• High Density Cluster 10 – 15 UPA; • Locate highest density units away from ALR along or near 92 Avenue.

Anniedale-Tynehead NCP: Urban-Agricultural Edge Development Guidelines

Table **4.1**

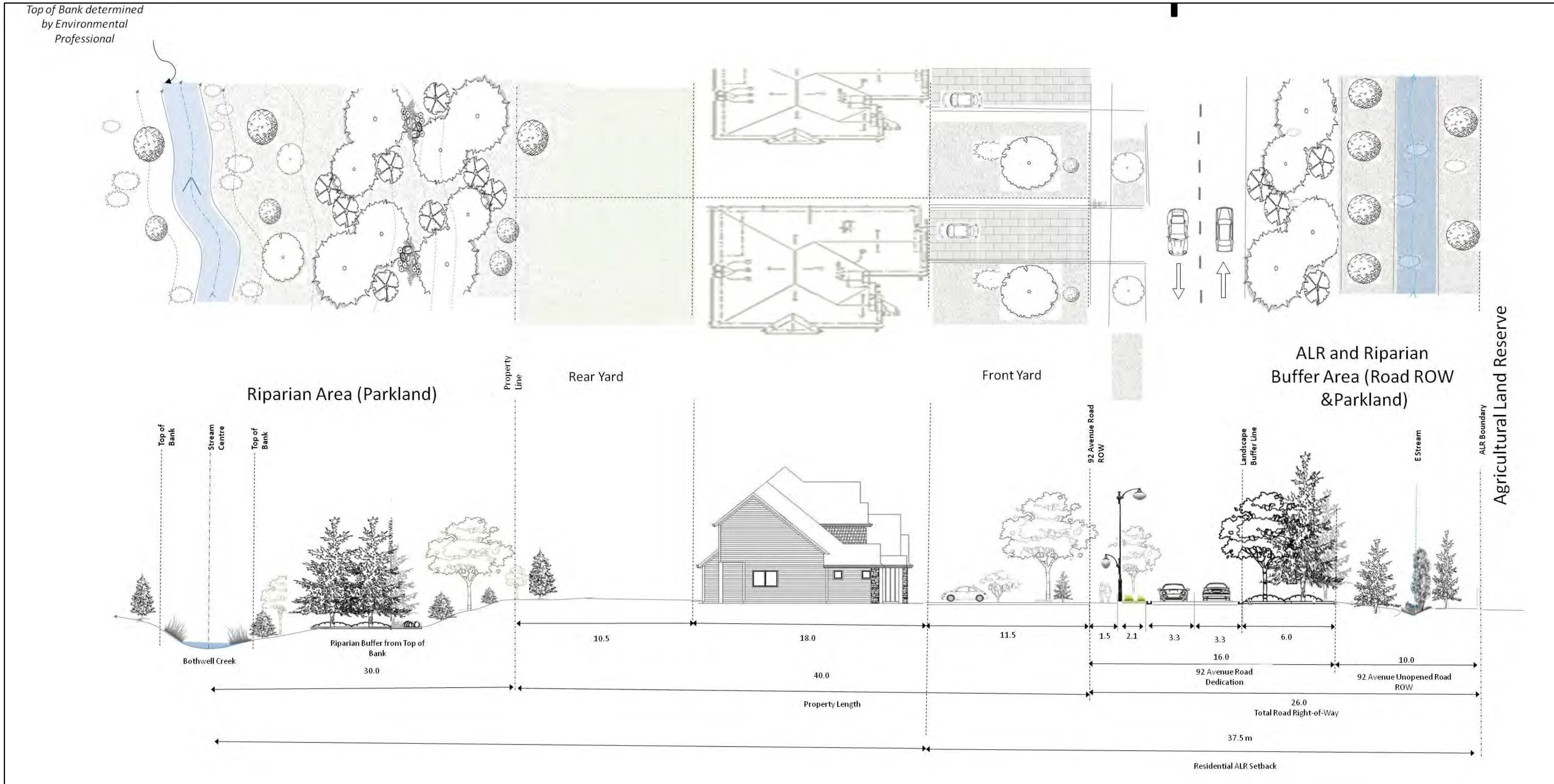

FIGURE 4.2

AREA 1:

Residential Interface along ALR Edge in Suburban Cluster Area at the South West Boundary. (Tynehead)

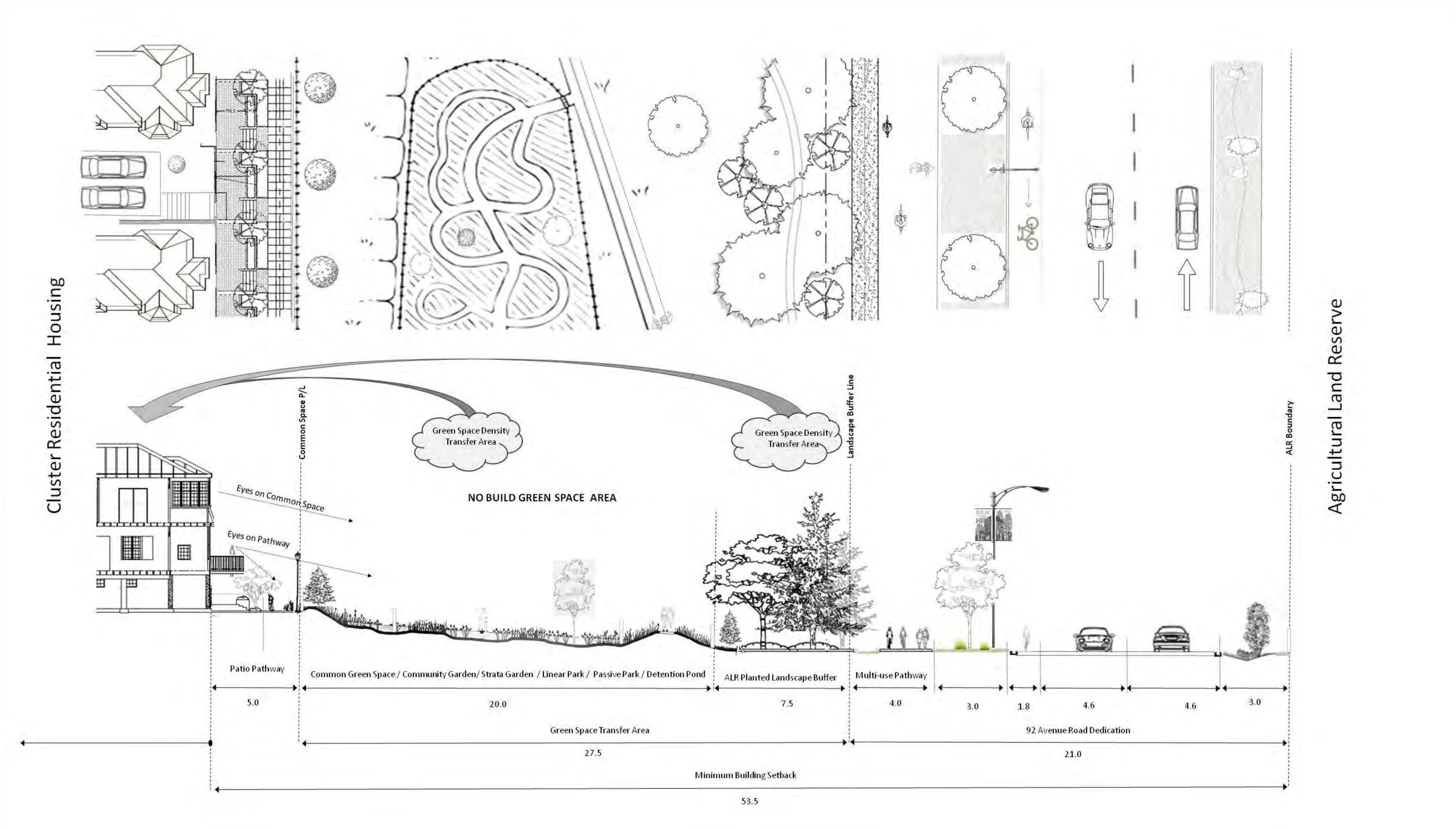

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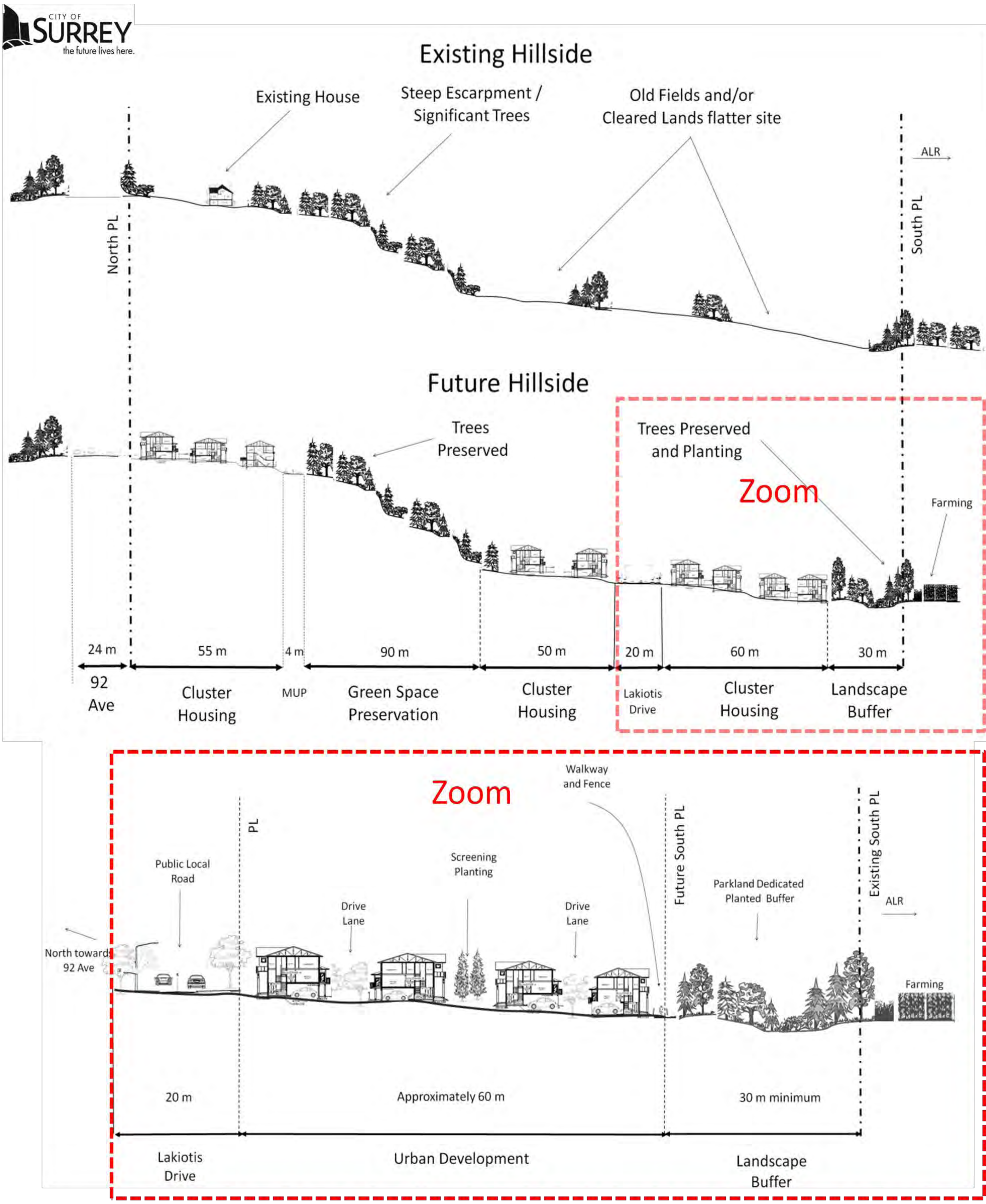
FIGURE 4.3

AREA 2:

Residential Interface along ALR Edge with 92 Avenue Road Separation.(Tynehead)



Anniedale-Tynehead NCP	Cluster Housing Lands South of 92 Avenue - Anniedale — West	Figure 4.4 AREA 4a

FIGURE 4.5

AREA 4a:

Cluster Residential Escarpment Interface along ALR Edge south of 92 Avenue minimum 30 meter Buffer (Anniedale-West)

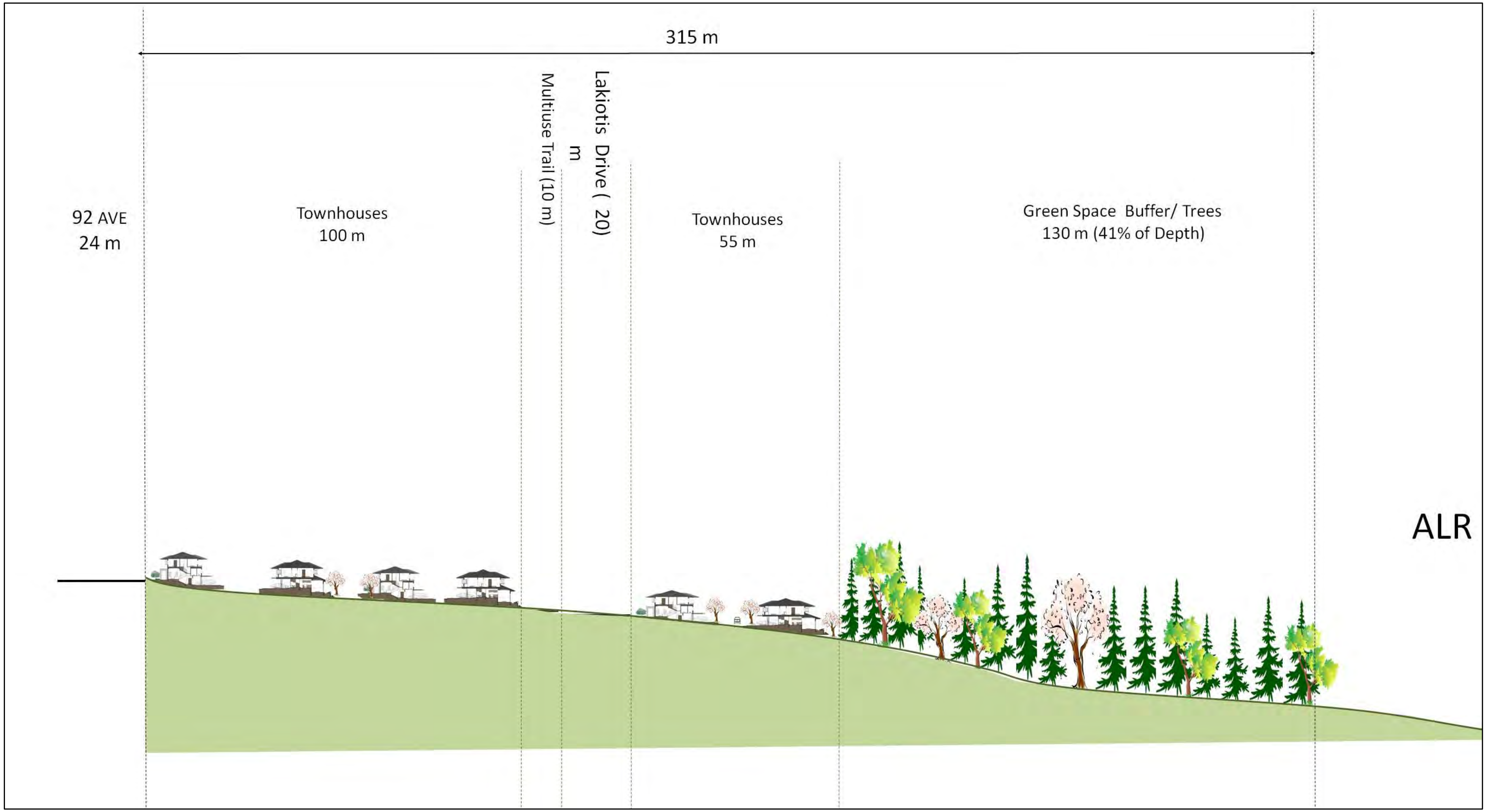


FIGURE 4.6

AREA 4b:

Cluster Residential Escarpment Interface along ALR Edge south of 92 Avenue minimum 100 meter + Buffer

(Anniedale-West)

4.2 ENVIRONMENTAL MANAGEMENT

Rapid urbanization, has resulted in significant impacts on the natural environment, including the alteration of habitats, an increase in the numbers of plant and animal species 'at risk', and a decline in air and water quality. Maintaining a healthy natural environment during urban and land development benefits each of us in many ways.

A healthy environment enhances the quality of life for the whole community and benefits local governments by providing free 'ecosystem services' such as rainwater management and maintenance of clean air. The use of good environmental practices and environment-friendly techniques by the development community can reduce costs and produce superior developments that have higher market value. Implementing good environmental practices also ensures compliance with federal and provincial legislation and demonstrates due diligence in environmental protection and stewardship.

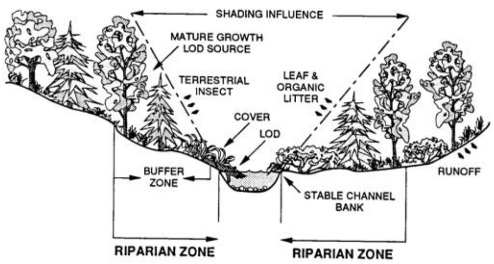
The following provides guidelines for:

A. Protection of Aquatic Habitat;
B. Species at Risk and Regional Significant Species;
C. Wildlife Hubs and Corridors;
D. High Value Vegetation, Trees and Rare Plant Species; and
E. Ecologically Significant Areas.

For more detailed information please refer to Provinces Develop with Care document and its contents which describes the Ministry's approach to results-based management and also City of Surrey Environmental Policy and Bylaws.



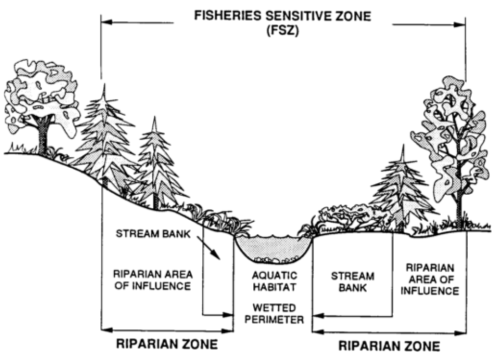

A. Protection of Aquatic Habitat



Riparian Buffer Zone

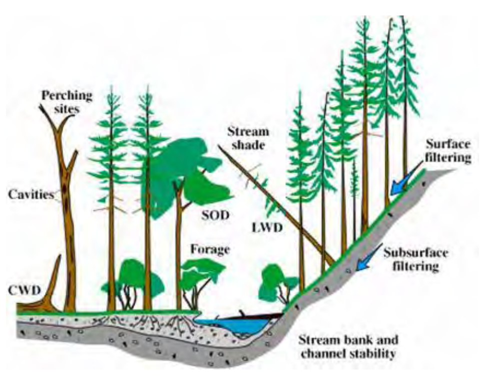
The primary objective of leave strips is to protect the riparian zone, which is critical to the maintenance of a healthy aquatic environment. Riparian zones, located next to streams, rivers, lakes and wetlands, have direct influence on aquatic habitat values. They can broadly be described as the area of the streambank, including any side channels and associated banks, and the area of influence, which contains upland areas not normally inundated during high water conditions.

Leave strips should be provided on all watercourses that flow into or contain fish or fish habitat. This may include wetlands, ponds, swampy areas or other intermittently wetted areas, small streams, side channels and ditches which may not flow throughout the entire year (ephemeral). The leave strip also helps to protect private property from flooding and potential loss of land due to stream erosion and instability. The riparian zone has characteristics that protect and nurture quality aquatic fish habitat. Disturbance or destruction of the riparian zone can have serious impacts to both the short and long-term viability and productivity of fish and fish habitat.



Riparian Setbacks

Under the existing City of Surrey bylaws, the degree of protection afforded to drainages is dependent on stream classification and the density of proposed development.



The maximum 30 m buffers are indicated in the Madrone Environmental Study mapping due to the fact that top of bank is undetermined and future zoning and other detailed on site stream assessments are unknown. The density of development adjacent to more significant fish habitat (e.g. the Serpentine River and Bothwell Creek) is less than 6 units per hectare, that the stream would receive a riparian setback of 15 metres, as per current City of Surrey bylaws. But, due to, City of Surrey Official Community Plan Policy, the significant sensitivity of the habitat, floodplain considerations and the considerable site potential for the development of riparian habitat, the setback should be no less than 30 m from top of bank for the Serpentine River and its direct tributaries regardless of the proposed density of development.

"Petitions for variances to Riparian leave strip widths and any watercourse classification or location changes may be considered but must include site specific Environmental Assessment from a Qualified Environmental Professional . Setback or stream reclassifications must be approved by the Department of Fisheries and Oceans (DFO) and Ministry of Environment (MOE), through the City of Surrey Environmental Review Committee (ERC)."

Permanent Protection of Leave Strips

The leave strip should be permanently protected using one of the following methods:

- Dedication as park, by return of the land to the Crown in the name of the City of Surrey;
- re-zoned as a protected natural area or reserve status;
- secured with restrictive covenants; or
- secured with a combination Statutory Right-of-Way and Restrictive Covenant.

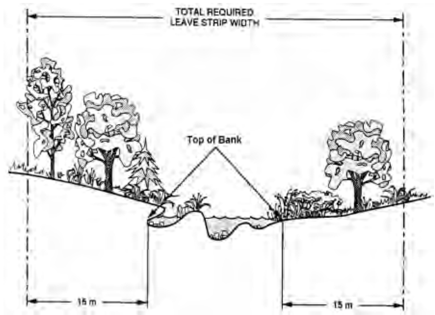
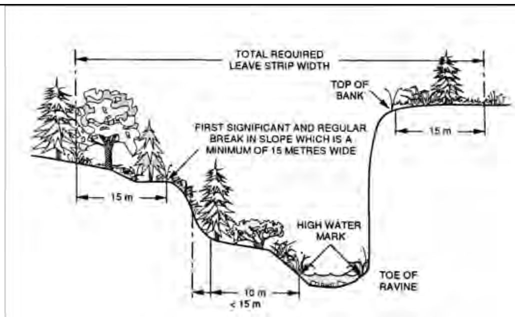
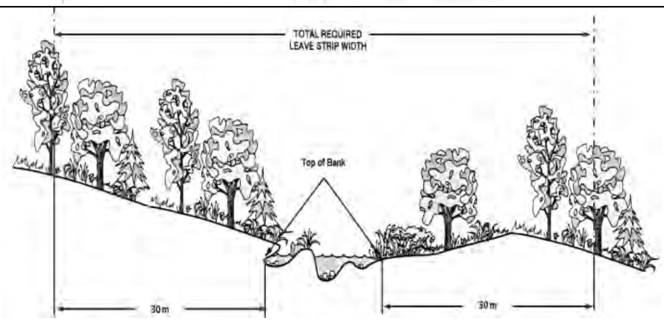
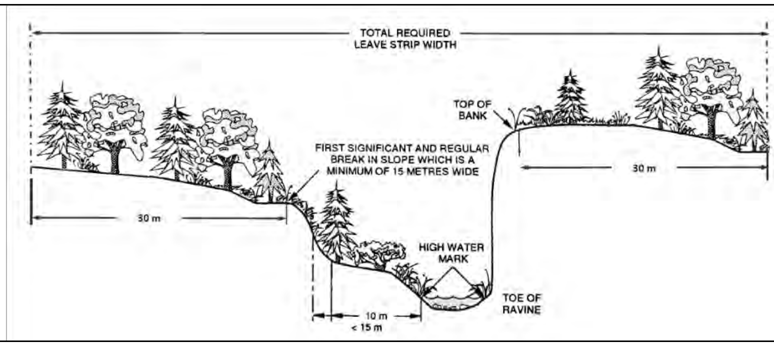
Determining Leave Strip Widths

Minimum leave strip widths for riparian zone protection can be established with these guidelines. The Top of Bank must first be determined; and then the widths specified are measured from that Top of Bank.

They are measured perpendicular to and away from the stream bank, for the distance specified, on both sides of the stream. These are suggested minimum widths and may be altered by DFO/MOE staff to suit onsite conditions.

See **Figure 4.7** for recommended minimum leave Strip widths.

FIGURE: 4.7 MINIMUM REQUIREMENTS FOR RIPARIAN LEAVE STRIPS

	Proposed Land Use Type, or Density	Minimum leave strip width	Leave Strip Illustration
LOWER INTENSITY RESIDENTIAL LAND USES	**Lower Density Residential Development Areas < 6 Units Per Acre**	***15 Meters on each side of watercourse from top of bank** *Give careful consideration to establishing the existing top of bank in wide flood plain or multi-channel areas, and features such as floating vegetation mats, undercut banks and seasonally dry areas.*	
LOWER INTENSITY RESIDENTIAL LAND USES	**Lower Density Residential Development Areas <6 Units Per Acre** Watercourse with steeply sloped topography	*If the distance from the high water mark to the toe of the slope is less than 15 meters, then the leave strip should be located at the first significant and regular break in slope which is a minimum of 15 meters wide.	
HIGHER INTENSITY LAND USES	**Commercial/ Industrial/ Business Park/Higher Density Residential Areas >6 Units Per Acre**	***30 Meters on each side of watercourse from top of bank** *Give careful consideration to establishing the existing top of bank in wide flood plain or multi-channel areas, and features such as floating vegetation mats, undercut banks and seasonally dry areas.*	
HIGHER INTENSITY LAND USES	**Commercial/ Industrial/ Business Park/Higher Density Residential Areas >6 Units Per Acre** Watercourse with steeply sloped topography	If the distance from the high water mark to the toe of the slope is less than 30 meters, then the leave strip should be located at the first significant and regular break in slope which is a minimum of 30 meters wide.	

Refer to **Figure 4.8 for Drainage Buffer Widths required along the Serpentine and its direct tributatries.*

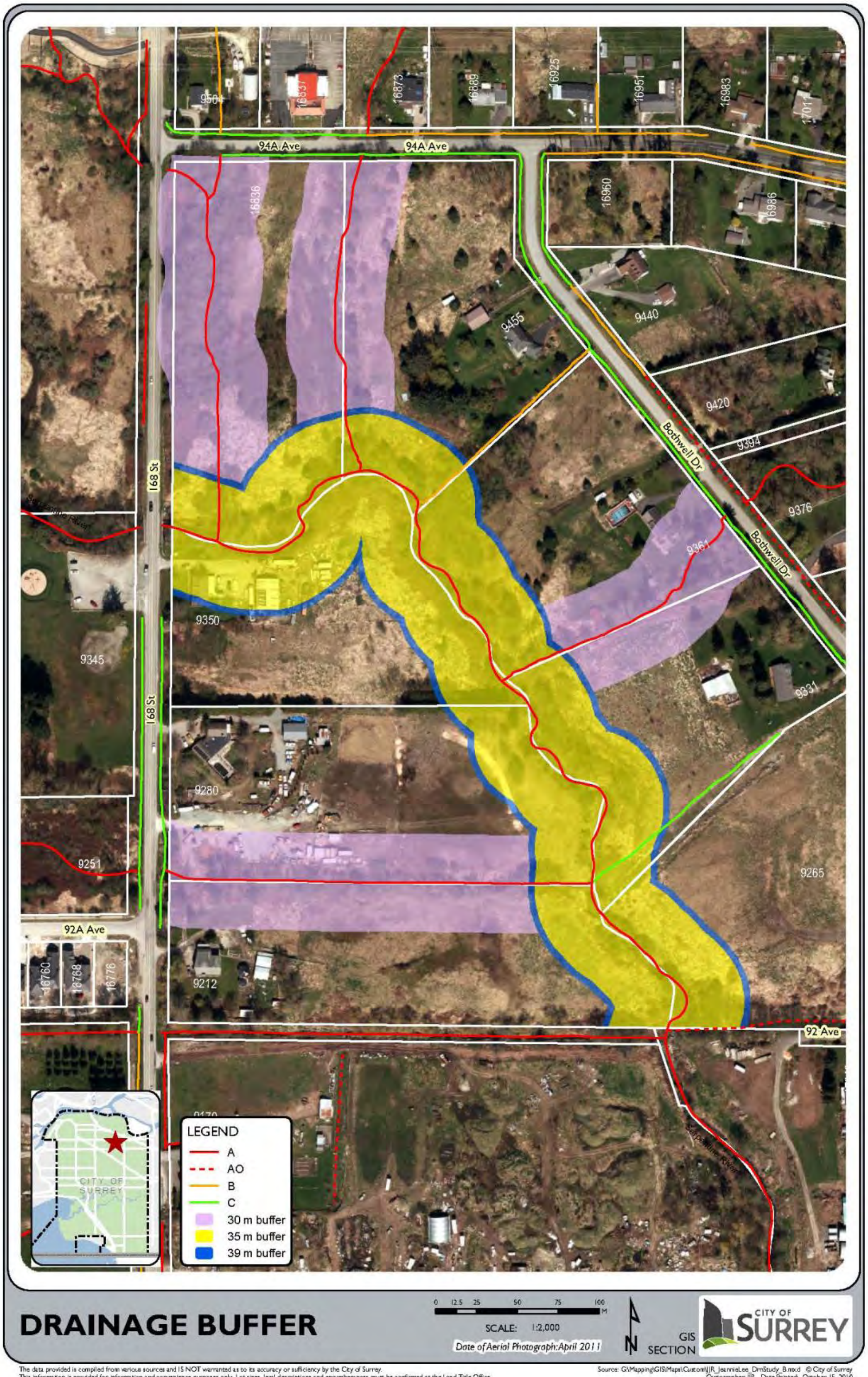


Figure 4.8

This map identifies the Minimum buffer widths required along the Serpentine River and its tributaries.

Buffer widths range from 39 m along the Serpentine River and 35 meters along its direct tributaries no matter the density or type of development.

General Opportunities for Fish Habitat Improvements

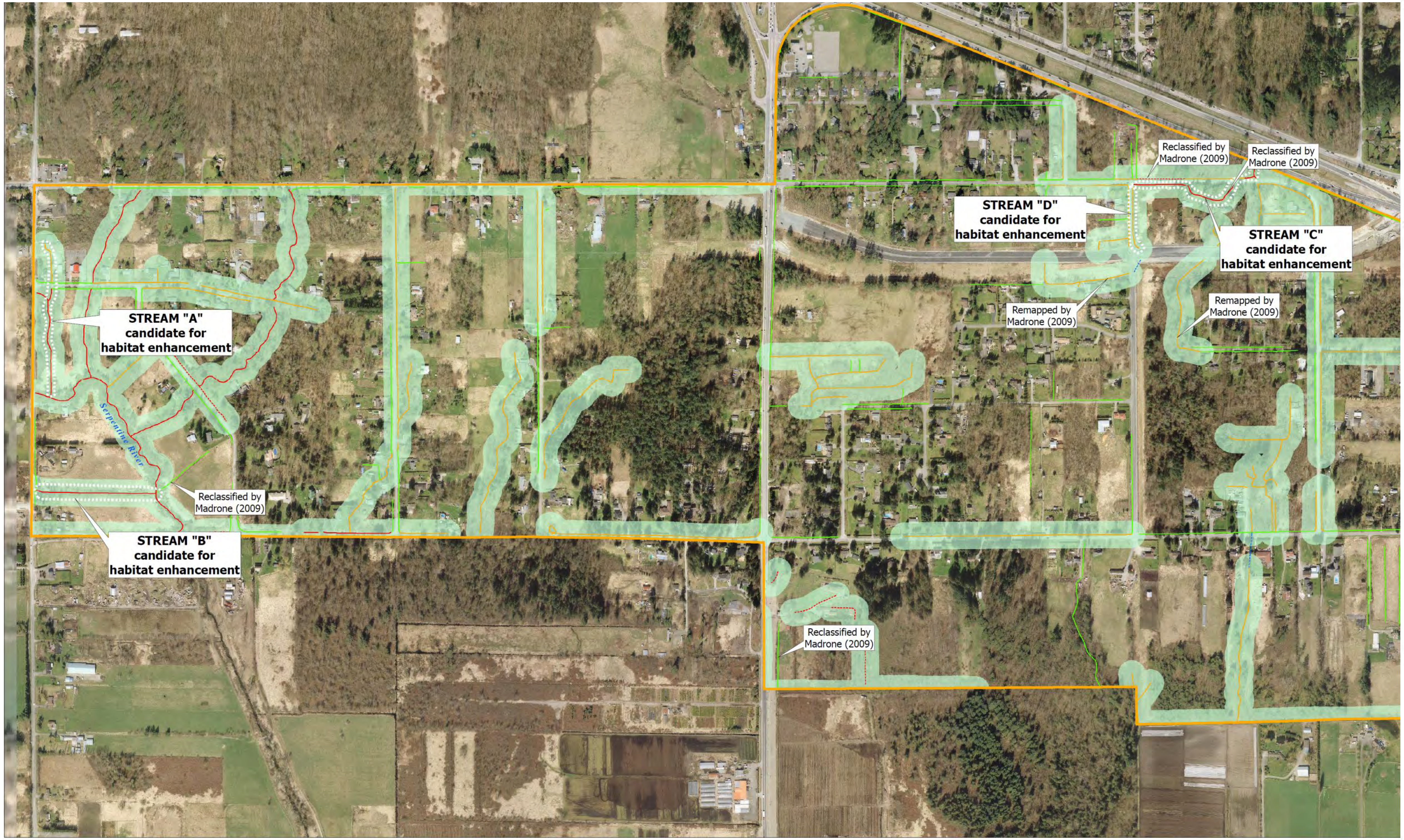
It is likely that habitat enhancement opportunities occur throughout areas of existing fish habitat (e.g. the mainstem Serpentine River). Instream modifications would lead to increased habitat diversity and an associated increase in fish productivity. Instream habitat enhancement projects that would be of benefit include (but are not limited to): log bank cover construction, rock/log weir construction, strategic instream boulder placement, gravel catchment/placement, installing wing/flow deflectors, LWD placement and off channel habitat development.

Riparian planting (including planting to increase bank stabilization) would be a habitat improvement option adjacent to existing fish habitat. For example, where it flows through the study area, the Serpentine River is currently associated with a riparian zone that offers limited biological function, largely due to the narrow treed riparian strip. The existing green space adjacent to the treed riparian zone of the Serpentine River results in the potential for improvement and the establishment of a wider functioning riparian zone.

Specific Opportunities for Fish Habitat Improvements

Restoration and/or enhancement of fish habitat would be most beneficial in areas that are known to currently support fish, or in immediately adjacent areas with sufficient potential (e.g. adequate water availability). To attempt to restore or enhance the majority of any of the Class B and Class C drainages on site (non fish-bearing systems) would be expensive and likely prone to failure. Marginal habitat that currently supports fish can be improved in several locations, which would result in increased fish productivity.

Figures 4.9 display the four candidate areas (labeled “A” to “D”) that were identified in the Madrone Environmental Study as having the most potential for habitat restoration and enhancement. In all cases, the habitat enhancement/restoration that is described in the Madrone report represents suggested measures that would require detailed design prior to implementation.



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Anniedale-Tynehead NCP

Riparian Areas

Restoration Opportunities

Figure **4.9**

B. Develop with Care Practices: Species at Risk and Regional Significant Species

Develop with Care best management practices should be integrated into development planning process. Enshrining long-range habitat protection measures is a necessary backstop for threatened species habitat protection and recovery. Areas of better management practices for species that may pertinent to the study area are drawn from MoE's Develop With Care series and the guidelines should be considered at all stages of the land development process, specifically for:

- **Pacific Water Shrew**
- **Raptors and Owls**
- **Amphibians**
- **Salmon and Trout**

C. Wildlife Hubs and Corridor Management

Recommendations for wildlife hubs and corridors are built on the results of wildlife habitat suitability ratings in conjunction with the results from the vegetation and ecosystem ratings in Madrone Environmental report. **Figure 4.10** Vegetation Ranking and Wildlife Corridor Opportunities Map which illustrates our recommendations for best potential wildlife hubs and travel corridors. This can be thought of, in effect, as a "fine filter" approach to habitat conservation. That is, if the life history needs of the focal species in this study are conserved then habitat will likely be available to a wide range of generalist species.

Wildlife corridors should be as wide as possible. Potential ways to achieve this are to cluster housing away from ecologically significant areas, provide conservation easements, or buffers, on development which occur adjacent to wildlife corridors and to enact strict lighting restrictions near corridors. Much wildlife activity occurs between dusk and dawn and increased lighting in wildlife reserve areas could impact safety and concealment of prey species.

Barriers to wildlife movement exist in several places. Highway 15 (176th Street) essentially bisects the study area into two distinct zones. Wildlife underpasses were not included in its recent upgrade and this presents a barrier to virtually all species except for larger mammals. This also applies to the new Golden Ears Parkway which essentially cuts off the triangle of land on the north perimeter of the study area.

Deer are common throughout north Surrey and migratory routes should be considered when planning future wildlife corridors. In establishing wildlife corridors, deer should be managed so as to maintain seasonal movement throughout North Surrey.

D. High Value Vegetation, Trees and Rare Plant Species

The study area is within the CWHxm subzone has the potential to contain at least 26 rare plant species; however, the Anniedale-Tynehead NCP Area contains no occurrences of species of conservation concern. Despite a careful survey, no rare plants during the TEM fieldwork were observed; however, this does not conclusively rule out their occurrence. A more detailed vegetation survey would be required to ensure that rare plants are not present.

Rare Ecosystems

All of the forested ecosystems mapped in the study area are considered at-risk in BC, including three red-listed and two blue-listed site series. These ecosystems are threatened or of special concern due to development and harvesting pressures on the coast. Over 150 ha of forested rare ecosystems occur in the study area, occupying over 36% of the land base. The majority of these forests are immature and are dominated by broadleaf trees or a mix of broadleaf and coniferous trees. Although they will likely develop into mature conifer forests with time (in some cases centuries) they are still classed as red or bluelisted ecosystems.

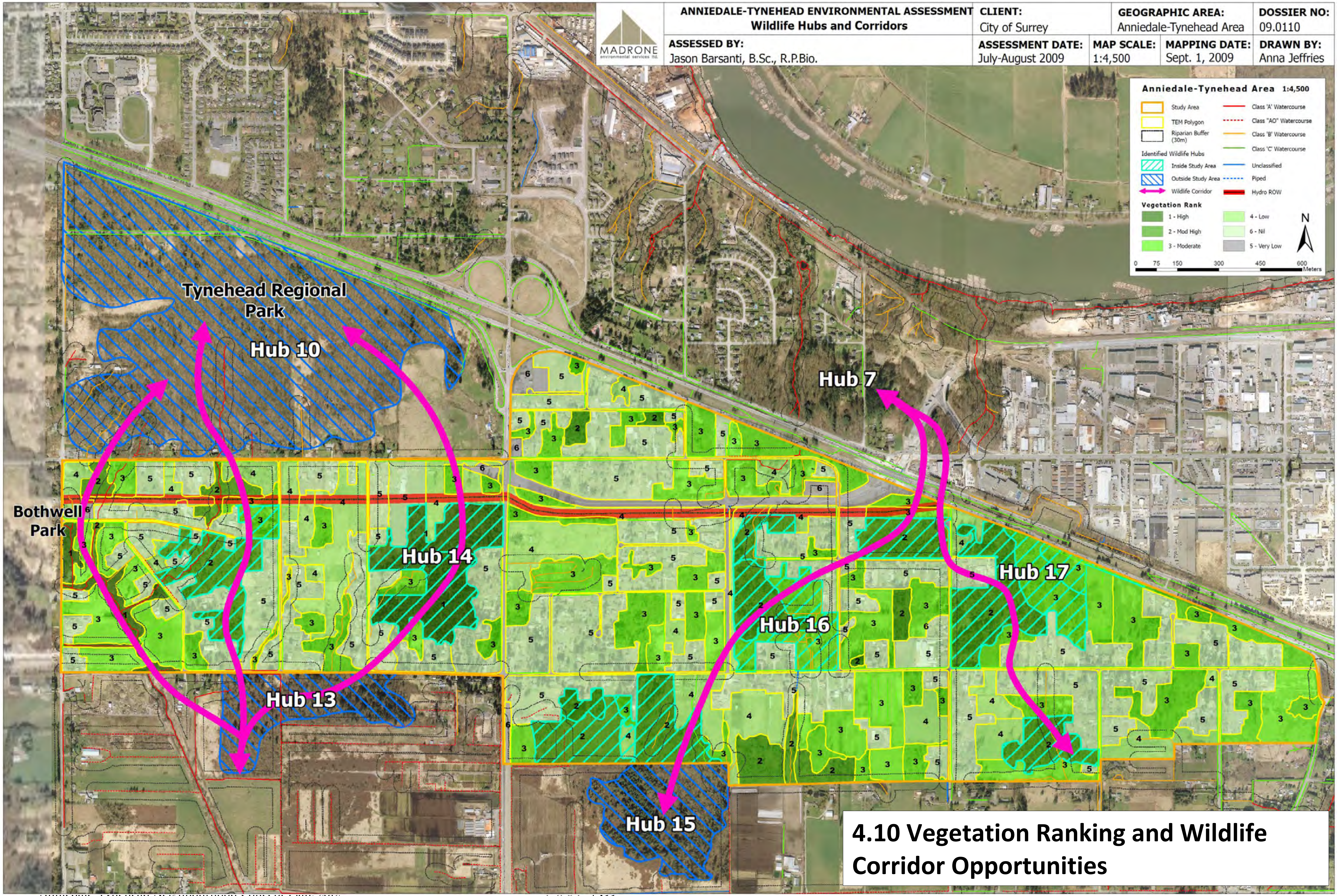
Go to the British Columbia Species and Ecosystems Explorer: Species and Ecosystems Search for more information: http://a100.gov.bc.ca/pub/eswp/

High Value Ecosystems

Four elements were considered when ranking ecosystem polygons for potential for vegetation value and to help protect ecosystems and species in the project area. Ranking took into account the value of:

- Critical habitat for significant wildlife species and for support of biodiversity (Ecosystem label element).
- Significant and valuable tree stands or specimens, including tree species and areas with a high potential for retention (structural stage element).
- Watercourses, watersheds and groundwater recharge areas (including associated features such as wetlands and riparian zones) (Riparian features element).
- Natural areas with potential to provide habitat corridors or greenways linking to other green spaces within and beyond the study area (Polygon size element).
- For each polygon, the four elements were given a value of 1 to 6; a value of 1 is the highest rating.

See **Figure 4.10** - Vegetation Ranking Map and Wildlife Corridor Opportunities for details



4.10 Vegetation Ranking and Wildlife Corridor Opportunities

Significant Ecosystem Hub Areas

Significant Ecosystem Hub Areas within Anniedale-Tynehead NCP where derived from vegetation and species values, and the Surrey Ecosystem Management Study Green Infrastructure Opportunities mapping generally shown in **Figure 4.11**. These areas are high priority areas for future Parkland Acquisition, Riparian Area Management and dedication, Cluster Housing, Agricultural Buffers, ecological enhancement or Tree protection depending on underlying land use designation.

Area# 1: The Serpentine River watershed and connecting tributaries connect to forests to the north into Tynehead Park and south along the Serpentine River system. This Ecological Hub has moderate to high conservation value, and is a key area for Riparian Area management and stream enhancement priorities. A 30 m buffer from Top of bank is proposed along this watershed, and cluster housing areas adjacent to the stream outside the buffer to preserve and enhance green space values.

Area #2: The large forested polygons in the west central region of the study area identified as Ecosystem Hub #2. The majority of this stand is designated as future parkland, with the remainder made up of buffer, cluster housing, and commercial areas. Green Connections to the North towards Tynehead Park should be considered as part of development in the northern section of the hub area in the form of tree planting and buffers between commercial and residential areas.

Area #3 This Ecosystem Hub is made up of deciduous and conifer forests and associated drainages from Lakiotis Creek watershed this is a large, relatively undeveloped area that has older agricultural fields and mixed forests. Conservation of high value vegetation and tree stands must be considered in Cluster Residential areas within this Hub. Areas below Lakiotis Drive will be considered high priority for retention and parkland dedication, as well as coniferous tree stands to the north in return for density transfer potential. Planting of understory areas to increase biodiversity values is recommended to enhance tree growth and buffering against the ALR boundary.

Area #4: This area is comprised of moderate to high value vegetated areas. This Ecosystem Hub is rated as having high vegetation value that is an excellent candidate for conservation because of the drainage and connectivity to the forests to the south. Parkland acquisition, riparian dedication and enhancement and cluster housing priorities dominant this areas future land use.

Area #5: This area is comprised of forest stands and moderate value vegetation cover with poor drainage. Portions of this hub are proposed as Future Park and cluster housing in efforts to preserve tree coverage and natural flow regimes.

Area #6: This ecosystem hub is comprised of moderate to high value mixed stand tree cover and provides opportunities for Cluster housing and vegetation buffers. Contiguous areas of natural vegetation should be considered during redevelopment of this area to ensure green space along the northern edge of the plan.

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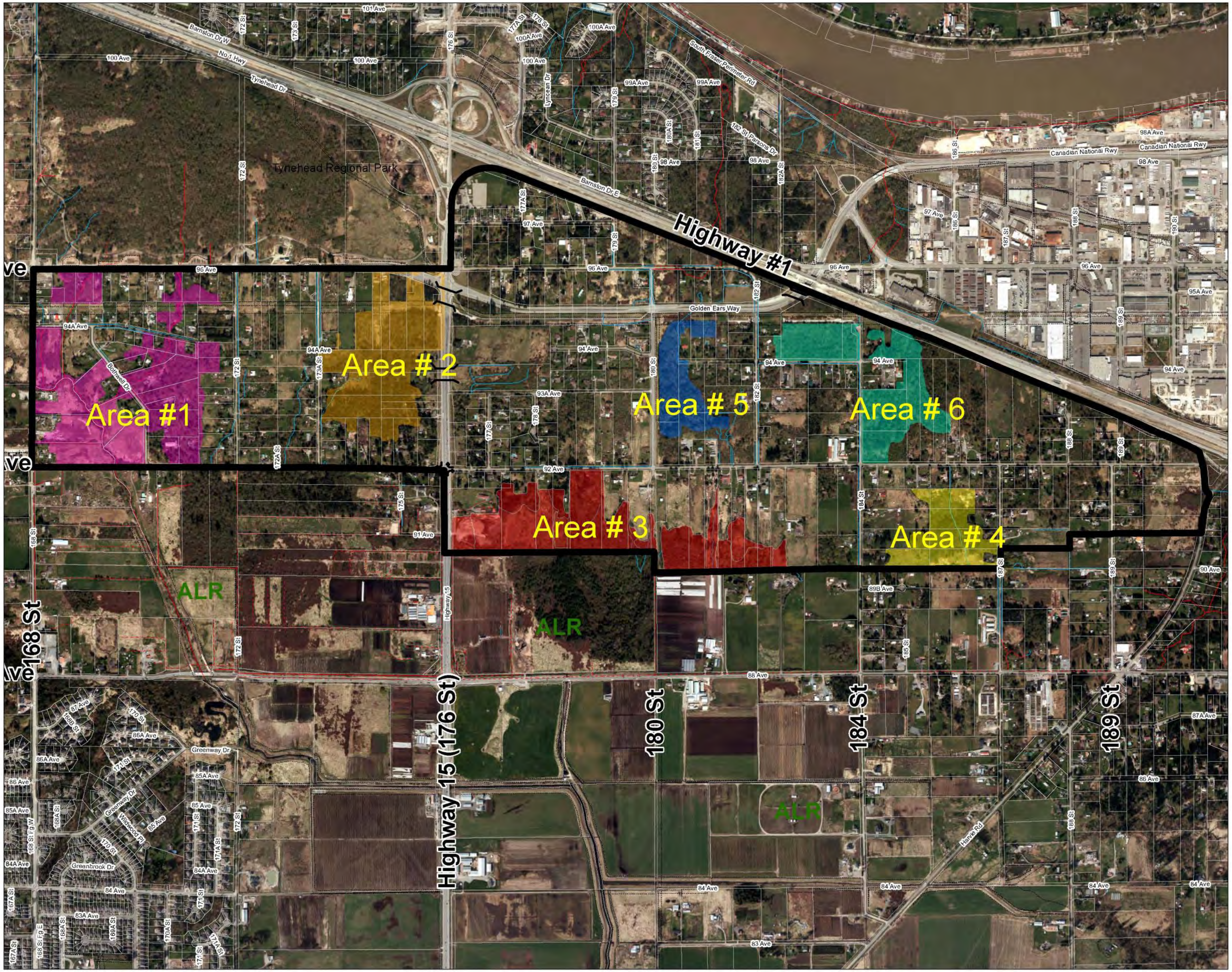


Legend

- Area #1
- Area #2
- Area #3
- Area #4
- Area #5
- Area #6

Anniedale-Tynehead NCP

Significant Ecosystem Hubs

The accuracy and completeness of infromation shown on this drawing is not guranteed. It will be the responsibility of the user of the information shown on this drawing to locate and establish the precise location of all existing information, whether shown or not.

1:7,000

0 250 500 1,000 Meters

Figure 4.11

V:\Policy&Long V:\Policy&Long Range\GIS_ANALYSIS\ANNIEDALE_TYNEHEAD_NCP\Annidale_Tynehead_NCP_OptionC_2010\Projects\Anniedale Tynehead Green Space - OPTION C Revised 3 Oct. 2011

4.3 GREEN SPACE AREA GUIDELINES

A. Parkland Acquisition and Dedication

Where a lot is split designated (e.g. Park and Residential use), in the Anniedale-Tynehead Land Use map, the park acquisition will be handled at the time a development application is made. Parks will purchase lands that are above and beyond the requirements of the Local Government Act.

Through the development application process, the developer would work with the City's Realty Division to determine an appropriate purchase price for any areas exceeding the dedication requirements of the application. There are many factors that determine the value of the property and would have to be assessed through the development process. For lands that are entirely designated as Park, the owner can initiate the Parks purchase with the City at any time;

B. Green Space Transfer Areas Dedicated as Parkland

Step 1: Density from Green Space Areas is transferred onto the developable portion of the lot.

Step 2: At time of subdivision, the green space is conveyed to the city and labelled as "Park" on the subdivision plan.

Step 3: Since density is increased on the lot, the compensation for the green space portion of the land is awarded through density bonus principle; therefore a City Park purchase is not required.

C. Green Space Transfer Areas Retained on Private Lands

Density value from the Green Space Transfer area is to be transferred onto the developable portion of the lot. The green space area is protected through a No Build Restrictive Covenant and held in private or common strata ownership. The green space area remains part of the lot, and can be counted toward the outdoor amenity space requirements for multi-family sites.

D. Riparian Area Dedicated as Park

The green space transfer value (or density value), of lands within the setback area can be used in the Green Space transfer calculation at 50% of the density value. Lands within 5-metres from top of bank cannot be calculated in the Green Space transfer area. **Figure 4.12** identifies Park Acquisition and dedication areas within the Plan.

Additional lands for the meander of the Serpentine River (between 7-10 metres) can be included in the Green Space transfer area at full density value.

Compensation for the Green Space lands is provided through the value of the density transfer onto the developable portion of the lot, therefore, therefore, a park purchase is not required. **Figure 4.13** identifies the overall plans for Riparian Compensation and Dedication within the Anniedale-Tynehead NCP.

E. Detention Ponds

The first developer in a sub-catchment requiring a detention or water quality pond shall secure the land and construct the pond before or as development begins.

(See Section 2, Part 7 Stormwater, 7.2 Proposed Servicing Plan, for more details).

F. Riparian Enhancement Area

Those lands designated as "Riparian Enhancement" in the Anniedale-Tynehead NCP will be purchased by the City for drainage purposes and enhanced to improve the Serpentine River area.

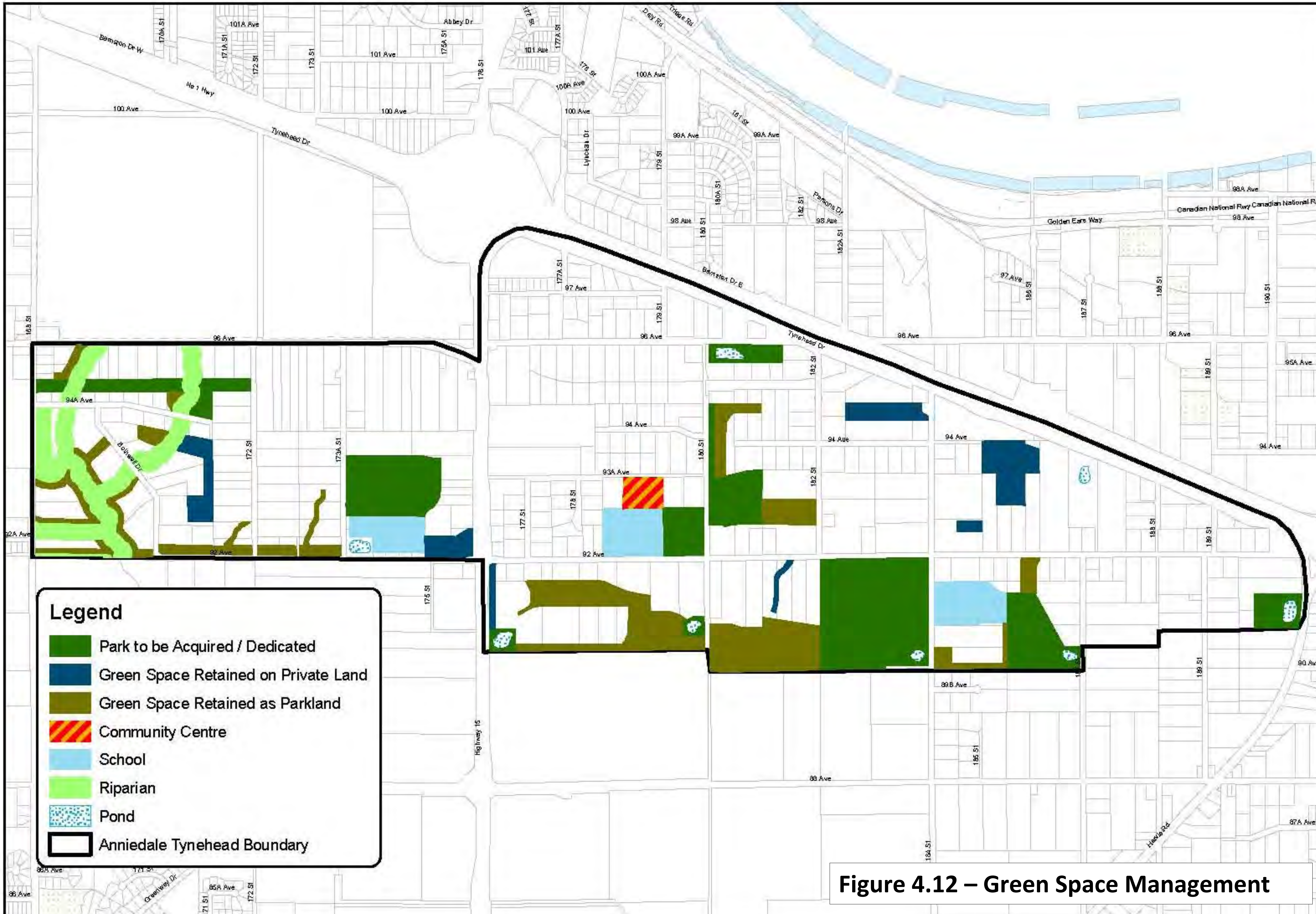
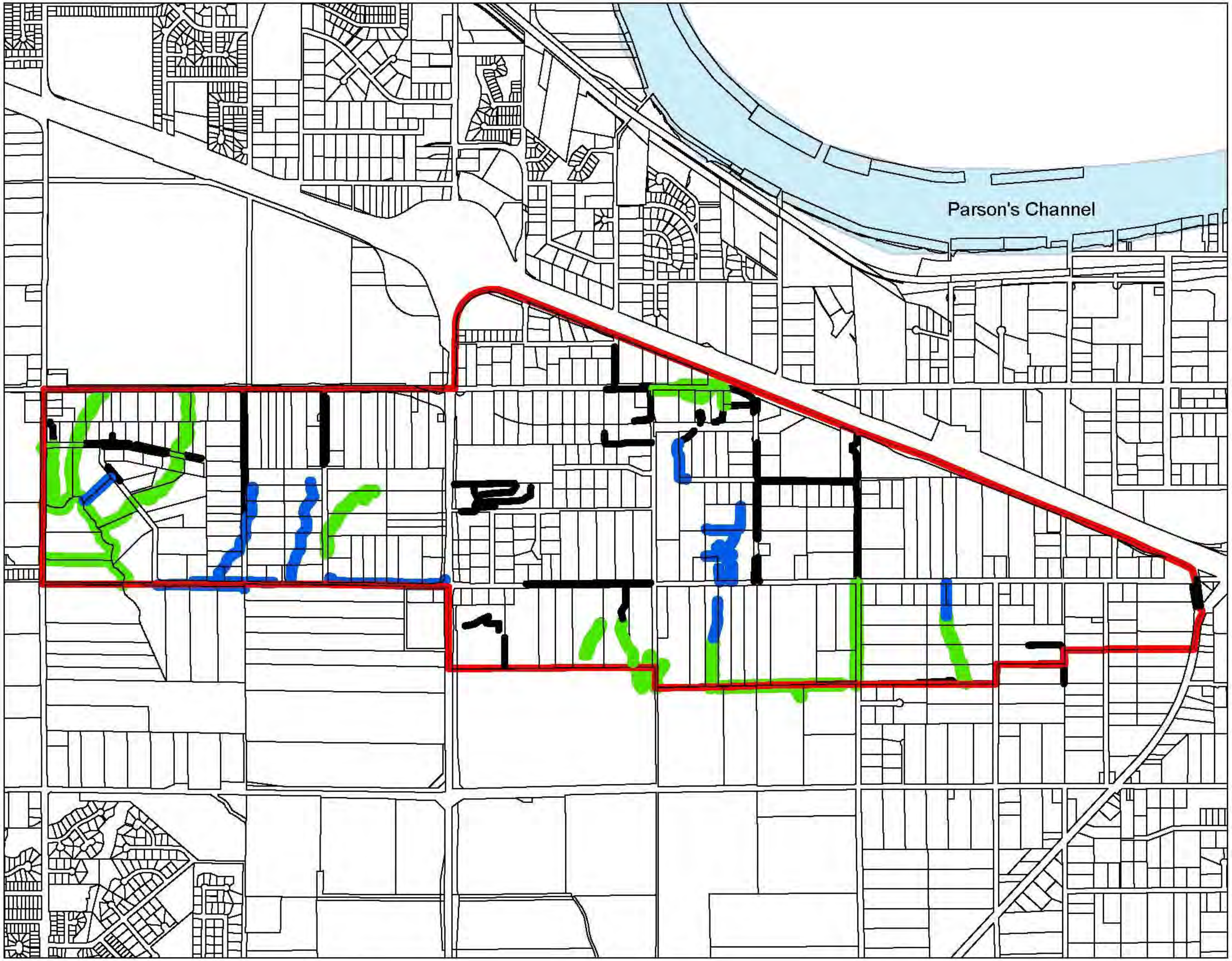


Figure 4.12 – Green Space Management



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Legend

- Annidale-Tynehead NCP Area
- Retain through RC or Cluster Housing
- Retain as Parkland (Dedicated Leave Strip)
- Compensation Needed (DFO requirements)

Anniedale-Tynehead NCP

Proposed Riparian Retention and Compensation Areas

Figure 4.13

0 250 500 1,000 1,500 2,000 Meters

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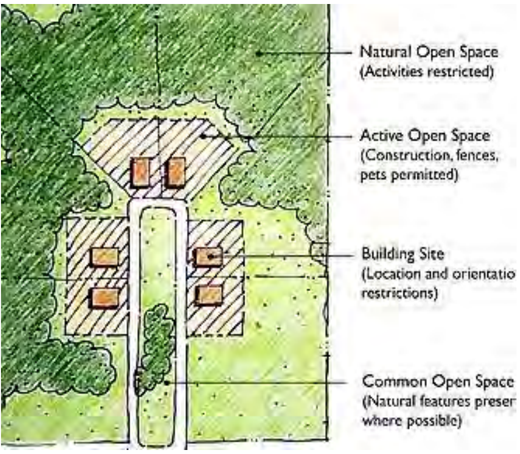
4.4 CLUSTER HOUSING DEVELOPMENT GUIDELINES



Development Guidelines for Cluster Residential Areas:

A. Application

- Cluster housing guidelines apply to the four "Cluster Residential" designation areas within Anniedale-Tynehead Neighbourhood:
    - Suburban Cluster 2 UPA
    - Low Density Cluster Residential 4-6 UPA
    - Medium Density Cluster Residential 6-10 UPA
    - High Density Cluster Residential 10-15 UPA

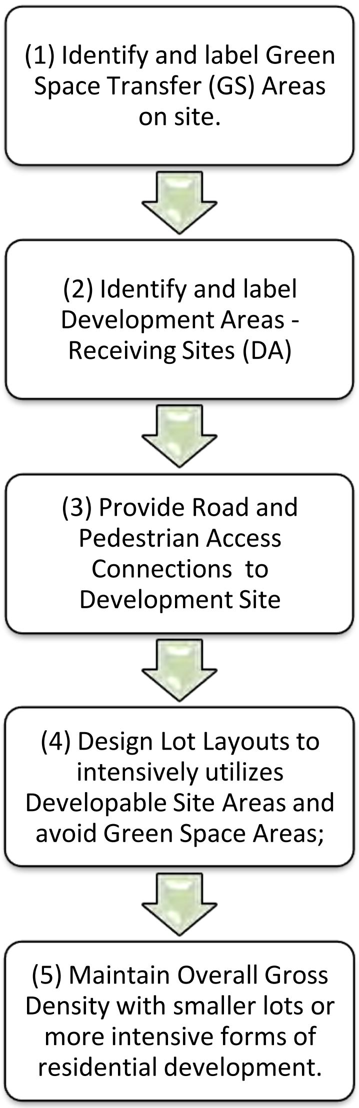
- The minimum parcel or consolidation size for development consideration in cluster areas is identified in **Part 4.0** or else is restricted to a 5 acre minimum.

B. Green Space Transfer Areas (GS)

- "Green Space Transfer" areas refer to the areas of a site where preservation of open space occurs. The potential density from the green space transfer area is intended to be transferred to the "development area" of a site and is generally identified in Green in **Figure 4.14**. A formal survey will be required to outline exact location and amount of Green space transfer Areas and they must be identified as such on any subdivision plans.

- The following areas or land uses may not be counted as a part of designated green space transfer areas:
    - Areas Covered by any Structures or Buildings;
    - Road Rights-of-ways;
    - Property Setbacks and private front or backyard areas;

- The following areas shall be high priorities for inclusion as designated Green Space Transfer areas:
    - DFO Riparian Dedication Setback Areas and Utility Corridors;
    - Landscape Buffers separating uses;



- Agricultural Land Reserve Buffers;
- Ecologically Significant Vegetation Areas (Value of 1, 2 or 3 as identified in the 2009 Madrone Environmental Assessment);
- Passive Recreation and Trail Areas;
- Additional Streamside Protection areas beyond DFO setback requirements (Serpentine River Meander Areas);
- Ecosystem Hub, Site, or Corridors areas as identified in Surrey EMS;
- Steep or unstable Slopes (Greater than 15%);

- At least 75% of designated open green space shall be contiguous, with no portion less than 20 meters wide.

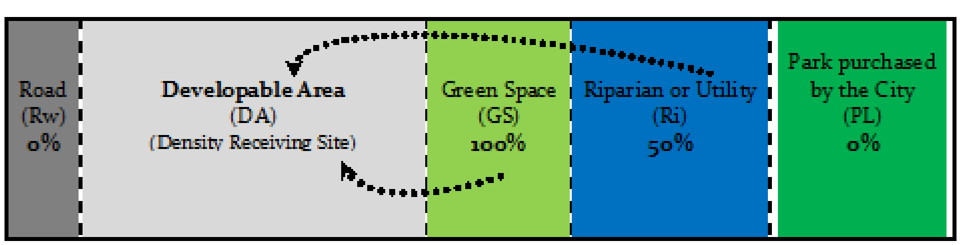
- Portions of the Green Space Transfer areas may be "community space" and may be used for public passive or active recreation, community gardens, or rainwater management facilities that meet all design, construction, maintenance, and public safety requirements set forth by the City of Surrey Engineering Department.

C. Development areas – Receiving Sites (DA)

- Development Areas, identified in **Figure 4.14** refer to the portion of the site where buildings should ideally be located. These areas are intended to be developed intensely, so that preservation can occur on other portions of the site. Individual Tree protection within Development Areas may still apply, as per the City of Surrey Tree Protection Bylaw.

D. Determining Cluster Housing Unit Yield

- Density Transfer Values for sites with a "Cluster" Designation:
  - 100% of site's density designation value from Green Space Transfer Areas
  - 50% of site's density designation value from Riparian, Gas, or Hydro ROW Areas
  - 0% from Road Dedication Areas
  - 0% from land purchased for Park by the City



• The total number of residential units allowable within a cluster development site shall not exceed the number of units allocated in the Anniedale-Tynehead land use designation based on a Gross density principle. The total maximum number of developable units allowed shall be determined using the following formula:

CLUSTER HOUSING - DWELLING UNIT FORMULA
$DU = BD[(DA+GS+{}^{1/2}R+{}^{1/2}U)]$ **$D_{welling}U_{nits} = B_{ase}\ D_{ensity}\ [(D_{evelopable}A_{rea} + G_{reen}\ S_{pace} + {}^{½}\ R_{iparian} + {}^{½}\ U_{tility})]$**
Where:
DU = Dwelling Unit (Potential)
BD = Base Cluster Density (dwelling units per acre)
DA = Developable Area/ Receiving Site (acres)
GS = Green Space Transfer Area (acres)
R = Riparian Leave Strip Area
U = Utility Corridor (acres)

Cluster Housing Development Yield Formula

Clustered Housing next to Riparian Area

- If green space transfer areas are not conserved in a manner consistent with these NCP Cluster Housing Guidelines, density maximums in all Cluster Residential areas may not exceed 1upa for properties adjacent to the ALR boundary, 2 upa for areas within 200 m of the ALR or 4 upa for all other areas.

- Developments should apply specific comprehensive development zone with a base zone containing density dimensional and building form standards most closely comparable to the total approved net density of the cluster development.

- Undevelopable areas such as stream setback areas and utility corridors can be included as green space transfer; however the areas shall be discounted by 50%. (Land area within 5 meters from creek top of bank cannot be included in the density transfer calculation).

E. Density Allocation

- The amount of Green Space preservation required should generally increase with increase in l and use density, because of the feasibility of protecting open space and to offset the cost of development.

- In lower density cluster designs (near Serpentine River), different techniques such as clustering homes into small groups may be used while in higher density urban areas small lot zoning and multiple family dwellings can be used to intensify development in specific locations such as near roads, on flatter slopes, and away from the Agricultural land reserve or environmentally sensitive features and clumps of established trees.

- The maximum density and minimum area of dedicated open space should meet the requirements outlined in **Table 4.2** below, as per example in **Figure 4.15**.

Green Space Transfer Required for Cluster Designations				
Land Use Designation	Max Base Density (upa)	Green Space Transfer Area (% of developable* Site Area)	**Potential Maximum Net Density on developable site area (upa) Low	High
Suburban Cluster	2	15-30%	2.3 - 3	
Cluster Residential	4-6	30-40%	5.5	8.5
Cluster Residential	6-10	35-45%	8.5	14.5
Cluster Residential	10-15	40-50%	15	22.5

**Note: Developable Area and Green Space Transfer Areas do not include Road Right-of-way dedication.*
***Note: If green space transfer areas are not provided for in a manner that is consistent with these NCP Cluster Housing Guidelines, base density maximums in all Cluster Residential areas may not exceed 2 UPA within 200m of ALR or 4 UPA in all other areas.*

Table 4.2 - Green Space Transfer Density Potential Summary for Cluster Residential Areas

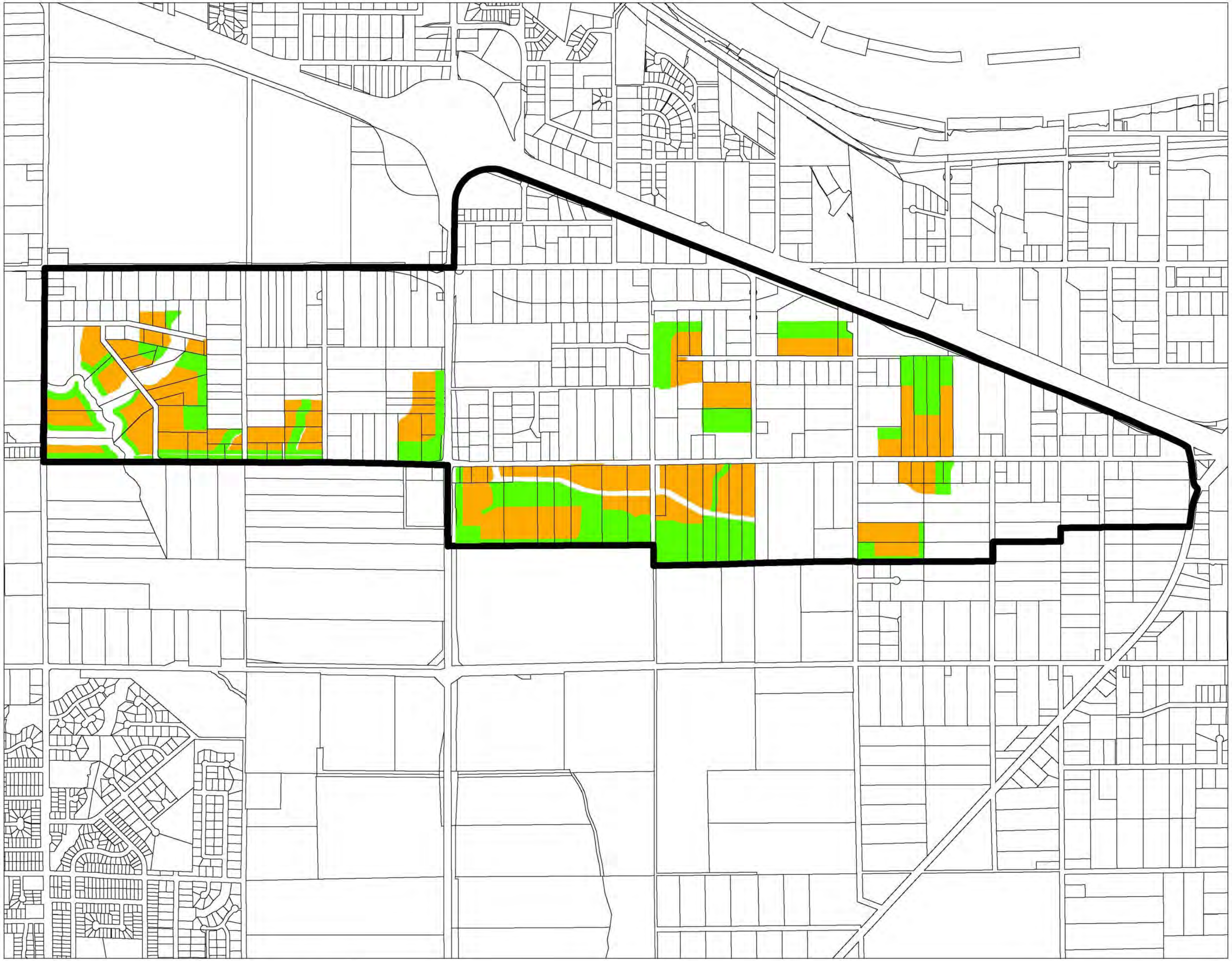

Tree Protection Fences in Place during Construction

F. Green Space Area Management

- The boundaries of designated green space areas, recreation areas, rainwater management facilities, and natural areas shall be clearly delineated on plans, including subdivision plans, rezoning plans, and marked in the field with signage during construction approved by the Surrey Planning and Development Department to distinguish these areas from private or common property.

  See **Part 4.3** for more details on Green Space Management.

Signage marking environmentally significant areas in place after construction



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Legend

- AnnidaleTyneheadStudyArea
- Green Space Transfer (Sending Sites)
- Development Areas (Receiving Sities)

Anniedale-Tynehead NCP

Cluster Housing Areas

0 250 500 1,000 Meters

Figure 4.14

The accuracy and completeness of infromation shown on this drawing is not guranteed. It will be the responsibility of the user of the information shown on this drawing to locate and establish the precise location of all existing information, whether shown or not.

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Example Site Calculation: Cluster Housing

DWELLING UNITS = BASE DENSITY [(DEVELOPABLE AREA + GREEN SPACE + ½ RIPARIAN + ½ UTILITY)]

DU = BD [(DA+GS+$^{1/2}$R+$^{1/2}$U)]

DU = 10 UPA [(4.5 Acres + 2.5 Acres + $^{1/2}$1.5 Acres+ $^{1/2}$ 0 Acres])

DU = 10 UPA [(7 Acres + 0.75 Acres)]

DU = 10 UPA [(7.75 Acres)]

DU = 78 Units**

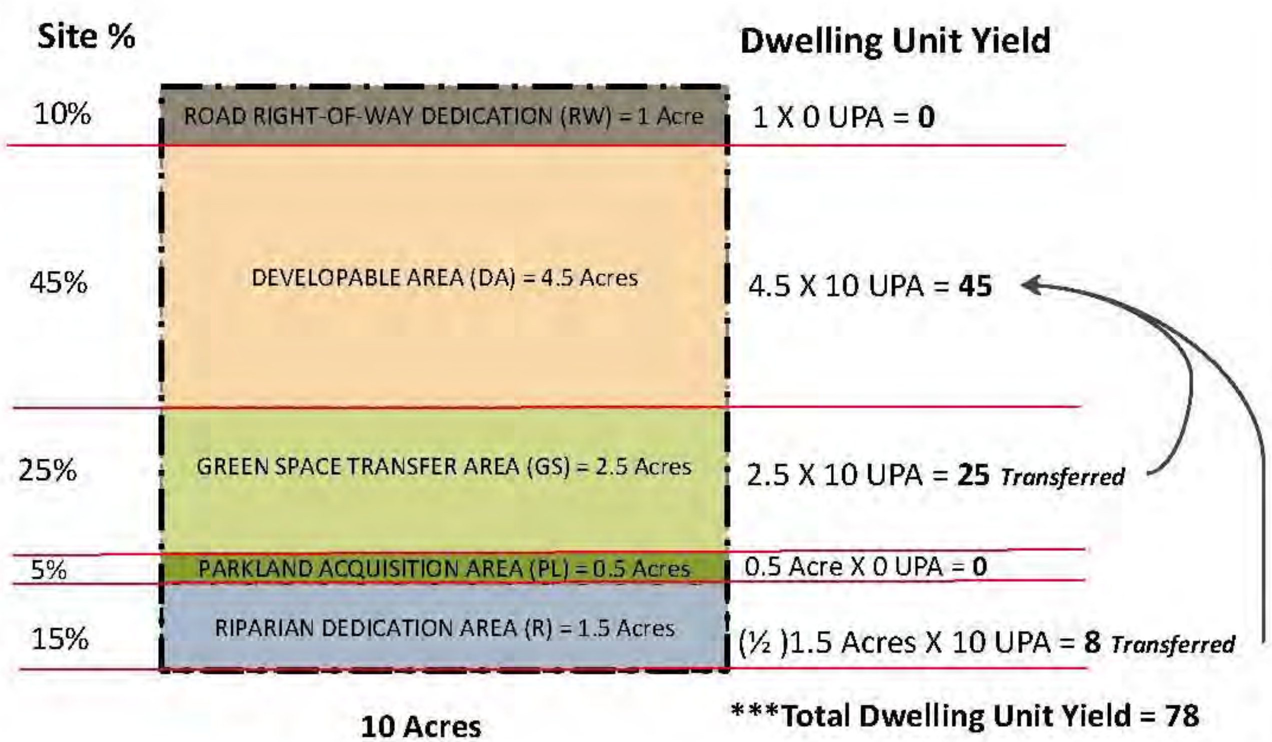
*****Total Potential Dwelling Units = 78 Units**

DU = BD[(DA+GS+$^{1/2}$R+$^{1/2}$U)]
Where:
DU = Dwelling Units (Potential)
BD = Base Cluster Density (UPA)
DA = Developable Area (acres)
GS = Green Space Transfer Area (acres)
R = Riparian Setback Area (acres)
U = Utility Corridor (acres)

Net Density = DU/DA

Net Density = 78 Units / 4.5 Acres

Net Density = 17.33 Units Per Acre



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Example Site Density:

***Base Cluster Density (BD)**	**= 10 Units Per Acre (UPA)**

Example Site Statistics:

Developable Area (DA)	= 4.5 Acres
Green Space Transfer Area (GS)	= 2.5 Acres
Riparian Dedication Area (R)	= 1.5 Acres
Utility Corridor (U)	= 0 Acres
Road Right-of-Way	= 1 Acre
Parkland Dedication	= 0.5 Acres
TOTAL GROSS SITE AREA	**=10 Acres**

** Cluster Density vary based on Cluster Designation Density shown in the Anniedale-Tynehead Land Use Plan.*

*** Units rounded to the nearest whole number.*

**** Total Dwelling Unit Potential may be limited by site constraints, and are not guaranteed.*

Anniedale-Tynehead NCP
Cluster Housing Dwelling Unit Calculation Example

Figure **4.15**

4.5 HERITAGE AREA GUIDELINES

Historic Context

Mill east of Pike Road on Townline Ave
Tynehead Memories

The South Port Kells area, occupied in pre-Contact time by the Katzie and Semiahmoo First Nations, contains three distinct sub-communities from the post-Contact area: Port Kells, Anniedale and Tynehead.

The Tynehead and Anniedale areas were among the first in Surrey to be settled by European settlers. In the early 1860s, the three Bothwell brothers pre-empted land along the Coast Meridian Road (168th Street) near the headwaters of the Serpentine River. Access was originally provided by water transportation. The first commercial logging in the area was undertaken by the Royal City Mills in 1864, and logging continued to be a primary industry for a number of years. Temporary rail spurs (known as 'shooflies') were laid to facilitate the transportation of logs to market. Settlement occurred as logging and fishing developed in the area, but as the logs were depleted, agriculture became increasingly important, and ultimately became the predominant use.

Stump near Maple Leaf Mill in Tynehead
Tynehead Memories

The area has remained largely a rural community, dominated by small agricultural pursuits and subsistence farming, and its heritage value is found in its response to those conditions. Additionally, logging was important in the early development of the area, and determined the location of a number of heritage resources. Early transportation routes crisscross and are evident throughout the area.

Heritage Resources

The history of the Anniedale-Tynehead Area of South Port Kells is reflected in small buildings on large properties often supplemented by out-buildings, such as barns, sheds, garages, stables, and other agricultural structures. The architecture may be more modest than in other parts of the City because of the rural setting; however, the evaluation of architectural merit has been scaled to the area's means and resources.

Many sites have mature trees and plantings, which contribute to the significance of siting and landscaping. Additionally, some sites have remnants of fields and orchards with mature fruit trees. As the area was primarily agricultural, the settings for the buildings have been culturally modified. Therefore the physical heritage of the area is as important as its built heritage in understanding its settlement, growth and development.


Old Anniedale School, *Surrey Archives*


Tynehead Community Hall

Harvie Road


Rae House


Harbidge House

Historic Buildings and Sites

There are a number of historic buildings and sites that have been determined to have recognizable heritage significance through the Heritage Register evaluation process (**Figure 4.16**). These are the sites that are considered to have the greatest heritage value, and should be the primary focus for heritage conservation efforts.

I. Old Anniedale School (9744 176 Street) and Tynehead Community Hall (9568 168 Street) are listed on the Surrey Heritage Register and individually protected by Heritage Designation By-law.

II. Harvie Road is listed on the Surrey Heritage Register but does not have any formal heritage protection.

III. Two buildings/sites are proposed for addition to the Surrey Heritage Register:

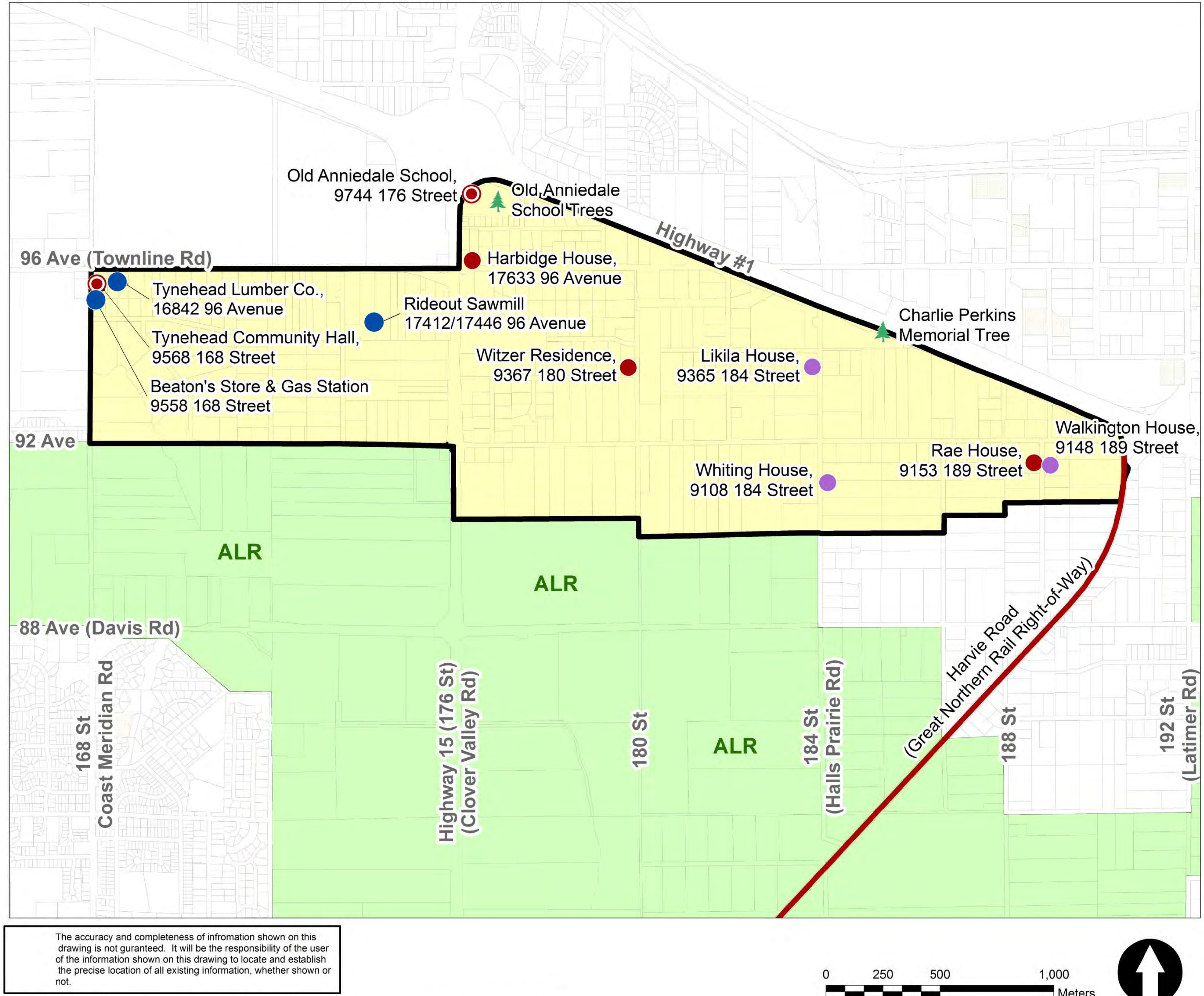
- Rae House (9153 189 Street)
- Harbidge House (17633 96 Avenue)
- Witzer Residence (9367 180 Street)

IV. A number of additional buildings/sites may or may not possess sufficient individual value to merit addition to the Surrey Heritage Register; however, they do contribute to the character and ambience of the area. These include:

- Whiting House (9108 184 Street)
- Likila House (9365 184 Street)
- Walkington House (9148 189 Street)

V. A number of trees have been listed on the City's List of Significant Trees ("Schedule B" of the Tree Preservation Bylaw), several of which have been determined to possess heritage value. In Anniedale-Tynehead, the following trees have been recognized:

- Various trees (9744 176 Street)
- Memorial Tree (184 Street and Highway #1)



Legend

- Registered and Protected Heritage Site
- Site to be added to Heritage Register
- Registered Heritage Route
- Sites with Potential Heritage Value
- Commemmorations Opportunities
- Significant Trees

Anniedale-Tynhead NCP

Heritage Opportunities

Figure 4.16

The accuracy and completeness of infromation shown on this drawing is not guranteed. It will be the responsibility of the user of the information shown on this drawing to locate and establish the precise location of all existing information, whether shown or not.

V:\Policy&Long V:\Policy&Long Range\GIS_ANALYSIS\ANNIEDALE_TYNEHEAD_NCP\Annidale_Tynehead_NCP_OptionC_2010\Projects\Anniedale Tynehead Green Space - OPTION C Revised 3 Oct. 2011

Protected by Heritage Revitalization Agreement By-law, 1999, No. 13859

Boothroyd House (16811 60 Avenue)
Protected by Heritage Revitalization Agreement By-law, 2004, No. 15233

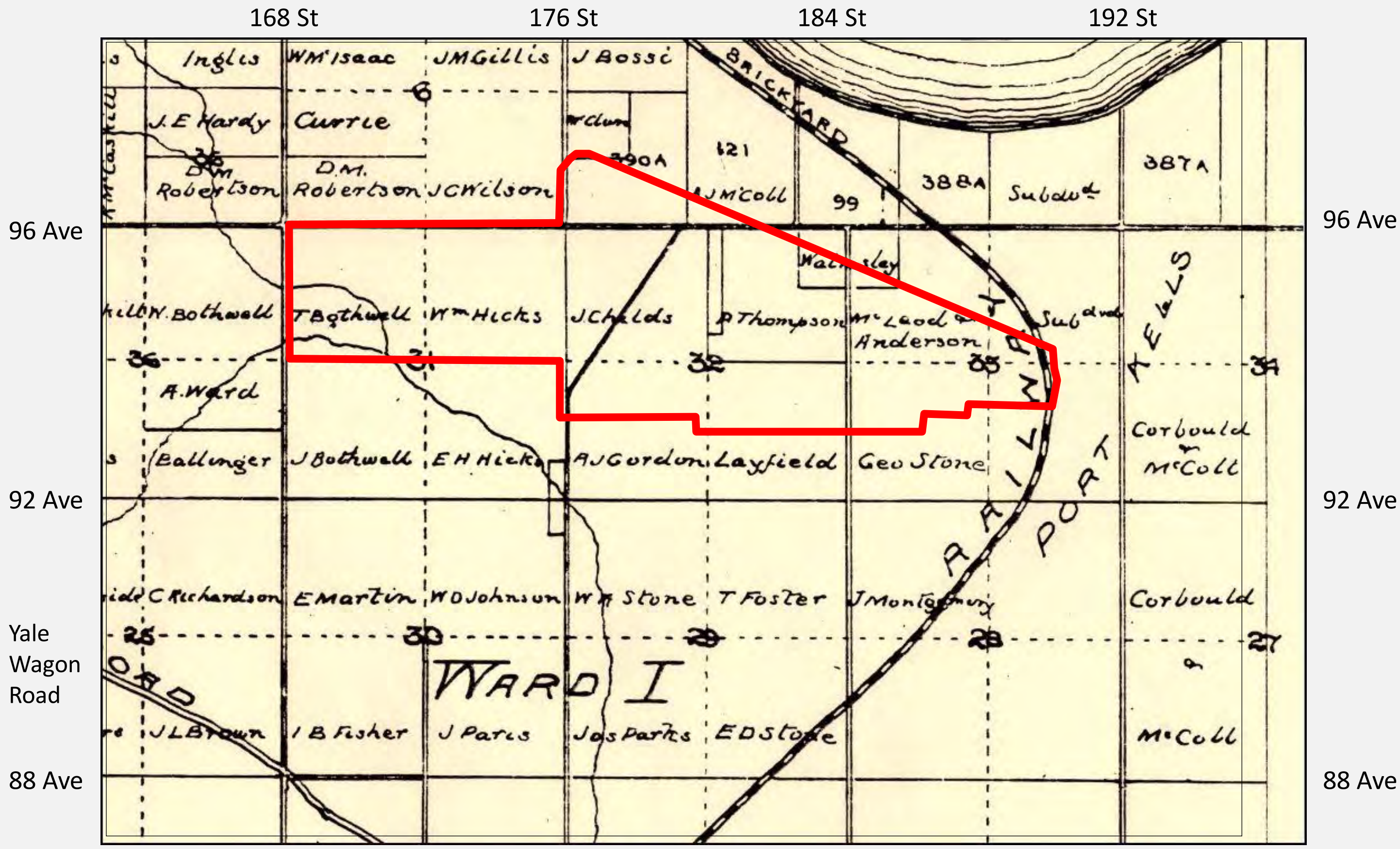
Example: Heritage Interpretation

Heritage Policy Objectives

The redevelopment of Anniedale-Tynehead will constitute a major change to the built heritage and historic low density, character of the area. In order to maintain a sense of context within the restoration and revitalization of the historic structures, a programme of conservation, commemoration, documentation, and interpretation should be considered in conjunction with the buildings, sites, and features being preserved.

Heritage conservation, interpretation and commemoration strategies should include:

- The establishment of the “Tynehead Heritage Village Commercial Area Precinct” (168 and 96 Avenue) with special design guidelines.
- The preservation of registered heritage buildings/sites and buildings/sites recommended for addition to the Surrey Heritage Register. Development on these sites should not occur until the protection and restoration of each of the buildings is secured in a manner satisfactory to the City (e.g., heritage revitalization agreement). These buildings are intended to remain in private ownership with an adaptive use that respects the heritage value and encourages a viable future;
- As opportunity permits, the preservation of additional buildings/sites that have not yet been proposed for addition to the Surrey Heritage Register;
- Encouraging the preservation of heritage buildings/sites through variations in density, use, siting and other regulations via heritage revitalization agreements or other tools provided in the Local Government Act;
- Ensuring that new construction adjacent to heritage buildings/sites is sensitive to the historic context and design of existing heritage buildings;
- Encouraging publicly accessible interpretation about the values associated with existing heritage resources in the area, First Nations history, pioneering families, and historic street names;
- Encouraging the commemoration of the two historic mill sites in the area;
- Requiring the documentation and interpretive commemoration of demolished heritage buildings;



1897 Pre-Emption Map *Surrey Archives*

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CITY OF SURREY

the future lives here.

Anniedale-Tynehead

Neighbourhood Concept Plan (NCP)

April 2012

City of Surrey

SECTION 2

ENGINEERING, IMPLEMENTATION & FINANCING

PART 5:	Transportation Infrastructure
PART 6:	Sanitary Sewer Infrastructure
PART 7:	Stormwater Infrastructure
PART 8:	Water Infrastructure
PART 9:	Services, Amenities & Implementation
PART 10:	Infrastructure Summary and Financial Analysis

SECTION 2: ENGINEERING, IMPLEMENTATION & FINANCING

What are the Engineering and Infrastructure Requirements?

The following section describes the Transportation, Sanitary Sewer, Storm Water and Water System infrastructure based on the recommended servicing plan.

PART 5 TRANSPORTATION INFRASTRUCTURE

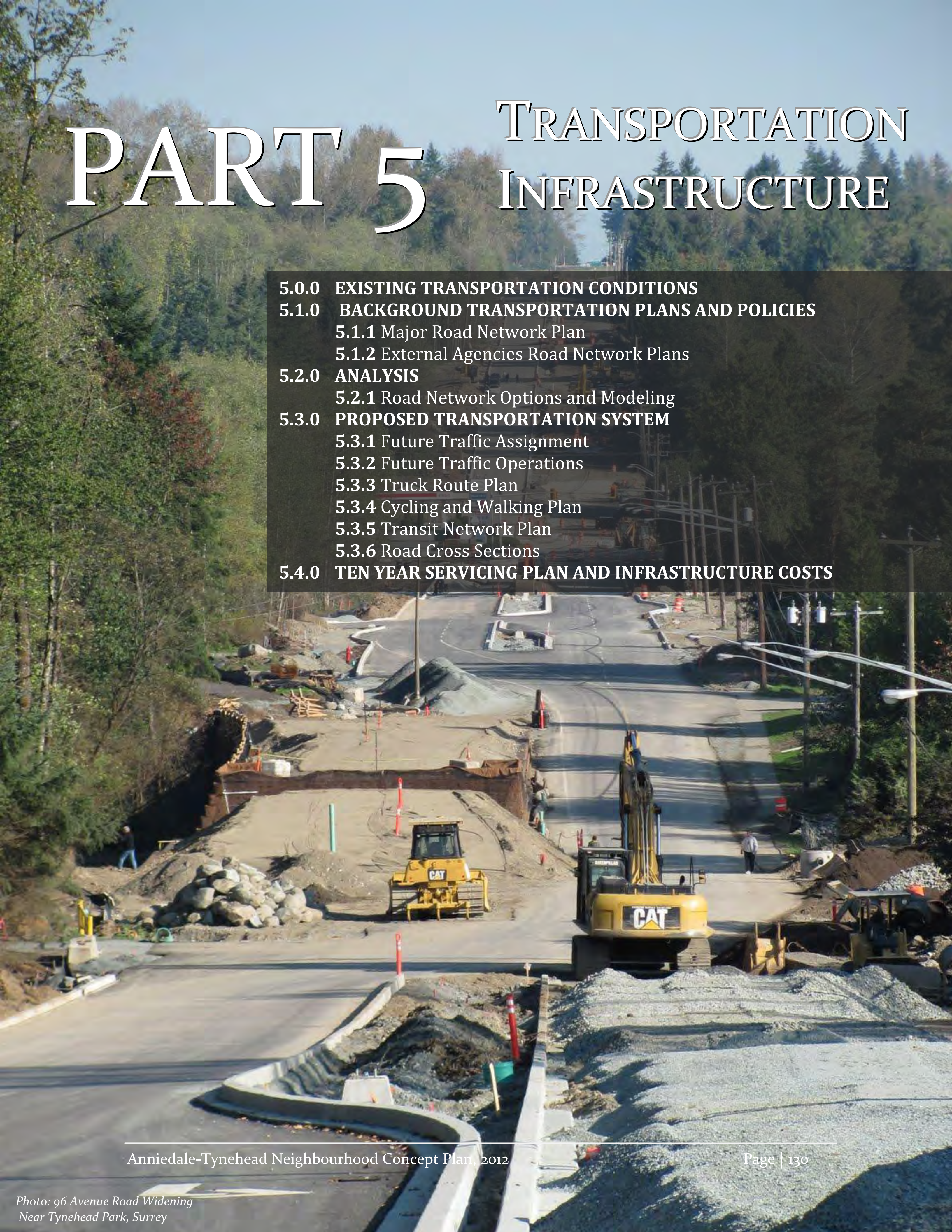

Photo: 96 Avenue Road Widening Near Tynehead Park, Surrey

PART 5: TRANSPORTATION INFRASTRUCTURE

5.0.0 EXISTING TRANSPORTATION CONDITIONS

Existing Road Network

At present, the City's existing road network in the Anniedale-Tynehead area is relatively sparse and discontinuous, with predominately 2 lane rural-standard roads and unsignalized traffic control. The existing roadway laning and traffic control in the study area is illustrated in **Figure 5.0**. This network operates relatively well now because of the existing low density suburban residential land use which generates little vehicle traffic, transit, or cycling trips.

With the redevelopment of Anniedale-Tynehead, it can be expected that the internal neighbourhood Collector road system, in particular, will be improved with new, realigned and widened urban-standard roadways. Along with improvements to the Arterial & Collector road network, the Local Road network will also have to be considerably developed to provide access to new developments as well as supporting internal, multi-modal neighbourhood circulation.

Existing Traffic Generation

At present, there are approximately 1,425 residents and 145 jobs in the Anniedale-Tynehead NCP neighbourhoods. If the Port Kells neighbourhood is included, there are approximately 2,235 residents and 400 jobs in all of South Port Kells (SPK).

During the development of the General Land Use Plan for South Port Kells, a travel demand forecasting model using EMME/2 software was developed to estimate the existing traffic generation of the area. During the Weekday PM Peak Hour, SPK currently generates about 825 vph, of which 344 are entering SPK and 499 are exiting SPK. Of these 825 PM Peak Hour trips, approximately 0.7% or 6 trips are internal trips, 41% or 337 are Internal-External Trips, and 58% or 483 are External-Internal Trips.

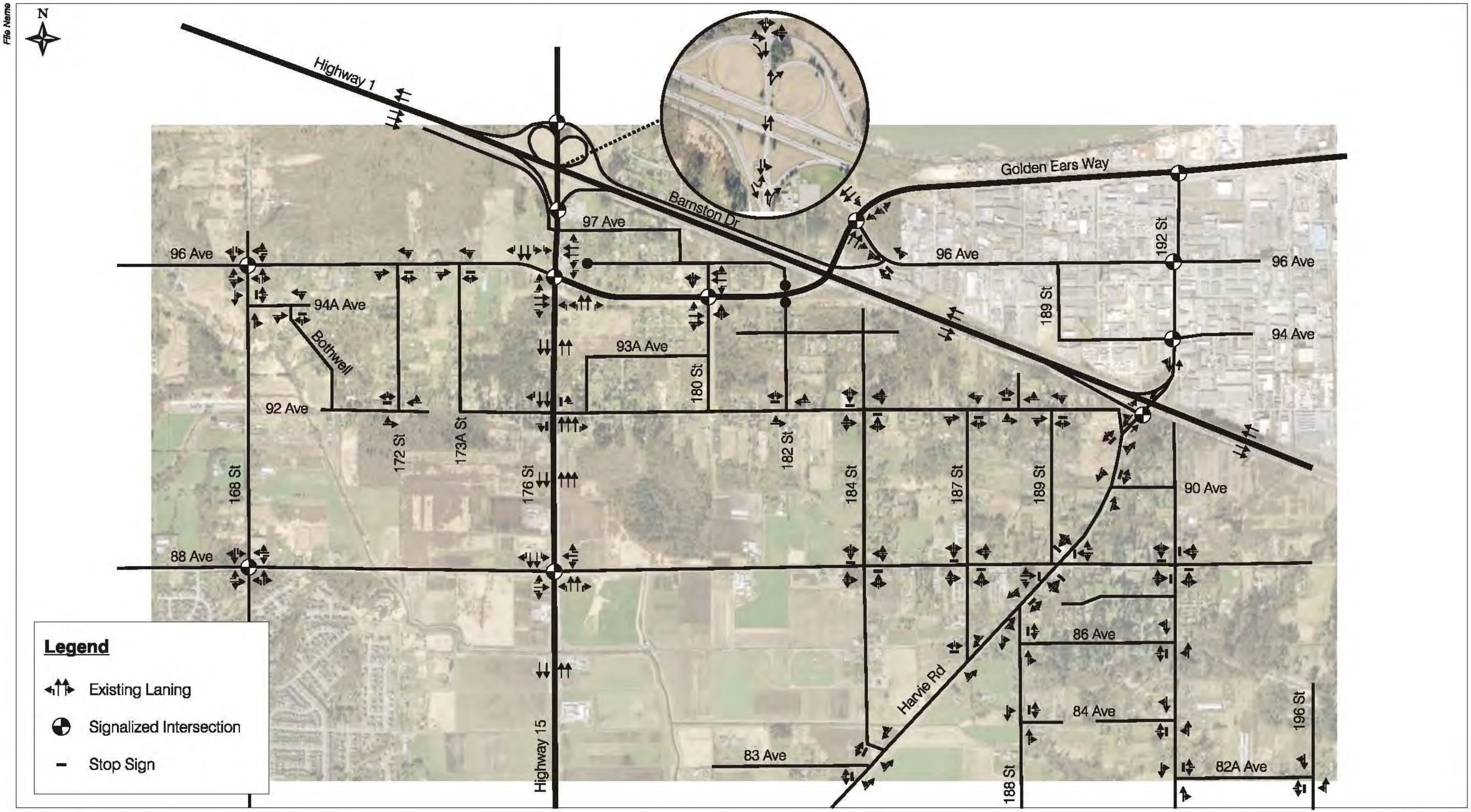

Figure 5.0

Existing Laning and Traffic Control

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Existing Traffic Volumes & Operations

Figure5.1 illustrates available 2004 AM and PM Peak Hour traffic volume data in the South Port Kells area, which was collected prior to the Golden Ears Bridge and Golden Ears Way construction, and prior to the conversion of Highway 15/92 Avenue to right-in/out only. It can be seen that Highway 1 and Highway 15 are by far the busiest routes, with 88 and 96 Avenues also carrying significant volumes. 168 Street, 192 Street and Harvie Road are currently lower-volume Arterials. While little traffic data is available on internal Anniedale – Tynehead roads, it is likely peak hour volumes do not exceed 200 vph on either 180 Street or 92 Avenue, the busiest internal Collector roads in the two neighbourhoods. Based on recent traffic data from 2009 Golden Ears Way is now carrying peak hour traffic volumes in the same order of magnitude as 96 Avenue, about 1,200 vph just east of Highway 15.

Traffic operations at the key intersections in the study network were evaluated based on the capacity analysis methods outlined in the 2000 Highway Capacity Manual (HCM) using the Synchro 6.0 analysis software for signalized and stop-controlled intersections. Reported operational performance measures include Volume-to-Capacity (V/C) ratios and delay-based Level of Service (LOS).

For the purposes of road network planning, the City applies threshold values for operational performance measures of V/C = 0.90 or less, and Level of Service (LOS) "D" or better. Table 5.2 summarizes the overall Volume-Capacity (V/C) ratio and Level of Service (LOS) for the Highway 15 / Golden Ears Way (GEW) intersection for the Existing (2004 and 2009) Weekday PM Peak traffic condition.

Table 5.0 - Intersection Performance for Existing (2004 and 2009) PM Peak Traffic Conditions

Intersection	Year**	V/C	LOS
Golden Ears Way / Highway 15	2009	0.57	C
88 Avenue / Highway 15	2004	0.70	C
88 Avenue / Harvie Road*	2004	-	F
88 Avenue / 192 Street*	2004	-	C
96 Avenue / 168 Street	2004	0.63	C

*Highway Capacity Manual do not report overall V/C ratio for 4-way stop-control intersections.
** 2004 = before GEW open; 2009 = after GEW open

Clearly all the studied intersections within the Anniedale-Tynehead study area are operating within capacity under the Existing (2004 and 2009) PM Peak Traffic conditions, with the exception of 88 Avenue and Harvie Road where long delays are experienced in the southbound approach on Harvie Road. This is due to the heavy southbound through and right-turn volumes travelling from the Port Kells Industrial area north of Highway 1, which share a single lane approach to this 4-way stop controlled intersection.

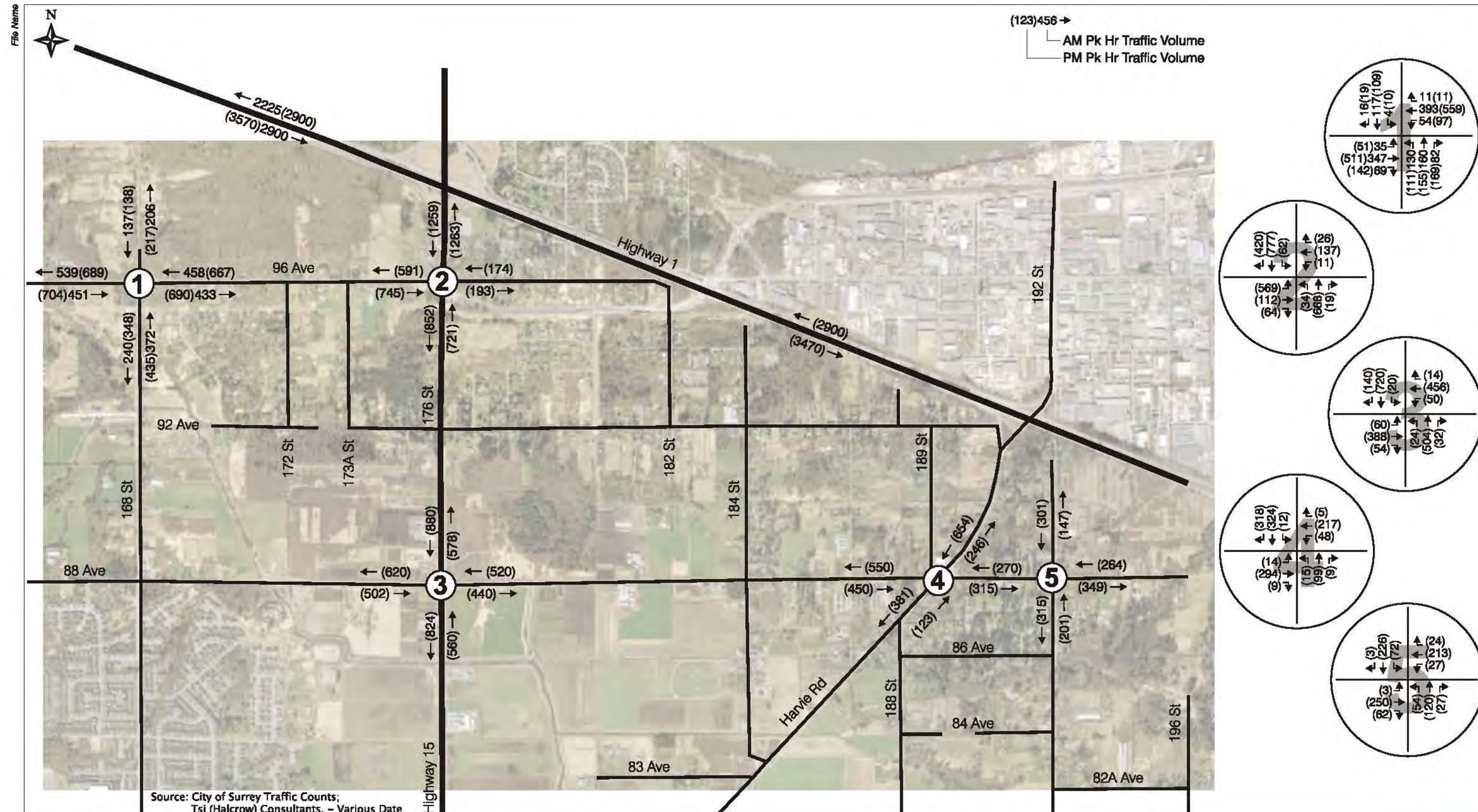

Figure 5.1
2004 (Pre-Golden Ears Bridge) Peak Hour Traffic Volumes

Existing Transit Network

Figure 5.2 illustrates the current transit network in the vicinity of Anniedale-Tynehead. There is only one peak period transit route (#388) that originally was routed along GEW, Highway 15 and 88 Avenue through SPK linking Walnut Grove in Langley to the 22nd Street SkyTrain Station in New Westminster. This route originally had no stops in the SPK area so effectively, the area had no transit service and therefore transit mode split was therefore negligible. During the NCP development the City worked with TransLink and Coast Mountain Bus Company to revise the routing and utilize bus stops constructed as part of the recent 96 Avenue widening program completed in late 2010. The route currently travels along GEW, 96 Avenue, and 168 Street to 88 Avenue.

Existing Cycling & Pedestrian Network

Existing bicycle facilities as well as elements of the City's current bicycle plan relevant to the Anniedale-Tynehead neighbourhoods are discussed below. **Figure 5.3** illustrates both existing and currently planned bicycle facilities in the area. Existing on-street and off-street facilities are described below.

Most of the existing roadways within the neighbourhood are currently built to rural standards with no sidewalks, although they may have narrow shoulders and carry very low traffic volumes; hence, they are reasonably attractive for walking and cycling. Harvie Road has wider paved shoulders which make it attractive for cycling and is identified by the City as a 'shared-traffic' cycling route. Golden Ears Way (GEW) has marked bicycle lanes on both side of the street between Highway 15 and 96 Avenue east of Highway 1. 96 Avenue between Highway 15 and 168 Street has on-street bicycle lanes. Paved shoulders are available on both sides of Highway 15, although the heavy traffic volumes on Highway 15, as well as its vertical grade and limited access points are significant barriers at present to walking and cycling on and across Highway 15. Golden Ears Way also creates a walking/cycling barrier between the Anniedale "Triangle" and the rest of the South Port Kells area.

There is an existing off-street multi-use path on the south side of GEW that starts from Highway 15 in the west connecting to 196 Street. The City of Surrey recently completed construction of a pedestrian /cycle overpass across Highway 1 on 168th Street, which was opened in the summer of 2011 and which will ultimately connect into the future Tynehead Park pathway.

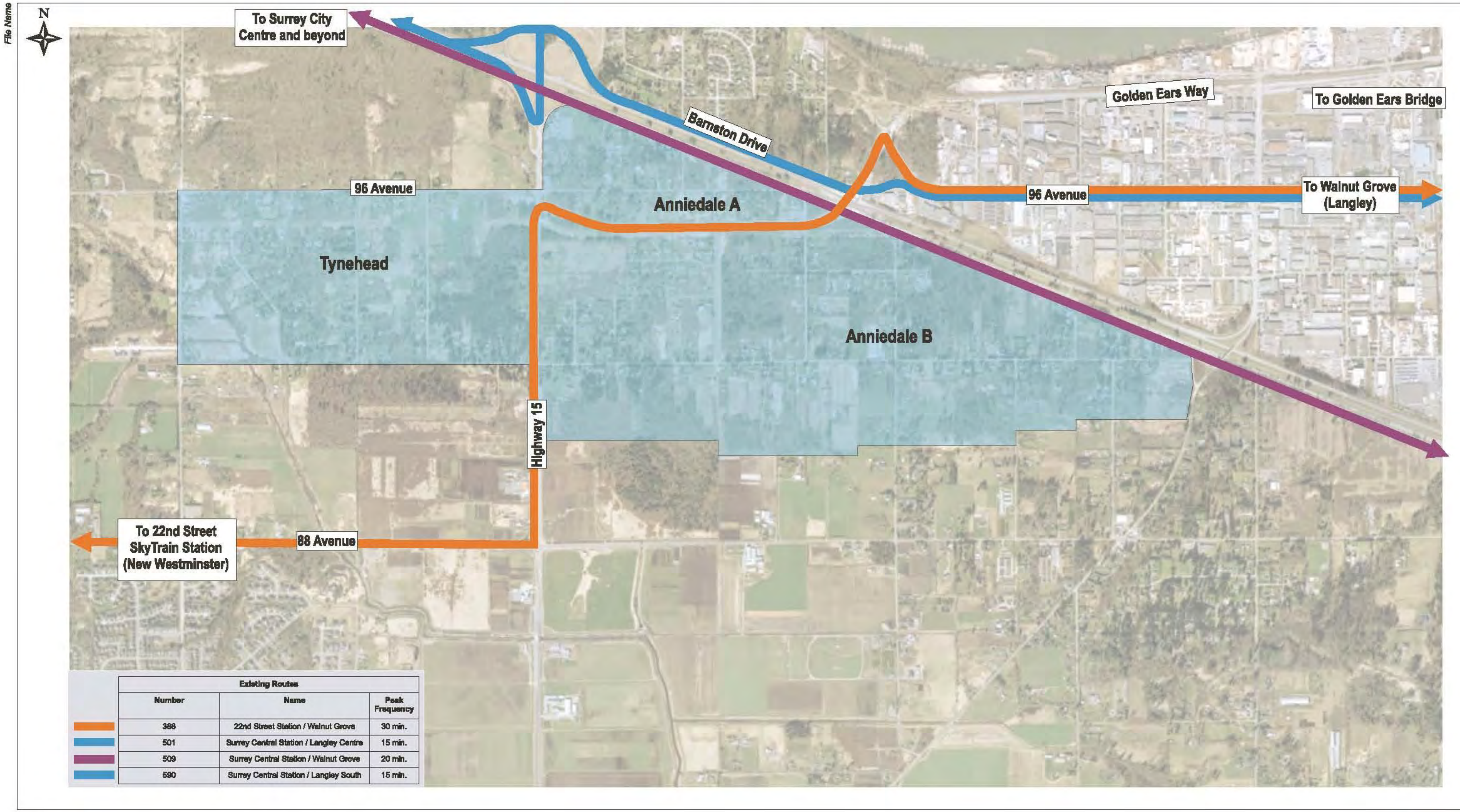

Figure 5.2

Existing Transit Network

Anniedale / Tynehead Stage 1 NCP Road Network Study, Surrey BC
4027.15 July 2011 Scale NTS

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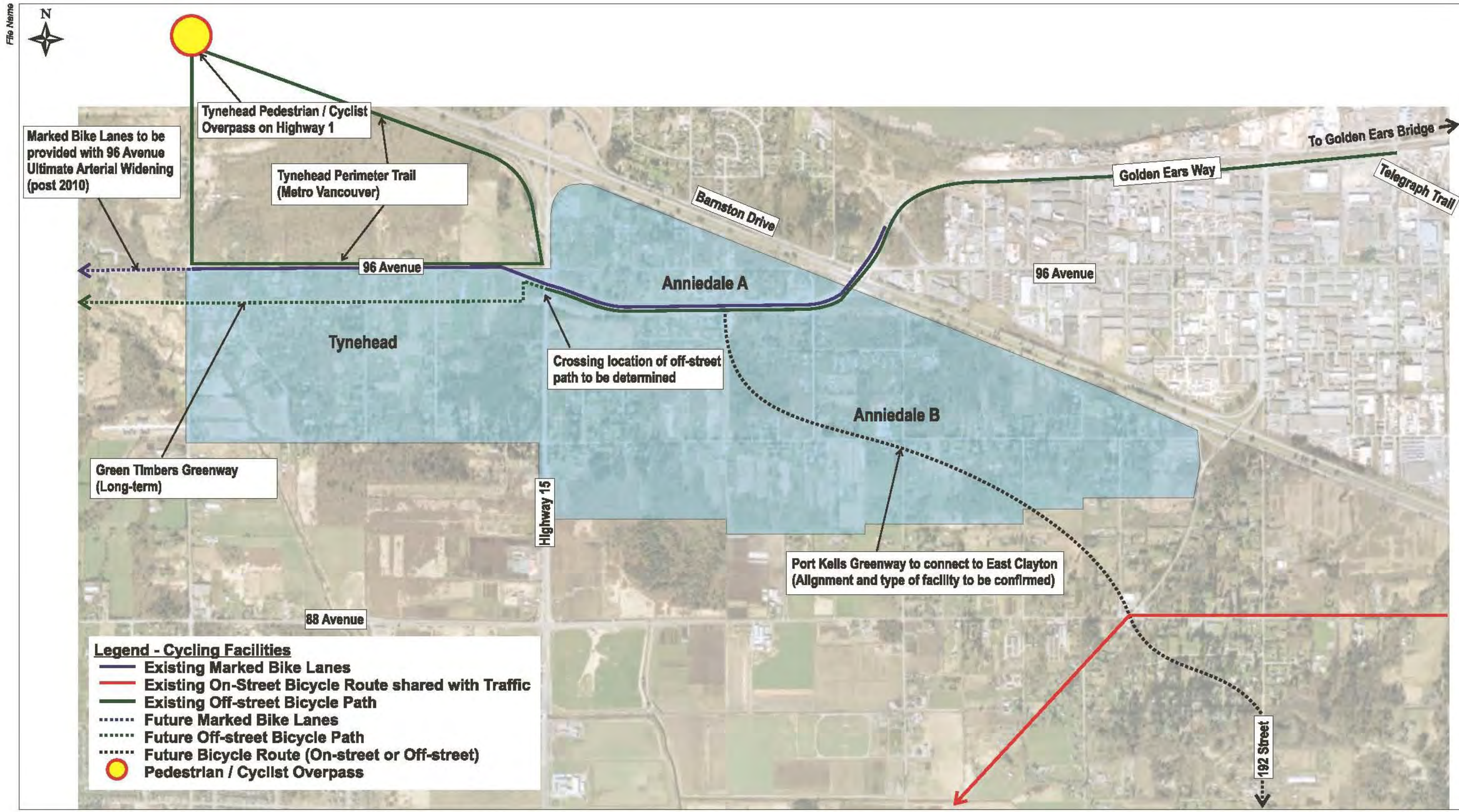

Figure 5.3

Existing / Currently Planned Bicycle Network Elements

5.1.0 BACKGROUND TRANSPORTATION PLANS AND POLICIES

The transportation component of the NCP was developed based on the guiding principles identified in the City's Transportation Strategic Plan and supplementary Walking and Cycling Plans, as well as TransLink's South of Fraser Area Transit Plan. It is also consistent with, or an improvement upon , the Highway and Traffic By-law and City policies and practices in regards to traffic operations, and truck routes.

Transportation Strategic Plan – General Road Network Layout, Spacing & Density

The 2008 *Transportation Strategic Plan* was developed to set out the vision, objectives and principles for transportation in Surrey. The six major strategic guiding principles are as follows

1. Effective And Efficient Network Management
2. More Travel Choice
3. Safer, Healthier Communities
4. Successful Local Economies
5. Protection Of Our Built And Natural Environment
6. Transportation Integration

In support of these principles, the general road network objectives for this NCP are:

- Provide an open, inter-connected and continuous grid or modified grid road network that is integrated with established and planned future roads within and surrounding the study area;
- Develop a major road network with Arterials spaced at ½ mile (800m) maximum and Collectors at ¼ mile (400m) maximum;
- Maintain Local Road intersections with Arterials & Collectors spaced 100m (min.) to 200m (max);
- Keep Local Road intersections with internal neighbourhood Collectors and other Local Roads to 100m (min.) to 200m (max) spacing;
- Align intersections of minor roads together across major roads to provide better inter-connection of neighbourhoods and avoid offset T-intersections;
- Avoid use of cul-de-sacs, unless these are required to avoid environmental or other impacts. If possible, favour loop roads over cul-de-sacs to ensure a minimum two entry/exit points to all developments.

Walking Plan

The City of Surrey published the first edition of the Walking Plan in 2011 as an update to the 1997 Pedestrian Master Plan. The document builds on the recognition that everyone at some point in their trip is a pedestrian and as such, walking is a critically important travel mode in achieving the broader six guiding transportation principles. The document outlines various guiding principles which should be applied to the Anniedale / Tynehead NCP including:

- Promote walking as a viable, and sustainable alternative to the private car for many trips and in turn increase access to health services, education, shopping, employment, cultural events, and recreation;
- Deliver policies and strategies that recognize that walking is about more than just building sidewalks and, as a result, examine everything that would encourage walking;
- Create a culture that integrates and expands walking with both strategic and "street-level" decision-making and planning across multiple departments;

Cycling Plan

The process of updating the 1994 "Bicycle Blueprint" with the official Cycling Plan was underway during the development of the NCP. As indicated earlier, **Figure 5.3** illustrates the current Bicycle Network Plan in the Anniedale-Tynehead area which includes both existing and proposed on-street bicycle lanes and off-street multi-use pathway and Greenway routes. Although, the Plan will be updated to reflect the recommended cycling plan for this NCP the then current network was assumed to be the starting point for developing a future bicycle network in Anniedale-Tynehead . The key cycling policies considered for the NCP were:

- All new Arterial and Collector Roads will have marked bicycle lanes on both sides;
- Off-street multi-use pathways should have lighting and/or be in wide open corridors, adjacent to roads , or have to meet CPTED (Crime Prevention Through Engineering Devices) principles; and
- Connect to the nearest (preferably signalized) intersection when crossing roadways to avoid mid-block crossings where possible.

Two planned major Greenway multi-use pathways are located in the NCP:

1. The Green Timbers Greenway is planned to connect with the existing multi-use pathway in the Golden Ears Way corridor through the Tynehead area using the BC Hydro right-of-way, which is south of and parallel to 96 Avenue.
2. A new greenway connecting the Anniedale, Port Kells and North/East Clayton neighbourhoods has been identified to connect these communities in the long-term.

As the current Zoning By-law does not include provision for end-of-trip facilities except for short term bicycle racks for multi-family and commercial developments, as a general policy for developments in the NCP, particularly employment lands, new development should also provide other supporting end-of-trip facilities including. The City plans to review the zoning bylaw for bicycle parking in due course to tackle this issue.

- long term bicycle parking (in the form of safe and secure bicycle storage rooms or bicycle lockers)
- lockers, showers and washrooms to support commuting by bicycle.

South of Fraser Area (SofA) Transit Plan:

In 2007, TransLink prepared the South of Fraser Area (SoFA) Transit Plan, which outlined the Long Range Transit Plan and Vision for all levels of transit to 2031, including the Analyses of the Network for 2031 as well as the Short-term Implementation Plan to 2013 for the municipalities south of the Fraser River including Surrey, Delta, Langley Township, Langley City and White Rock.

In the NCP area, future Local and Neighbourhood Bus services and routes were proposed and identified in the SoFA Plan, typically connecting to major transfer points such as Guildford, Surrey City Centre and Walnut Grove. One of the proposed routes was considered to be a candidate for inclusion as part of the Frequent Transit Network (FTN) which would provide service frequency at a minimum of 15 minutes for 15 hours a day, 7 days a week. Service on the proposed routes in the NCP would have connections to existing higher-capacity services such as SkyTrain and planned Bus or Light Rapid Transit on 104 Avenue and Highway 1. Since publication of the SoFA plan in 2007, it has been undergoing updates and refinements. TransLink has confirmed that the SoFA plan routing and timing of implementation could be adjusted to effectively accommodate the increase in density of residents and employment in the NCP area.

Road Access:

The Highway & Traffic By-law (No. 13007) and the Engineering Design Criteria Manual regulate access to roads of all classifications. The following policies for the NCP are consistent with the Bylaw, or are an improvement to it, and can be summarized as follows;

- Provide primary access via Local Roads and maximize the number of access routes and permeability of the street system;
- Manage direct access on Arterials and maintain rear lane access for all residential land uses fronting Arterials.
- Minimize direct access on Collectors through the development of rear lanes or back access roads particularly in higher density and mixed use areas to improve pedestrian environment on fronting street and increase on-street parking supply. If direct access is unavoidable, follow principles of good access management in terms of location, spacing, sight distance and permitted movements;
- Avoid any frontage roads or gated private communities or neighbourhoods.

Truck Route Background & Policies

The City's Highway & Traffic By-law No. 13007 also regulates the streets designated as truck routes. **Figure 5.4** shows the current designated truck routes in the South Port Kells area, with includes City of Surrey truck routes as well as Provincial/Regional truck routes. The City maintains a designated truck route plan in order to focus larger commercial vehicles on appropriate roadways and minimize impacts to residents. This bylaw states that no person shall drive, operate, or park a heavy truck on any highway in the City other than on a truck route except for:

- any heavy truck operating for or on behalf of the City;
- as authorized by a permit issued by the City Engineer;
- where it is necessary to deviate from a truck route for the purpose of delivering or receiving goods or other such common commercial purpose by the shortest route from the nearest truck route with the least impact on residential area; or
- where heavy trucks on any highway or part of a highway have been properly authorized as a temporary detour truck route.

When the existing truck weigh scale on Highway 1 between 152 Street and 176 Street (Highway 15) is relocated east of Highway 15 as part of the Highway 1 widening project and the South Fraser Perimeter Road is complete by 2013, the City will designate 96 Avenue west of Highway 15 as a truck route. Also, it is likely 88 Avenue east of Highway 15 to the Langley border will also ultimately be designated a truck route, since it is on TransLink's Major Road Network (MRN).

Traffic Operations & Control Policies

As part of the Transportation Strategic Plan, the City has recognized the need and importance of managing the network on a day to day basis. Maintaining a safe and efficient transportation system with properly managed traffic operations is critical to supporting efficient movement of goods, regional, and local traffic. As well, it reduces the potential for through traffic to use local streets. Example principles are:

- Plan for likely locations of traffic signals (All Arterial/Arterial and Arterial/Collector intersections) but only install when warrants are met based on minimum vehicle volumes, delay and collision history.
- Optimize spacing of traffic signals on Arterial Roads at 400m for good signal progression;
- Consider roundabouts as alternatives to a traffic signal or all-way stop, if conditions are appropriate;
- Install traffic calming devices on Local Roads as per the City's Traffic Calming Policies and Practices, or in special circumstances where considered appropriate.

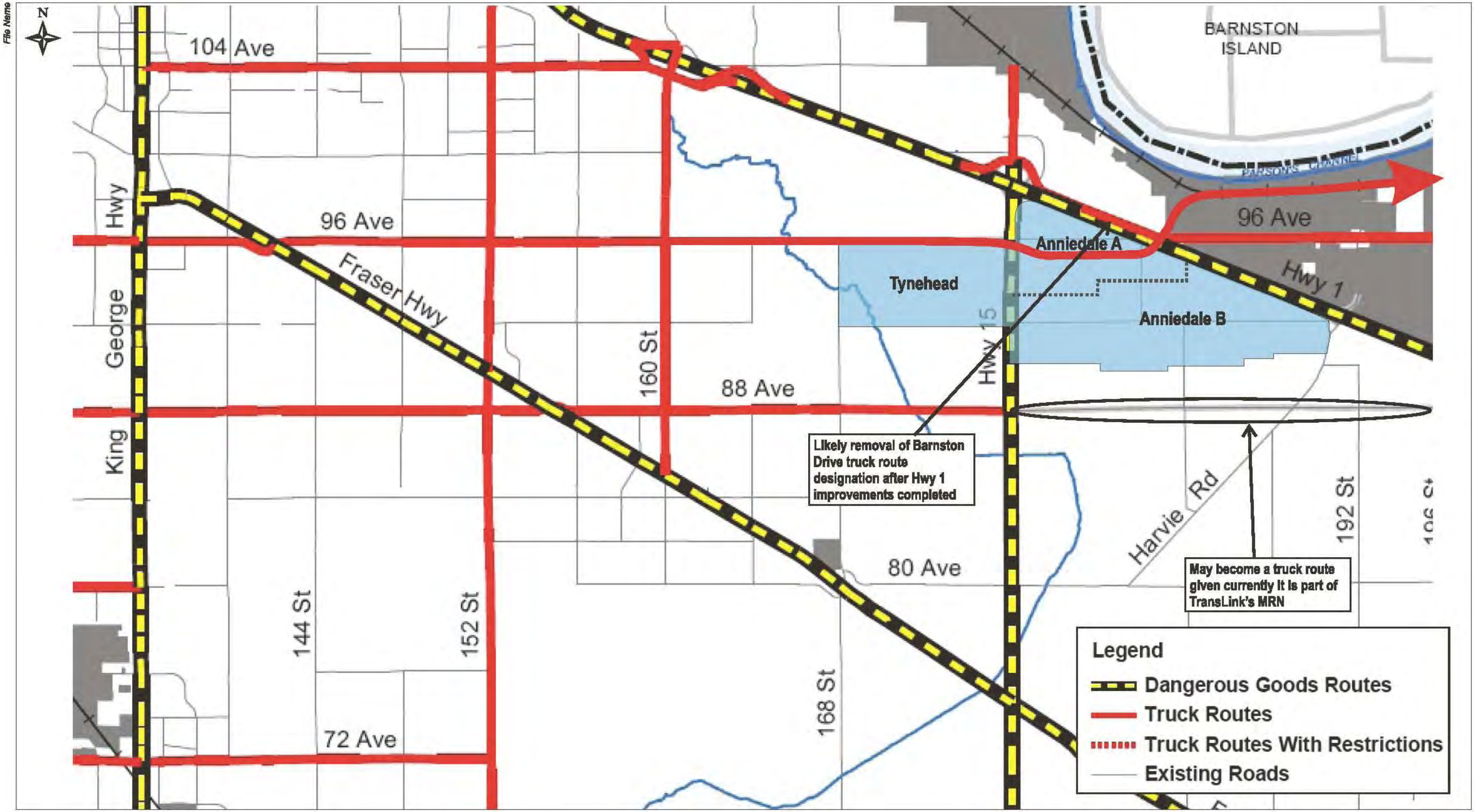

Figure 5.4

Existing Truck Routes

Anniedale / Tynehead Stage 1 NCP Road Network Study, Surrey BC
4027.15 June 2011 Scale NTS

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5.1.1 Major Road Network Plan

The City defines roads based on a classification system as follows:

- **Provincial Highways –** are generally controlled access facilities that provide high speed connections to other parts of the region.
- **Arterial Roads –** generally function to carry through traffic from one area to another with as little interference as possible from adjacent land uses and may provide limited direct access to adjacent properties as a secondary function, although this is generally not desirable.
- **Collector Roads –** primary function is to distribute traffic between arterial roads, other collector roads and local roads within an area. Collector roads may also provide access to adjacent properties as required.
- **Local Roads –** are generally lower volume neighbourhood streets that provide access to individual properties

The City maintains a long range arterial and collector classification network plan, identified in the Subdivision Bylaw, as Schedule “D” (R-91) Road Classification and “K” Major Road Allowance maps. These plans designate all existing and proposed new Arterial and Collector Roads, and the Road Allowance necessary, to support full build-out of the City according to the current Official Community Plan.

The City’s Major Road network hierarchy plan and identified Ten Year Servicing Plan projects in, and adjacent to, the Anniedale-Tynehead prior to the implementation of the NCP is illustrated on Figure 5.3. Current designated Arterials in the area are 88 Avenue, 96 Avenue, 168 Street, 192 Street and Harvie Road and designated collectors are 92 Avenue east of Highway 15, 182 Street between Golden Ears Way, 92 Avenue, 184 Street south of 92 Avenue and 90 Avenue between Harvie Road and 192 Street.

The current R-91 Plan designated road classifications assume Anniedale-Tynehead would be developed at lower residential densities than are contemplated in the NCP. The current plan also does not reflect changes that occurred as part of the construction of Golden Ears Way such as the down classification of 96 Avenue east of Highway 15 and the revision of the principle north south connection to 180 Street instead of 182 Street. Although the basic framework of the Arterial and Collector road system as illustrated on **Figure 5.5** is assumed to be the starting point in developing a long range road network plan for the NCP it is understood that the development of the NCP will result in significant changes required to the R-91 Plan.

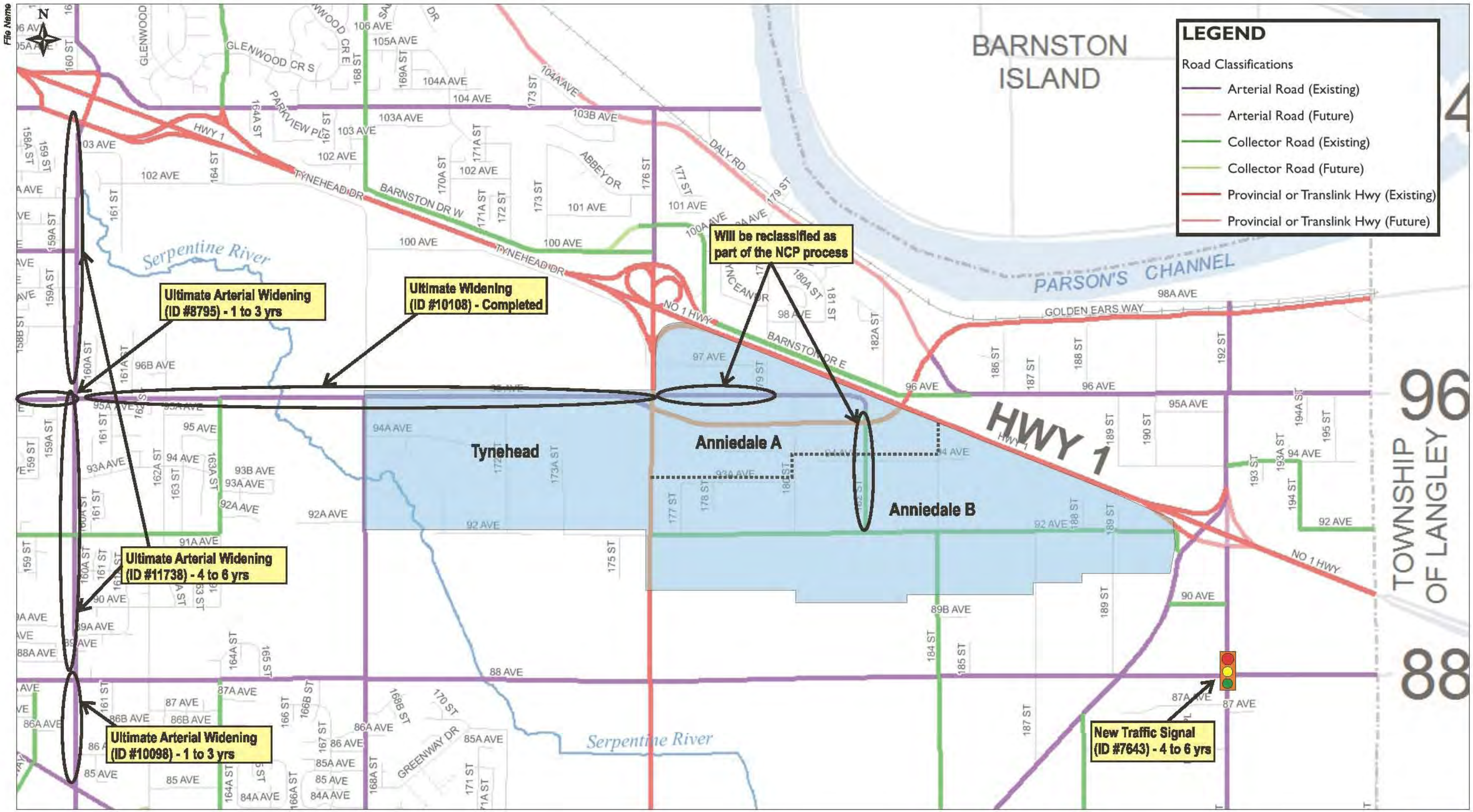

Figure 5.5

R91 Road Network Plan & Current 10 Year Servicing Plan Improvements

Anniedale / Tynehead Stage 1 NCP Road Network Study, Surrey BC
4027.15 June 2011 Scale NTS

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Table 5.1 below describes the hierarchy of roads within the NCP and provides a detailed listing of the City's standard road classifications and their design elements, including required road allowance dedications, occasionally referred to as road right-of-way (ROW). As development occurs over time, the City will require developers, as part of the Subdivision By-law, to dedicate road allowance either along their property frontages or for new roads planned within their properties in accordance with these roadway standards.

Table 5.1 - City of Surrey Road Classes & Design Features

Road Classifications			Design Features				
Type	**Sub-Type**	**Land Use**	**No. Lanes**	**Right-Of-Way**	**Pavement Width + Median**	**Sidewalks**	**Bicycle Facilities**
Provincial / Regional Jurisdiction							
Highway	Freeway	---	4 to 8	Varies	varies	n/a	n/a
	Expressway	---	4 to 6	Varies	varies	varies	possibly, varies
City Jurisdiction							
Arterial	Divided Urban	---	4 plus median/ left turn bays	30m	20m	2 @ 1.8m	1.8m bike lanes
	Divided Rural	---	4 with two way left turn lane	30m + Statutory ROW for roadside ditches as required	20m	n/a	1.8m bike lanes
Collector	---	---	2 + left turn bays or 2 with parking lanes	24m	14m	2 @ 1.8m	1.7m bike lanes
Local	Through (3)	Commercial /Industrial	2	20m	11m	2 @ 1.5m)	Share traffic lane
		Single Family (1) Residential	2	18m or 20m	8.5m or 10.5m	2 @ 1.5m	Share traffic lane
		Medium to High (2) Density Residential	2	20m	10.5m or 11m	2 @ 1.5m	Share traffic lane

Table Notes:
Arterial and Collector road standards based on cross section information received from Engineering Department (November 2010);
The City of Surrey has Alternative Residential Road Standards. The smaller dimensions under Right of Way Dedication and Pavement Width for Residential Streets reflect the narrower Alternative Standards.

(1) 'Single Family' is considered A-1 to RF Zone Designation;
(2) 'Medium to High" is RF-12 and denser;
(3) Limited Local designations will be considered where physical constraints prevent through local connections and are subject to Design Criteria.

5.1.2 External Agencies Road Network Plans

Highway Improvements
There are several major Provincial (Ministry of Transportation & Infrastructure) and Regional (TransLink) roadway projects recently completed or underway within or adjacent to Anniedale-Tynehead that have impacted or will impact traffic volumes and traffic patterns in the study area. These are described below.

Gateway Program
The Gateway Program was established by the Ministry of Transportation & Infrastructure (MoTI) to address the impact of growing regional congestion and to improve the movement of people, goods and transit throughout Greater Vancouver. Of all the projects that are undertaken by the Gateway Program, two of them will have direct impact to the Anniedale-Tynehead area:

- Port Mann Bridge / Highway 1 Project; and,
- South Fraser Perimeter Road.

The proposed Port Mann Bridge / Highway 1 Project is part of the overall Gateway Program, and will include the construction of a new 10-lane Port Mann Bridge, widening of Highway 1 from 1st Avenue in Vancouver to 200th Street in Langley to 8 lanes (6 general purpose lanes plus 2 High Occupancy Vehicle (HOV) lanes) and upgrading of the interchanges. These improvements are currently under construction and expected to be completed by 2013.

Within the Anniedale-Tynehead study area, key Gateway project elements are the widening of Highway 1, the re-construction of the Highway 15/Highway 1 interchange, widening of Highway 15 south from 104 Avenue to Golden Ears Way (GEW), and modifications to the Harvie Road interchange to provide movements to/from the north (for all traffic) and east (for trucks only).

To date, the only completed construction in the study area has been the widening of Highway 15 south from Highway 1 and through the GEW intersection to 4 lanes, undertaken in conjunction with the opening of GEW. Four through lanes have been provided on Highway 15 through the signalized intersection, along with dual left turn lanes on both the north and southern legs. However, Highway 15 has been constructed to ultimately permit 6 through lanes at GEW, which represents the “maximum footprint” of the intersection. On the north side of the Highway 1 / Highway 15 interchange, the north-south portion of Barnston Drive East connecting to 100A Avenue has now been upgraded and widened as part of the interchange improvement works.

The South Fraser Perimeter Road (SFPR) will be a new four-lane arterial highway (expessway) route along the south shore of the Fraser River extending from the Deltaport Way in the southwest Delta to 176th Street and the Golden Ears Bridge connector road in Surrey and Langley. The SFPR is anticipated to be completed by 2013. The completion of the SFPR will provide some relief to the traffic demand through the city’s east-west arterial roads as well as the Highway 1 corridor. While not within the study area, the SFPR is expected to shift traffic (particularly truck traffic) off Highway 1 and east-west roadways in the City of Surrey, including 96 Avenue and Golden Ears Way in Anniedale-Tynehead.

Border Infrastructure Program

The Border Infrastructure Program (BIP) was a jointly funded Federal-Provincial initiative to improve the movement of goods to and from the Lower Mainland's four border crossings. The Highway 15 project component of the BIP included the widening of Highway 15 (176th Street) in Surrey to four lanes from 32 Avenue to Golden Ears Way (GEW). The focus of the Highway 15 improvements was the widening to 4 lanes but also access management. The only access permitted between 88 Avenue and Highway 1 (besides minor driveways which will ultimately be closed when properties redevelop) was a right-in/right-out access at 92 Avenue. The Ministry of Transportation & Infrastructure has confirmed that this is the only direct access permitted to the Anniedale-Tynehead neighbourhood from Highway 15.

Golden Ears Way

The Golden Ears Bridge (GEB) is a six-lane tolled bridge across the Fraser River connecting the Township of Langley with Pitt Meadows and Maple Ridge, generally following the 200th Street alignment and with connector roads in the north and south shores. The GEB was opened to traffic in 2009. Of key importance to the Anniedale-Tynehead study area was inclusion of a new east-west arterial route, known as Golden Ears Way (GEW) which generally follows the 95 and 96 Avenue alignment, passing under Highway 1 to connect with Highway 15 at 96 Avenue.

TransLink controls all access to GEW and in the Anniedale-Tynehead area, access is limited to a new signal located at 180 Street. No additional direct access will be permitted, according to the Master Municipal Agreement between TransLink and the City of Surrey. At the GEW/Highway 15 intersection, 4 though lanes and dual eastbound and westbound left turn bays have been provided on GEW as well as separate right turn lanes on the east and west legs.

TransLink has confirmed that the right-of-way for GEW was established for a four lane roadway and there are currently no plans to ultimately widen it to 6 lanes in the study area. It is noted that the GEB and GEW were planned in 2003-2005 and the designs were based on Design Hour Volumes (DHV) that did not contemplate any major redevelopment in the Anniedale-Tynehead area.

TransLink Major Road Network

TransLink is responsible for the shared funding of maintenance, rehabilitation and development of over 2,100 lane-km of Major Road Network (MRN) across the region. The designation of MRN is based on the road providing access to important activity centres in the region, and meeting criteria related to trip lengths, traffic volumes, transit ridership and commercial vehicle demand. Since 1999, as part of TransLink's MRN Capital Development Program, they have invited municipalities to submit funding requests for 50-50 cost sharing on improvements to MRN roadways. Within the study area, 88 Avenue, 96 Avenue and Golden Ears Way are all designated MRN roads.

5.2.0 ANALYSIS

Approach

The road network plan for Anniedale-Tynehead was developed by forecasting future peak hour traffic demands generated by the proposed land uses for both neighbourhoods, and superimposing this demand on future background traffic demands assigned to a series of road network options. These road network options included different strategies to address the anticipated increase in traffic generation in the area. Then, detailed analysis of traffic flow patterns, link and intersection capacities was undertaken to determine the most effective and best-performing elements of the future road network options. Ultimately, a Preferred Road Network was selected which was then used as the framework for developing truck, bicycle and potential future transit plans for the Anniedale-Tynehead neighbourhoods.

Future Traffic Generation

To estimate traffic generation, the study area, covering Anniedale, Tynehead and also the Port Kells neighbourhood was first divided into approximately 60 traffic zones and then a peak hour traffic generation estimate prepared for each zone. The City of Surrey's policy is to use land use-based trip rates when forecasting NCP traffic, as this is the basis for the City's Development Cost Charge (DCC) calculations. Therefore, vehicle trips during the Weekday PM Peak Hour were estimated for each traffic zone based upon the draft NCP land uses provided by the City, applying rates from standard industry sources or previous relevant studies. More information on the methodology and assumptions in estimating future traffic generation can be found in the Anniedale-Tynehead Stage One NCP Road Network Study.

Table 5.2 below summarizes the future traffic generation of the Anniedale-Tynehead. The table lists traffic generation by land use type and also by neighbourhood. Note that this traffic generation estimate was for the Anniedale-Tynehead NCP land use plan as it was in November, 2010; the land use plan has changed slightly since then but these changes have not resulted in any substantive changes to the forecasted traffic generation.

Table 5.2 - November 2010 PM Peak Hour Traffic Generation Forecast

Land Use/Area	In	Out	Total
By Land Use type within Anniedale- Tynehead			
Residential	3,024	1,583	4,607
Institutional	18	36	54
Recreational	75	84	130
Commercial	1,268	1,409	2,678
Industrial	365	1,073	1,439
All Uses	*4,750*	*4,185*	*8,908*
By Area within in Anniedale- Tynehead			
Anniedale	2,726	2,212	4,938
Anniedale Triangle	173	345	518
Tynehead	1,852	1,628	3,480
All Areas	*4,750*	*4,185*	*8,908*

5.2.1 Road Network Options and Modelling

Five NCP road networks were developed and tested: A "Base Network" which represented the draft April 2010 road network plan; and, four alternatives to the Base Network. These alternatives were developed to test the impacts of various overall road network element strategies, including improvements to key congested intersections and new or widened Arterials and Collectors.

The road network options were analyzed using two types of transportation computer models: a VISUM travel demand model (to forecast future traffic on the road network options) and a Synchro traffic operations model (to assess the quality of future traffic operations including V/C ratios and Level of Service).

For the travel demand forecast modelling, the EMME software was used initially to develop a detailed sub-area model of the South Port Kells area, including the Anniedale, Tynehead and Port Kells traffic zones. The sub-area model was based on the Gateway Program's 2031 Sub-area model Version 5.0 (GSAM V5.0) using the Growth Management Strategy Version 5.2 land uses, which in turn was based on TransLink's regional travel demand forecasting model. GSAM 5.0 was used in this study as the Metro Vancouver regional model was in the process of being updated to 2041 and was unavailable for use.

The EMME NCP sub-area model (EMME NCP SAM) was employed to extract regional travel patterns due to major changes in the regional network external and internal to the NCP area. These changes included the planned upgrades to the Patullo Bridge, tolling on the Port Mann and Patullo Bridges, implementation of a new full movement interchange at Highway 1 & 192 Street, possible implementation of a new interchange at Highway 15 & Golden Ears Way (GEW) and the extension southward of 180 Street from GEW to 88 Avenue. All of these network modifications would have implications for longer distance travel patterns through the NCP study area road network. A number of EMME SAM scenarios were developed that reflected these network changes and then traversal Origin-Destination Matrices within and across a cordon line outside of the NCP study area were extracted from the model runs.

Once the traversal OD matrices were extracted from EMME, the VISUM software was used to assign traffic to the neighbourhood roadway network and external gates to the study area. The VISUM models were also employed in assessing major traffic patterns and in evaluating overall network comparison statistics such as total vehicle-km of travel.

For operational analysis modelling, the intersection volume outputs from the VISUM models were transferred to the Synchro software to create traffic models for the assessment of traffic operations. The Synchro analysis focused on key major intersections and assisted in refining laning arrangements and proposed traffic controls. The Synchro analysis results were also employed to refine the road network plan options based on capacity and queue assessments.

For further more detailed information on the network options and the analysis of these options, refer to the Anniedale-Tynehead Stage One NCP Road Network Study

5.3.0 PROPOSED TRANSPORTATION SYSTEM

The Preferred Road Network is illustrated on **Figure 5.6** Elements of the Preferred Road Network and its rationale is discussed below, based upon the findings of the detailed modelling analysis.

Highway 15 / Golden Ears Way (GEW) Interchange

All of the traffic forecasting and analysis work conducted for the previous South Port Kells GLUP study as well as the Anniedale-Tynehead NCP study identified major capacity constraints at the Highway 15 & GEW intersection by full build out of Anniedale-Tynehead in 2041. Therefore, it was concluded that to support the growth anticipated in Anniedale-Tynehead, operational improvements to the intersection beyond the "maximum footprint" already planned by MoTI/TransLink should be considered. Various means to achieve operational improvements at the Highway 15 & GEW intersection were investigated, including:

- ❖ Reducing the trip generation of Anniedale-Tynehead;
- ❖ Implementing adjacent road network improvements to shift traffic away from the intersection;
- ❖ Widening GEW to 6 lanes through the intersection; and,
- ❖ Upgrading the intersection to provide either a non-conventional at-grade intersection or a grade separated interchange.

Based on the analysis of these options, the Preferred Network includes:

- ❖ 6 lanes on Highway 15 through the intersection;
- ❖ Direct access to Highway 15 at 92 Avenue which, combined with the 92 Avenue overpass, allows all-way movements in/out of both Anniedale and Tynehead from Highway 15 without using Golden Ears Way;
- ❖ A full movement interchange at Highway 1 & 192 Street; and,
- ❖ 180 Street connected through to 88 Avenue.

In addition, the land use designation in the Anniedale Triangle area was modified from its initial draft April 2010 "Business Park" designation to "low impact Industrial" to reduce traffic volumes at both the Highway 15 & GEW and GEW & 180 Street intersections.

However, even with these network and land use changes, the capacity of an at-grade signalized intersection at Highway 15 & GEW did not meet the City's desired threshold V/C ratio of 0.90. Also, with an at-grade intersection, the traffic forecasting model indicated that inappropriately high (700 vph) volumes of longer-distance municipal and regional traffic could use 180 Street between Golden Ears Way and 88 Avenue, due to significant congestion and poor Level of Service at the Highway 15 & GEW intersection. Therefore the Preferred Network as illustrated on **Figure 5.6** includes a grade separated interchange at Highway 15 and GEW.

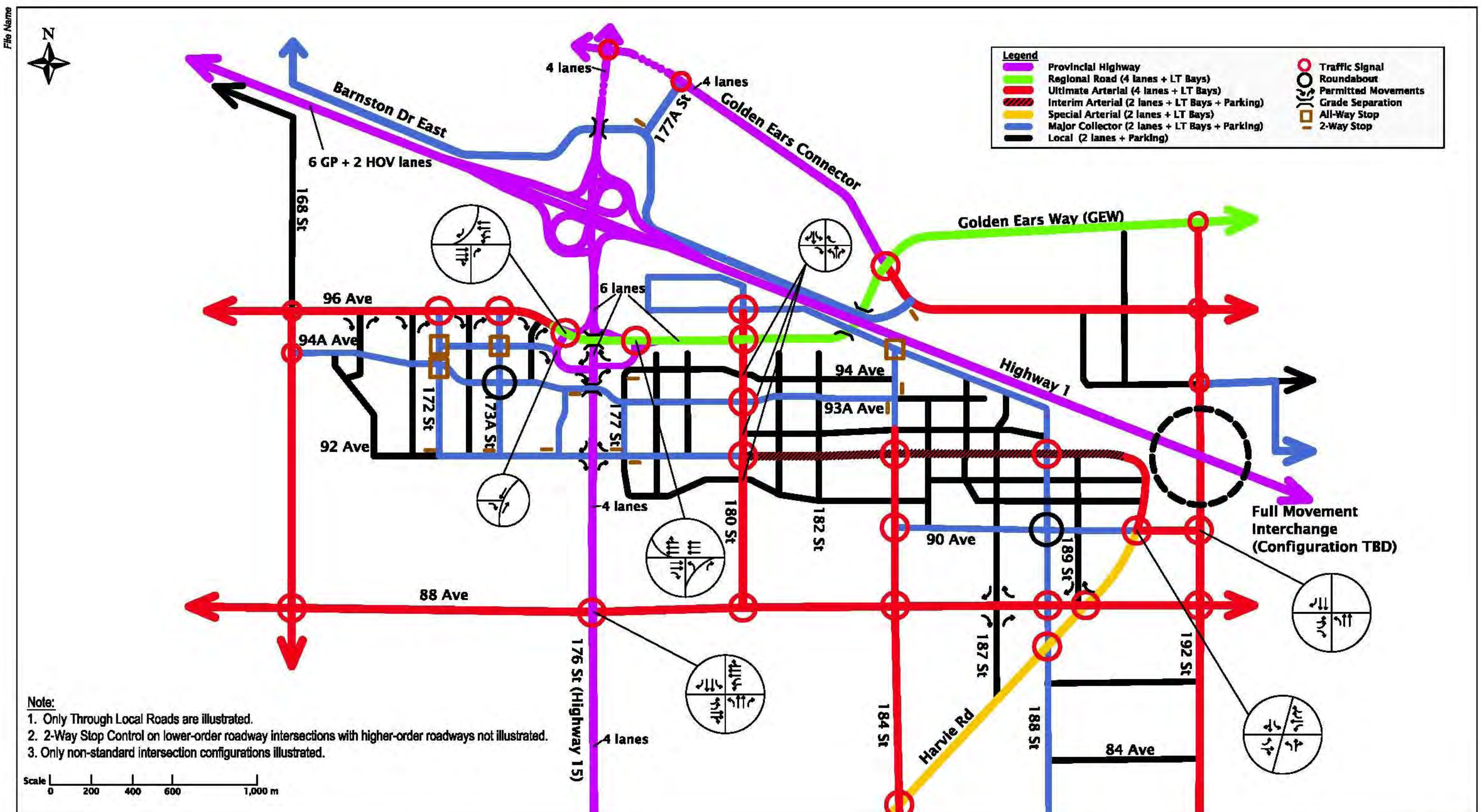

Figure 5.6
Preferred Road Network

Anniedale/Tynehead Stage 1 NCP Road Network Study, Surrey BC
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Once it was concluded that a grade separate interchange would be required to meet the City's performance objectives at the Highway 15 & GEW intersection, further work was undertaken to select a preferred interchange configuration, establish the required right-of-way footprint and develop "Class D" cost estimates. Five interchange design concepts were developed and evaluated using a comprehensive Multiple Account Evaluation process which included criteria such as cost, customer service, and environmental, economic development and socio-community impacts. This work is described in detail in the Highway 15 and Golden Ears Way Intersection Study.

Figure 5.7 illustrates the preferred conceptual design of the City's preferred interchange layout for the Highway 15 and Golden Ears Way interchange. The preferred layout has the following features:

- 4 through lanes on 96 Avenue/Golden Ears Way, with dual left turns lanes at the west intersection and right turn exit lanes at both intersections;
- Single lane direct ramps and loops, with dual lanes tapering to a single lane to accept the dual westbound to southbound left turn lanes at the west intersection, and dual left turn lanes for the northbound to westbound movement at the east intersection;
- 6 lanes on Highway 15 north and south of the interchange;
- 4 lanes on Highway 15 generally within the interchange between the exit/entrance ramps with acceleration and deceleration lanes at ramps;
- 96 Avenue/Golden Ears Way crossing over Highway 15 using 6% grades that flatten at intersection locations;
- A clear span overpass structure over Highway 15; and,
- A 4 m wide multi-use path on the south side of 96 Avenue/Golden Ears Way over the structure to connect planned cycling facilities on the 96 Avenue/Golden Ears Way corridors across Highway 15 via a grade-separate crossing.

Representatives of the Ministry of Transportation & Infrastructure, the Gateway Program and TransLink were consulted during the development and evaluation of interchange alternatives. Currently, these agencies are unable to either endorse the conclusion that a grade separated interchange may ultimately be required, nor the preferred design concept. Due to the unknown timeline and budget availability these agencies are unable to commit to contributing any funding for the future interchange.

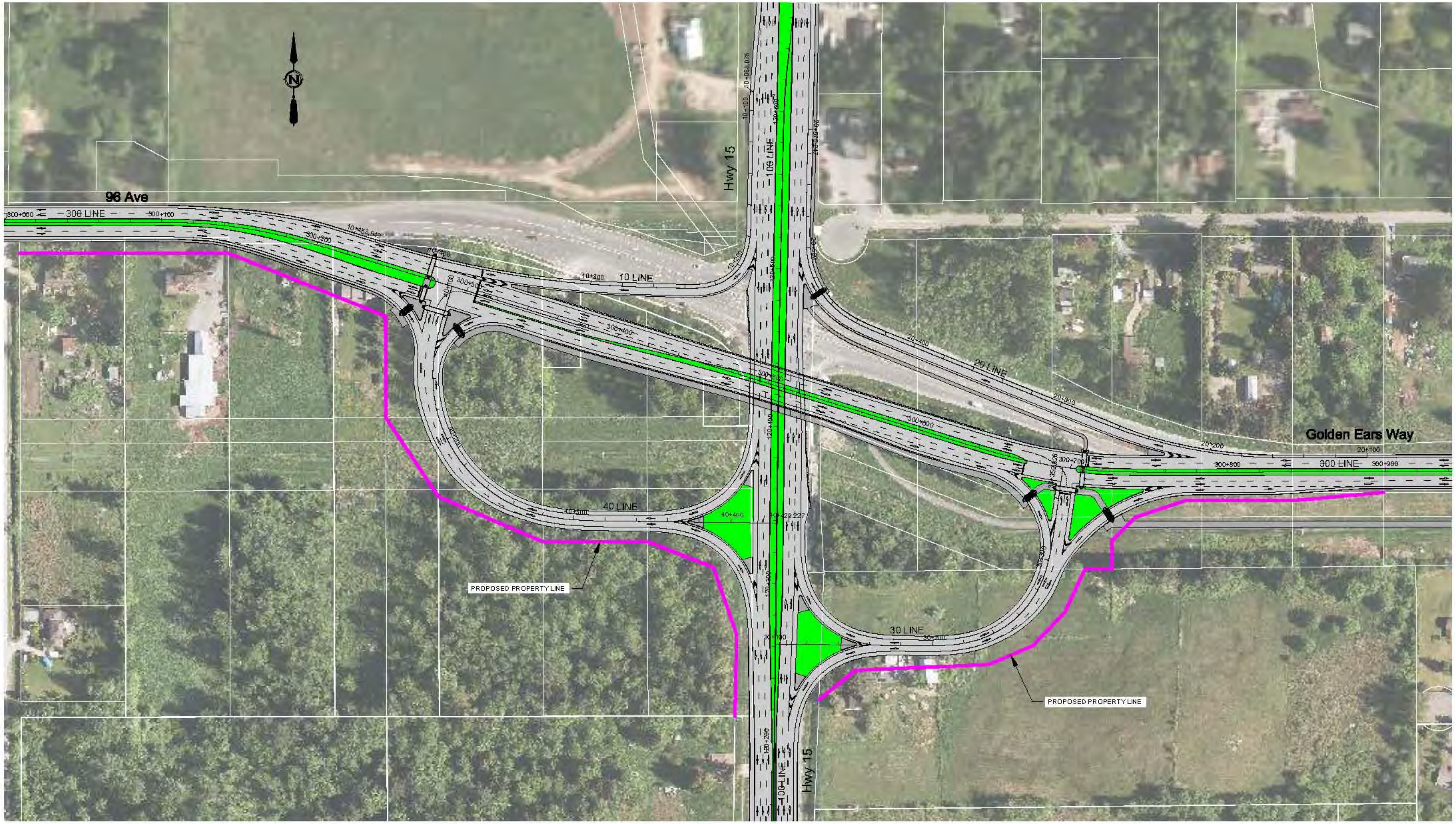

Figure 5.7

HWY 15 / GEW INTERCHANGE OPTIONS
INTERCHANGE OPTION 3 - Laning

Dwg. No.: 20112805-00-SK018
Date: November 01, 2011

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Associated Engineering

Highway 15 & 88 Avenue

Even with westbound dual left turn lanes assumed at Highway 15 & 88 Avenue, desired traffic operations thresholds could not be met without adding through lanes on 88 Avenue (or alternatively, Highway 15). This improvement has been shown on the Preferred Network, but it is noted that the volumes at this intersection are highly dependent on whether 180 Street is connected directly to 88 Avenue. When this connection is in place, it may attract through traffic between GEW and Highway 15 south of 88 Avenue or between GEW and 88 Avenue west of Highway 15, resulting in very high westbound to southbound left turn and westbound through movements at the intersection.

New Arterial Road Classifications

In the Preferred Road Network, two additional roadway sub-classifications to the City's R-91 Road Classifications were introduced, specific to the Anniedale-Tynehead neighbourhood: "Special Arterial" and "Interim Arterial."

The "Special Arterial" standard is applied solely to Harvie Road, which includes 2 lanes plus left turn bays with paved shoulders for walking and cycling. This standard was considered necessary to reflect the required traffic operations while recognizing the historical importance of Harvie Road, as it was originally a dedicated right-of-way for the original rail corridor connection to the United States. While remaining only 2 lanes, Harvie Road provides a strategic connection between the Port Kells neighbourhood and the future 192 Street interchange in the north, to 188 Street and Fraser Highway in the south. Traffic forecasting and analysis work showed that while future volumes are expected to remain relatively low for an Arterial Road, Harvie Road will carry longer distance traffic and continue to play an important role in the City's major road network.

The section of 92 Avenue between 180 Street in the west and its transition to Harvie Road in the east is classified as an "Interim Arterial". With this designation, the City will protect 30m of right-of-way as per a typical 4 lane Arterial standard, but in the interim will construct a different roadway cross section. In the Preferred Road Network, 92 Avenue is proposed to be constructed as a 2 lane Interim Arterial with left turn bays and parking on both sides permitted between intersections. This cross section would permit future upgrading to full 4-lane Arterial standard by simply removing on-street parking, if ever required.

95 Avenue – 175 Street Collector Road

An east-west Collector Road is proposed approximately on the 95 Avenue alignment within the major commercial parcels in the Tynehead neighbourhood in conjunction with a potential "Entry-only" access connecting this roadway to the proposed southbound on-ramp from Golden Ears Way to Highway 15.

This direct access to the interchange ramp is proposed as it will provide better connectivity for all vehicles from Tynehead to travel to the south. However, it will be contingent on the configuration of the intersection/interchange at Highway 15 & GEW as well as approval from the agency or agencies ultimately responsible for the ramp.

With subsequent refinement of the grade-separated interchange design the ability to connect 95 Avenue with 175 Street allows flexibility for increasing connectivity to the 92 Avenue right-in right-out access with Highway 15 should the direct ramp access not be permitted.

Local Road Class Designations

Figure 5.8 illustrates the Local Road class designations for the Proposed Road Network. The various Local Road classes are listed and described in details in the **Table 5.1** previously.

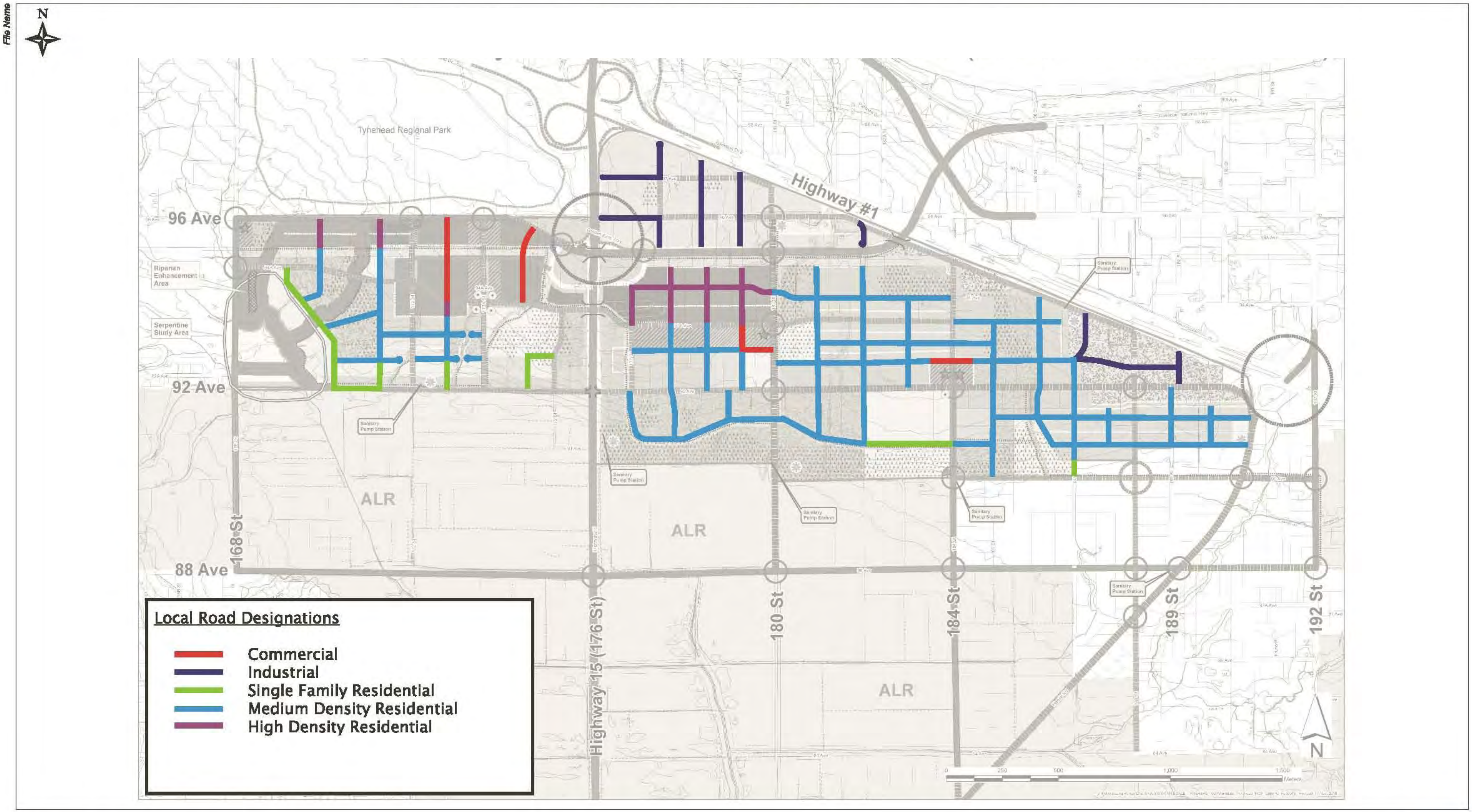

Figure 5.8

Preliminary Local Road Designations

Anniedale / Tynehead Stage 1 NCP Road Network Study, Surrey BC
4027.15 February 2011 Scale NTS

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5.3.1 Future Traffic Assignment

Figures **5.9** and **5.10** summarize the Weekday PM Peak Hour traffic distribution for the Preferred Road Network. **Figure 5..11** illustrate the VISUM model's traffic assignment to the Preferred Network and Figure **5.13** illustrates the Synchro model plot of key intersection turning movements. **Table 5.3** below provides the Weekday PM Peak Hour directional screenline volumes on the Preferred Network.

Table 5.3 - Weekday PM Peak Hour Screenline Volumes

Screenline Description		Dir	Preferred Network 2031/2041
South of 96 Ave/ GEB		S	4,237
		N	2,598
North of 92 Ave		S	3,926
		N	3,272
South of 88 Ave		S	4,473
		N	4,029
East of 173A		E	2,005
		W	2,976
East of 180		E	3,235
		W	3,585
East of 187		E	1,545
		W	2,137
External Zones	North	OUT	7,429
		IN	6,332
	South	OUT	3,544
		IN	4,144
	East	OUT	6,779
		IN	5,942
	West	OUT	8,095
		IN	9,096

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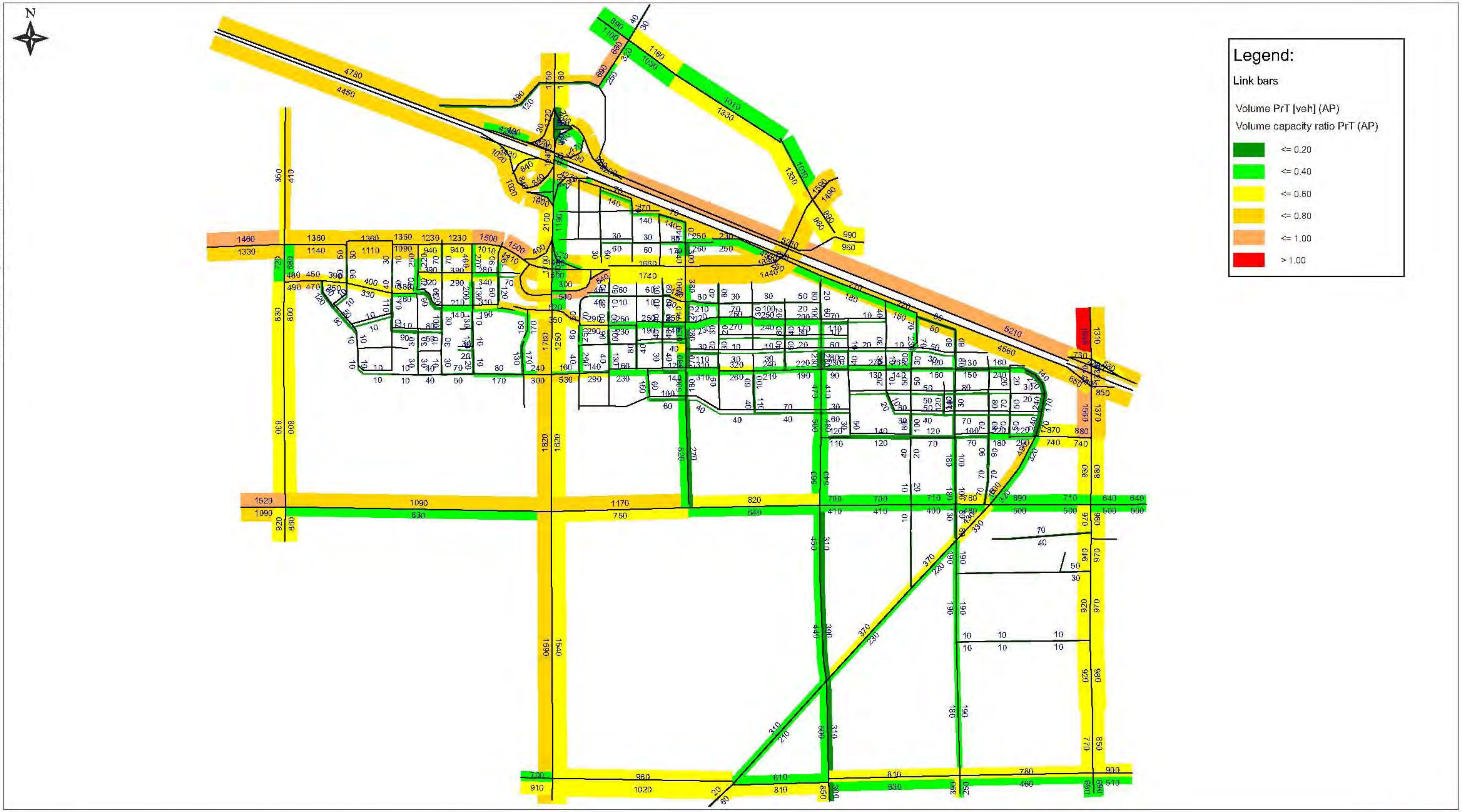

Figure 5.9

Preferred Network Weekday PM Peak Hour Assignment Plot

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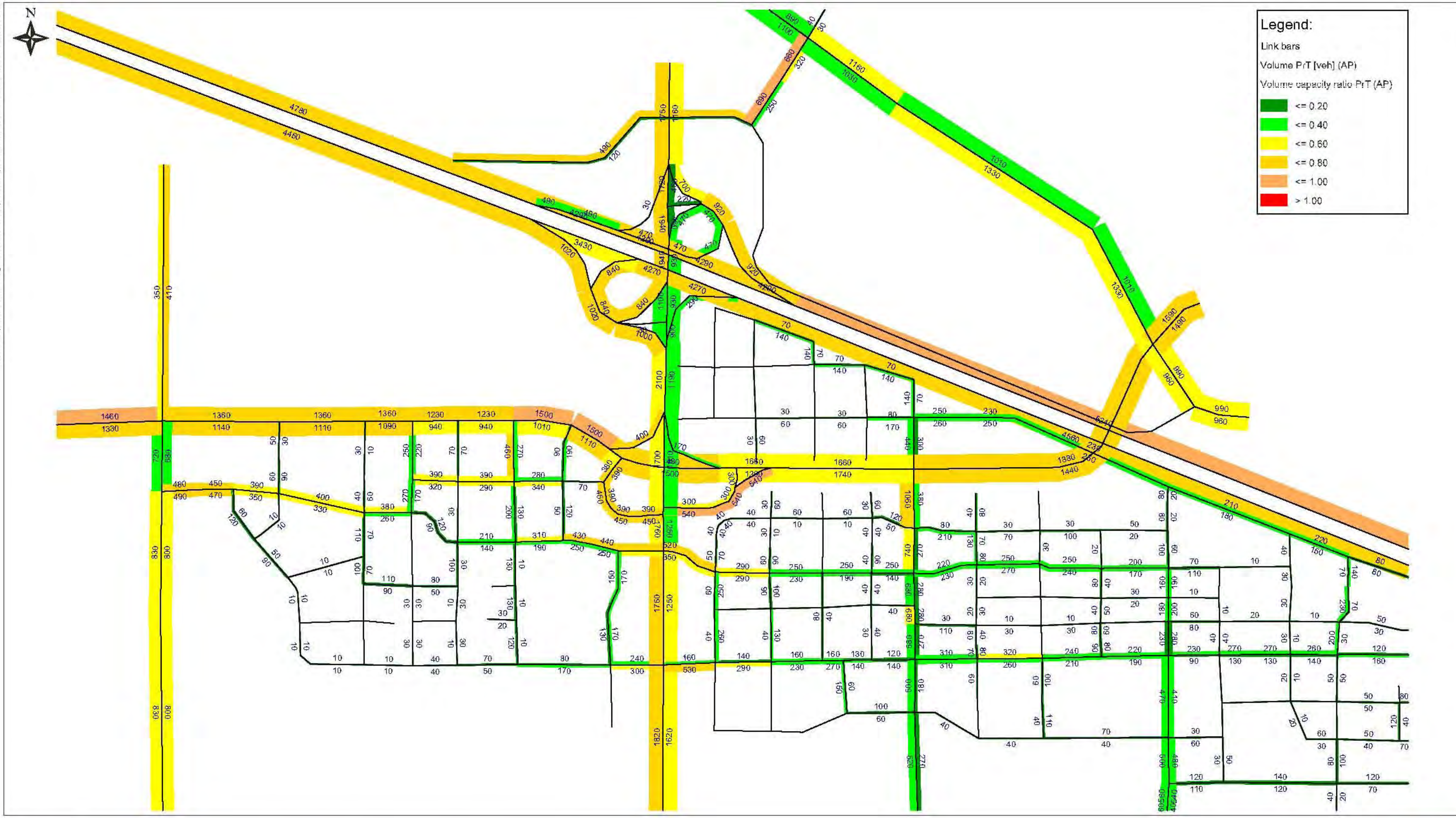

Figure 5.10

Preferred Network Weekday PM Peak Hour Assignment Plot Detail

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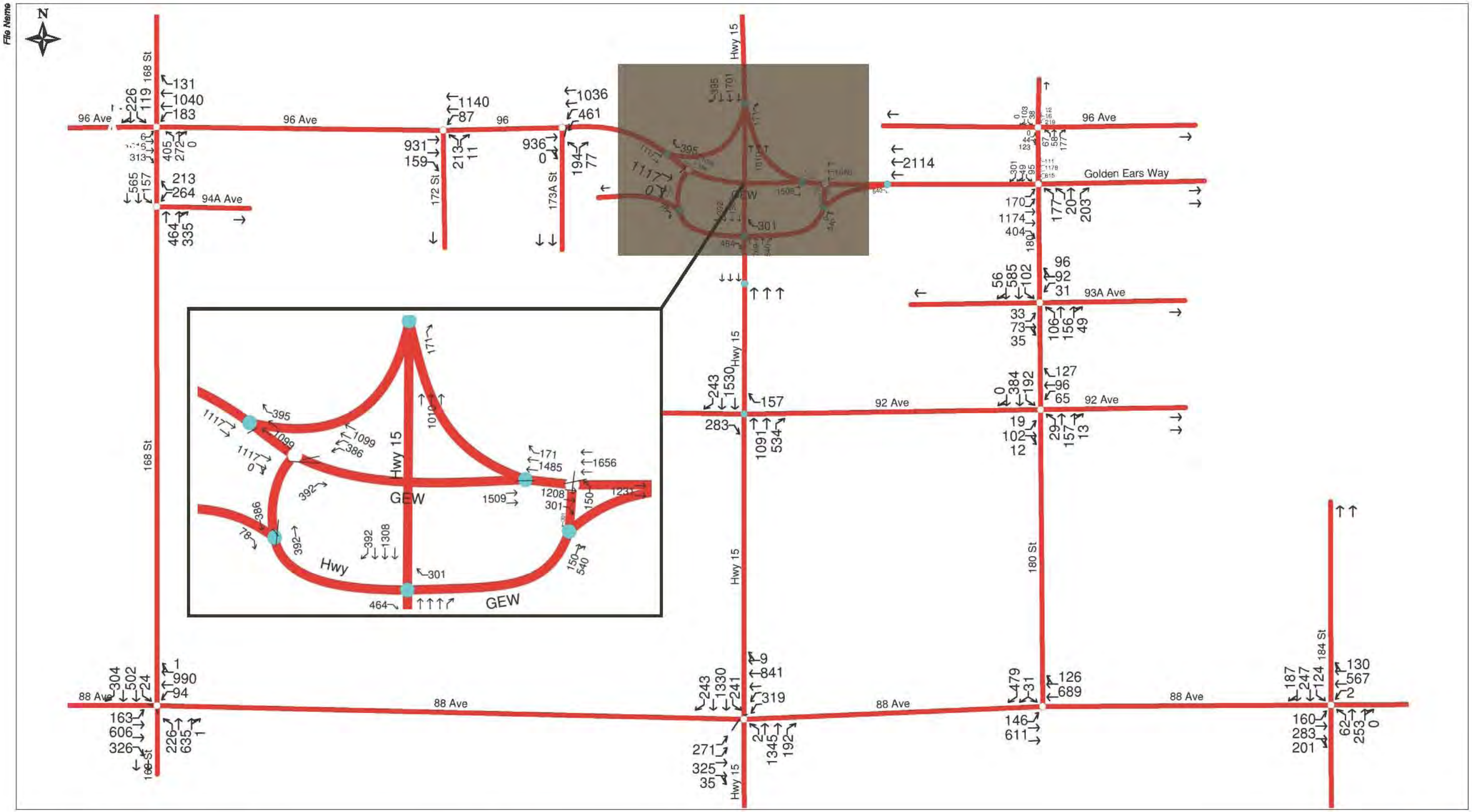

Figure 5.11

Synchro Model Plot for Key Intersections of Preferred Network

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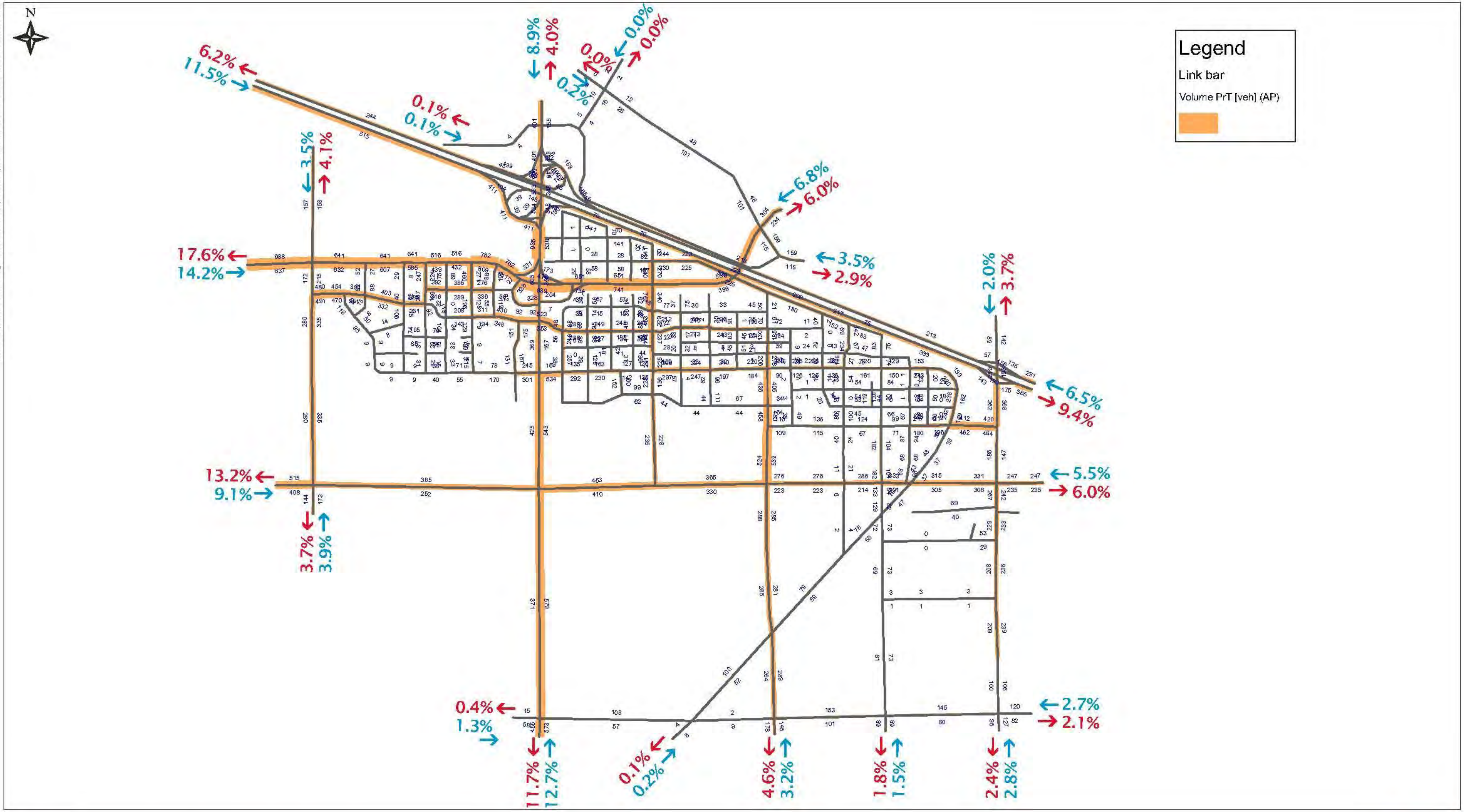

Figure 5.12
Preferred Network Trip Distribution

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5.3.2 Future Traffic Operations

Traffic operations at the critical intersections on the Preferred Network were evaluated based on the capacity analysis methods outlined in the 2000 Highway Capacity Manual (HCM) using the Synchro 6.0 analysis software for signalized and stop-controlled intersections. Initial laning assumptions, based upon the VISUM traffic assignments, were entered into Synchro and the model run; results were then reviewed and laning/traffic control assumptions refined to optimize operations. Except for the closely spaced signals on 96 Avenue and Golden Ears Way between 172 Street and 180 Street, all signalized intersections were assumed to operate independently. **Table 5.4** below summarizes the overall Volume-Capacity (V/C) ratio and Level of Service (LOS) for the key intersections in the study network for the Preferred Network.

Table 5.4 - Summary of Intersection Performance for Key Intersections in NCP

Intersection	Preferred Network Performance Measures	
	V/C	LOS
GEW / 180 ST	0.81	D
GEW / HWY 15 Interchange (EAST)	0.51	A
GEW / HWY 15 Interchange (WEST)	0.66	A
96 AVE / 173A ST	0.65	B
96 AVE / 172 ST	0.58	B
96 AVE / 168 ST	0.87	C
96 AVE / 180 ST	0.36	B
93A AVE / 180 ST	0.32	A
92 AVE / 180 ST	0.29	B
88 AVE / 180 ST	0.58	B
88 AVE / HWY 15	0.87	D
88 AVE / 168 ST	0.73	C
88 AVE / 184 ST	0.53	B
88 AVE / HARVIE RD	0.59	B
88 AVE / 192 ST	0.82	D

It can be seen that all of the major Arterial/Arterial and Arterial /Collector intersections in the Preferred Network are expected to operate satisfactorily at build-out in 2041.

5.3.3 Truck Route Plan

Figure 5.13 shows the Truck Route Plan for Anniedale-Tynehead NCP. The plan reflects the City's recent designation of 96 Avenue west of Highway 15 as a truck route to connect with the existing truck designated facility of Golden Ears Way. The plan also identifies two anticipated additions to the City Designated Truck Route Network:

- 88 Avenue east of Highway 15 to the Langley will ultimately be added because it is currently part of TransLink's Major Road Network (MRN) and typically all MRN roads are designated Truck Routes; and,
- At a minimum, 192 Street between 88 Avenue and Highway 1 should be designated a truck route in order to connect the future full movement interchange planned on Highway 1 at 192 Street with the future 88 Avenue designated truck route.

Additionally, an extension of the Truck Route designation on 192 Street to Fraser Highway would merit consideration for inclusion in the City's Truck Route Plan at a future date.

Within the Anniedale and Tynehead neighbourhoods, the following routes, while not recommended to be designated truck routes, could be used relatively frequently by trucks to legitimately depart and return to designated truck routes:

- 180 Street (provides link between Anniedale Triangle Industrial area, Golden Ears Way and 88 Avenue);
- 184 Street (provides link to Anniedale Triangle Industrial area and Business Park to 92 Avenue and 88 Avenue);
- 92 Ave east of 184 St / Harvie Road, north of 90 Ave / 90 Ave between Harvie Rd and 192 Street; and,
- All the collector roads within the Industrial / Business Park areas.

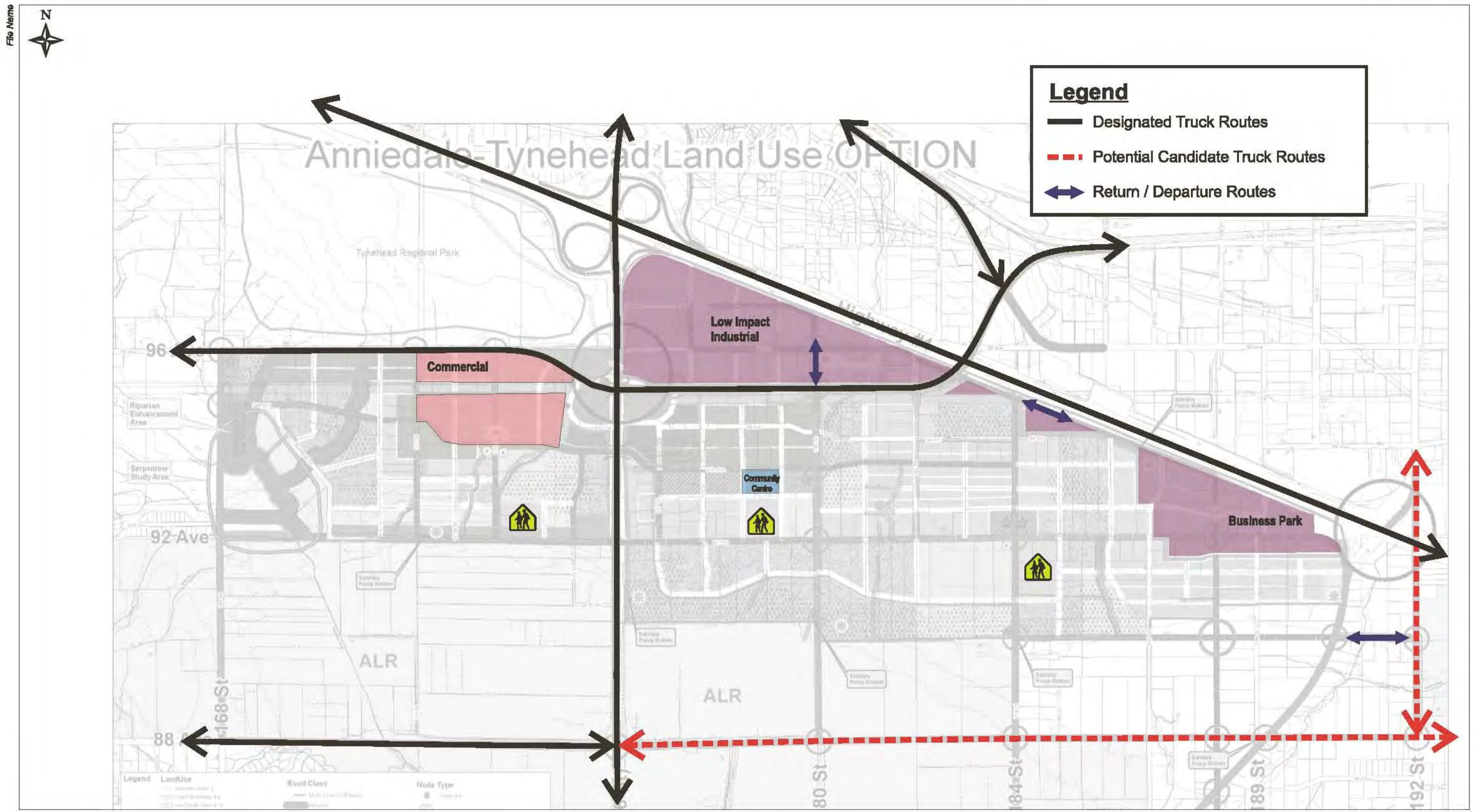

Figure 5.13
Preliminary Truck Route Plan

Anniedale / Tynehead Stage One NCP Road Network Study, Surrey BC
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5.3.4 Cycling and Walking Plan

The City's road cross-section requirements for all new Arterials and Collector roads includes marked bicycle lanes and sidewalks on both sides. Therefore, implementation of the Preferred Road Network in itself will provide an excellent, interconnected on-street cycling and sidewalk network for the Anniedale-Tynehead neighbourhoods.

On- street bicycle lanes will be 1.8 metres wide on Arterial roads, while bicycle lanes on Collector roads will be 1.7 metres wide as per City's Road Standards. Sidewalks on all Arterial and Collector roads will be a minimum of 1.8m wide, and 1.5m on local roads. In commercial areas and near civic buildings such as recreation centres and schools, consideration for wider sidewalks is recommended.

On-street bicycle lanes on major roads will be complemented with off-street multi-use paths and Local Road Neighbourhood Bicycle Routes, all of which will be accompanied with wayfinding signage for cyclists and pedestrians.

Figure 5.14 illustrates the Bicycle Network Plan for Anniedale-Tynehead NCP. Where multi-use pathways are proposed to be located next to roads additional statutory right-of-way beyond that required just for the roadway will be required to accommodate the pathway. Also illustrated on **Figure 5.14** are potential locations of bicycle/pedestrian-actuated signals to assist cyclists and walkers in crossing major roadways where traffic signals are not present; however, actual installations of such bicycle/pedestrian-actuated signals will continue to be based on meeting City-defined warrant criteria. Interim crossing measures, such as raised medians to allow two-stage crossings, could be employed until pedestrian/cyclist and traffic volumes would justify full signal installation.

There are several proposed off-street multi-use pathway routes proposed on the Bicycle Network Plan, including an extension of the Green Timbers Greenway proposed to be located on the existing utility Right-of-Way available just south of 96 Avenue / Golden Ears Way. This pathway is proposed to cross Highway 15 at the GEW interchange on the south side.

The other major off-street multi-use pathway on the Bicycle Network Plan is the Port Kells Greenway, which will connect Anniedale to Port Kells Village and East Clayton. This off-street multi-use path follows the alignment of 180 Street between Golden Ears Way to the local street just south of 92 Avenue. It then turns east to follow the alignment of the local street, crossing 184 Street and eventually turns south on 192 Street to connect to the planned greenway in East Clayton via 90 Avenue.

Other proposed new off-street multi-use pathways include:

- 92 Avenue in Tynehead neighbourhood;
- North-south connection between the commercial centre in Tynehead to 92 Avenue;
- Off-street path on Ridgeline Drive Overpass;
- North-south path east of Highway 15 between Golden Ears Way and the local street just south of 92 Avenue, continuing east to 180 Street;
- Off-street path along the southern edge of the Business Park connecting to 90 Avenue.

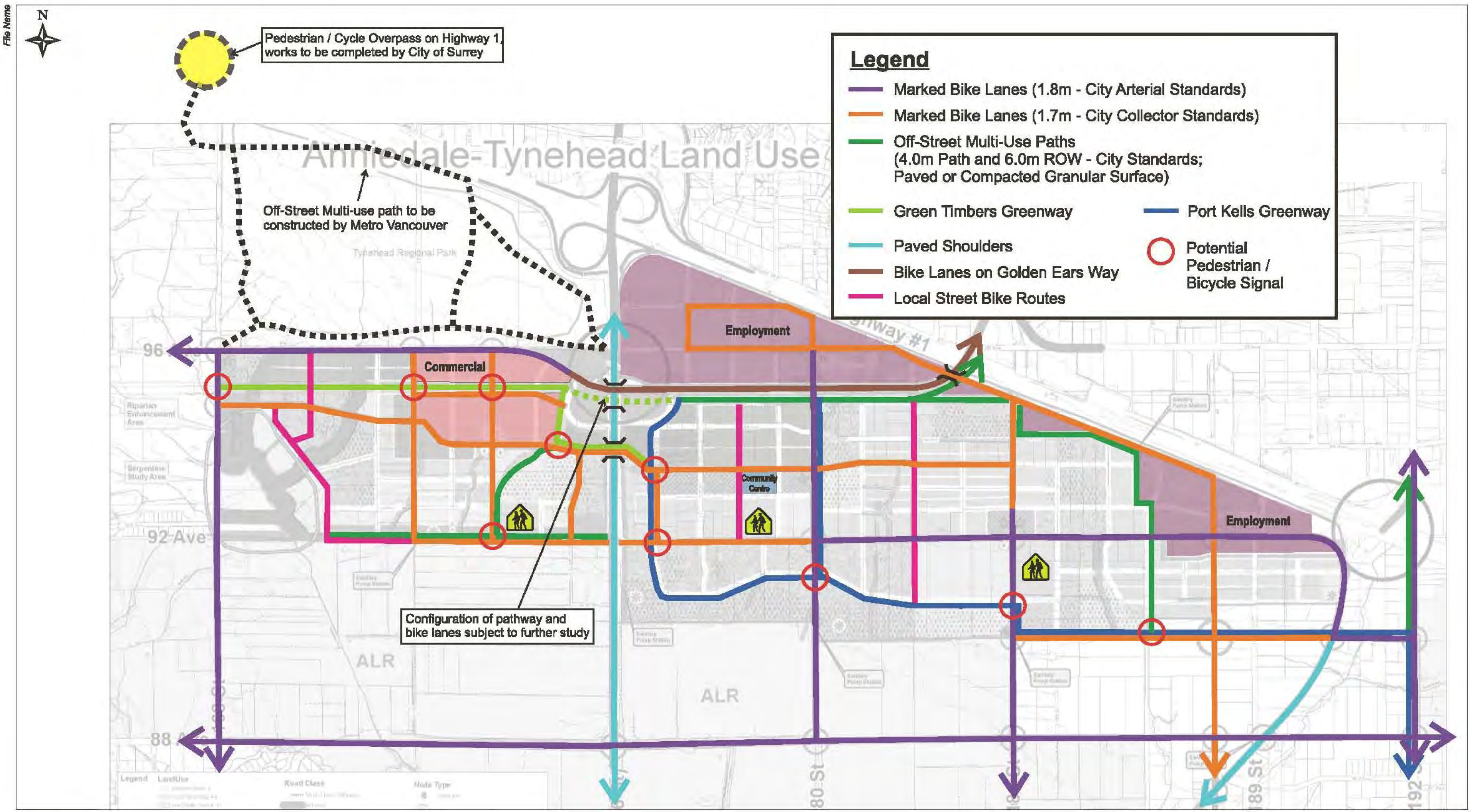

Figure 5.14

Preliminary Bicycle Network Plan

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5.3.5 Transit Network Plan

TransLink Transit Service Planning representatives were consulted during the initial planning process for the Anniedale- Tynehead NCP, as well as after Council approval of the Stage One NCP Land Use Plan, to discuss potential transit services in the study area. **Figure 5.15** shows a proposed transit service plan for the Anniedale-Tynehead neighbourhood which reflects the outcome of these consultations with TransLink staff. This plan shows both routes and potential bus stops and major transfer points.

Actual routing of transit services will ultimately be selected and implemented by TransLink and Coast Mountain Bus Company in consultation with the City of Surrey. Also, bus stop/transfer locations are illustrative only and highly preliminary. Finally, the timing of provision of these services will also be controlled by TransLink but generally would follow the progress of neighbourhood redevelopment after thresholds for anticipated ridership are met.

The following provides a brief summary of each of the routes identified in the draft transit plan:

- 388 Service| 88 Ave via 96 Ave – Existing services to be re-routed to travel along 96 Avenue;
- 396 Service| 96 Ave via 88 Ave – Revised South of Fraser Area Transit Plan (SoFA) routing to use existing roads;
- N-C25 Service| 189 St via 94 Ave – The South of Fraser Area Transit Plan identified a community/local route that connects Anniedale and the Walnut Grove transit exchange in Langley. It is suggested this route be modified to provide service between Tynehead, Clayton, and Cloverdale;
- 501 Service| Surrey Central to Langley Centre, BRT – Revised SoFA routing to reflect the future construction of a highway underpass at Barnston Drive;
- 392 Service| 192 St via 92 Ave – A new express route proposed from Langley Town Centre to Guildford BRT Station that runs through heart of East Clayton and Anniedale, and offers express service to Guildford via Highway 1.

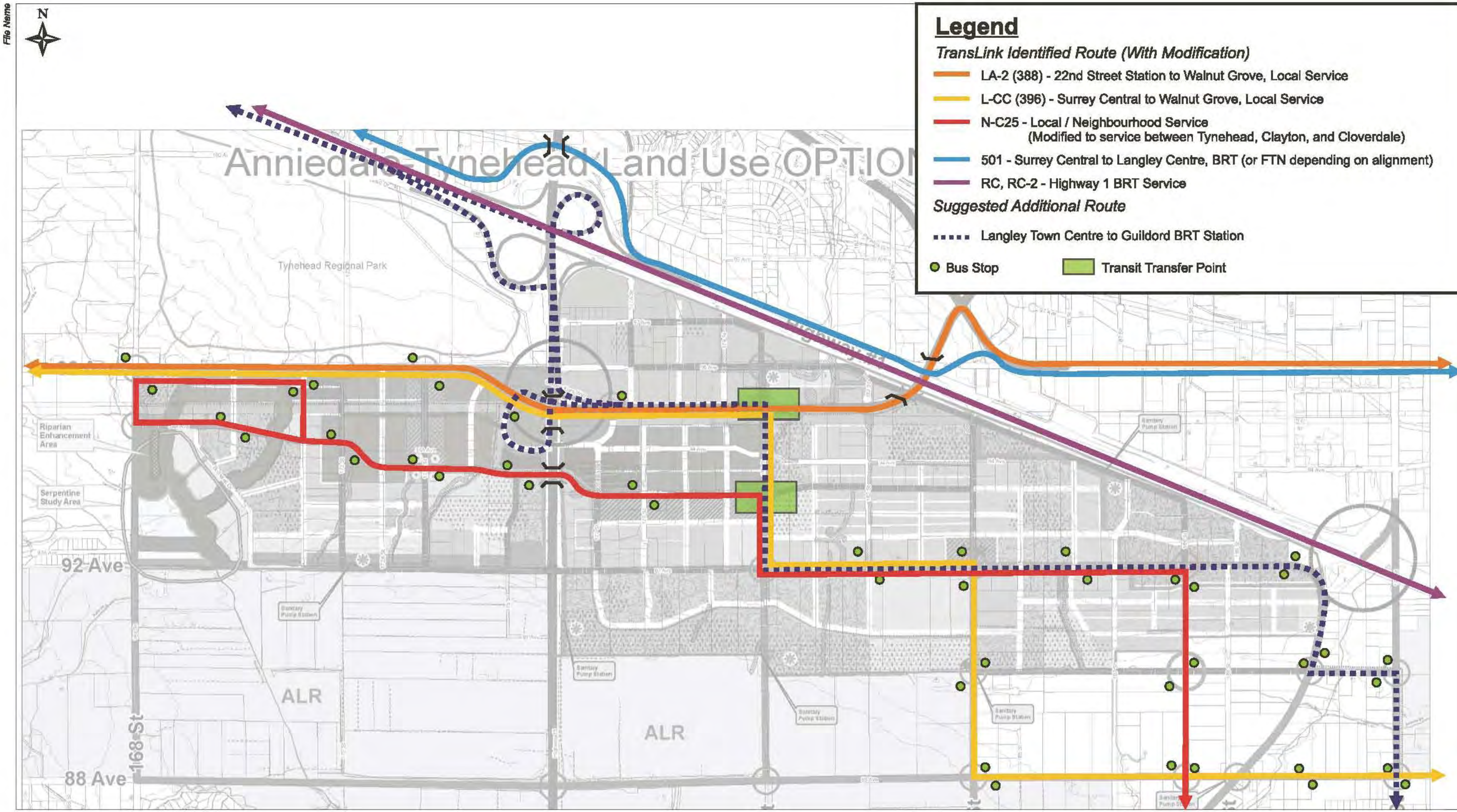

Figure 5.15

Preliminary Transit Network Plan

Anniedale / Tynehead Stage One NCP Road Network Study, Surrey BC
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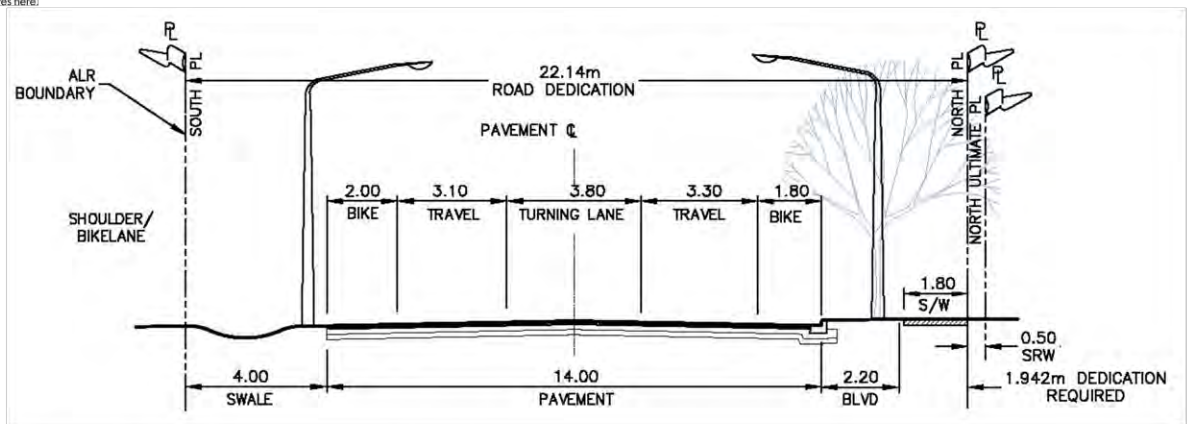
5.3.6 Road Cross Sections

Typical road cross sections in Anniedale Tynehead will adhere to the City standards for Arterial, Collector, and Local roads. However, there some cross sections required for the NCP, which were developed in recognition of unique conditions, and are identified in **Table 5.6** below.

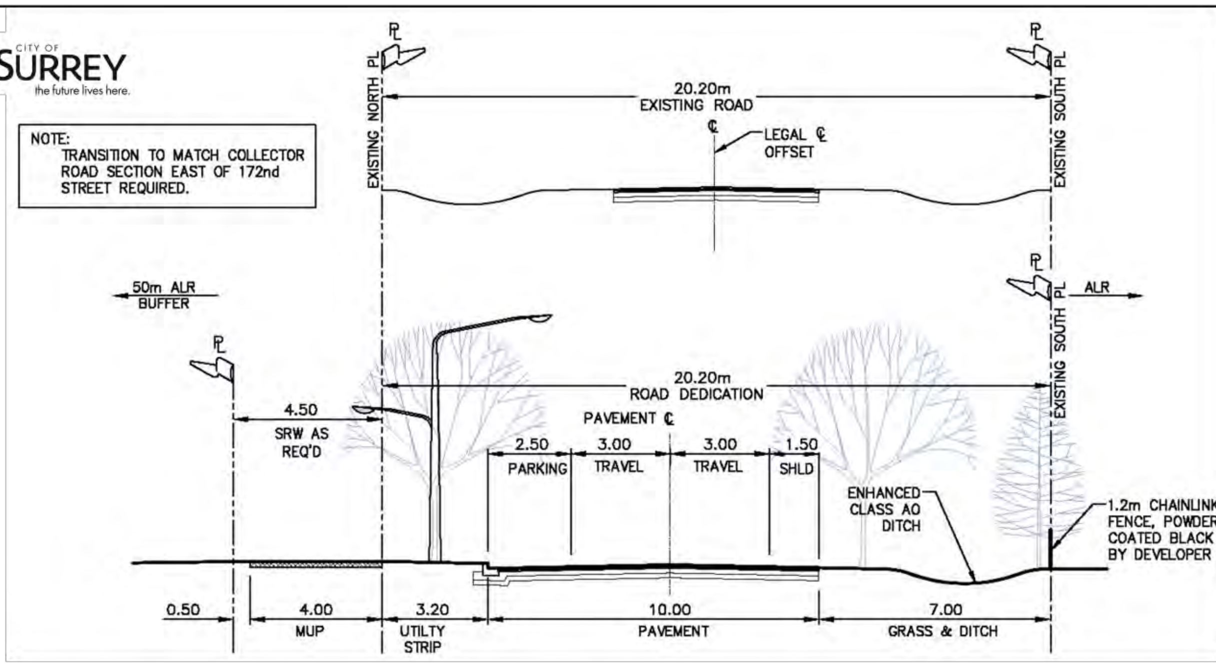
Table 5.6 - Anniedale-Tynehead NCP - Typical Road Cross Sections

ANNIEDALE-TYNEHEAD ROAD CROSS SECTIONS
A-A | "Ridgeline Dr" – 16900 Block 94A Ave – Collector
B-B | 92 Avenue – 172 Street to Bothwell – Local
C-C | 92 Avenue – 172 Street to 176 Street – Collector
D-D | 95 Avenue – Collector in Tynehead
E-E | 175 Street – Collector Adjacent to Park
F-F | Lakiotis Drive – Local
G-G | Anniedale Road – Collector
H-H | 180 Street – Arterial
I-I | 92 Avenue – Arterial
J-J | 186 Street – 91 Avenue to 92 Avenue – Local
K-K | 90 Avenue – 18500 Block to 187 Street – Collector
L-L | Lane south of 92 Avenue
M-M | 172 Street, 177 Street & 93A Avenue (Ridgeline Dr) – Collector with MUP



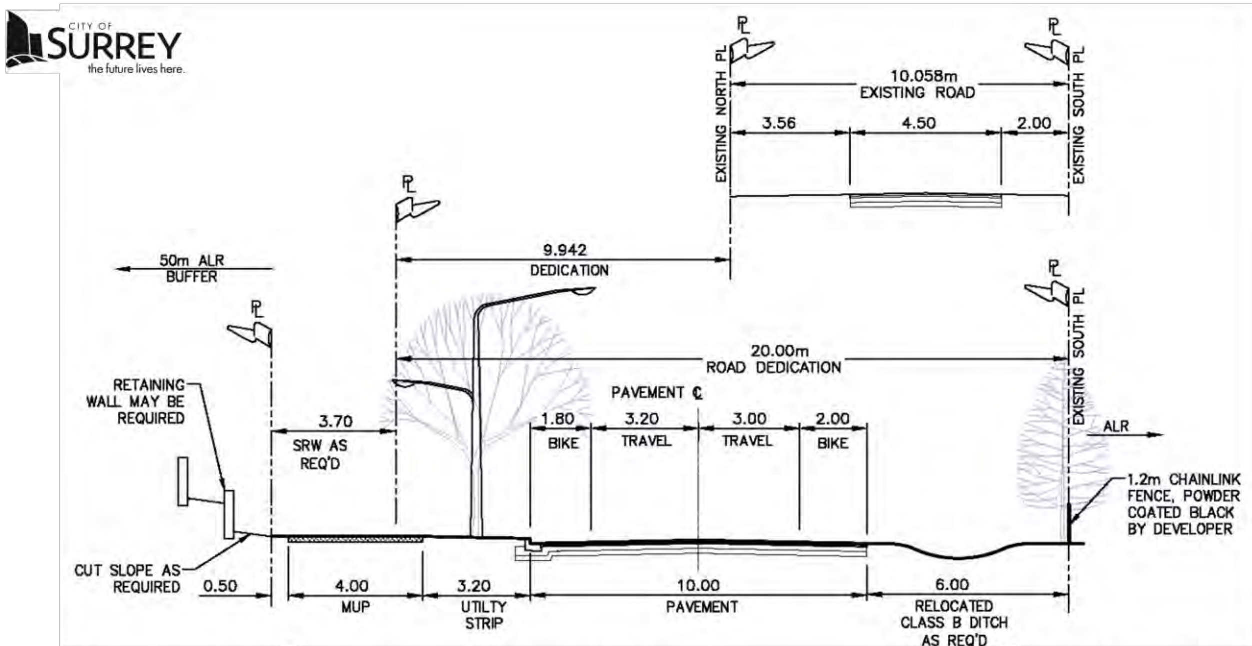
Anniedale-Tynehead NCP	Ridgeline Drive 94A Ave 168 St – 16900 Block	Cross Section AA

Reduced total dedication width, and open drainage swale requirements next to ALR boundary



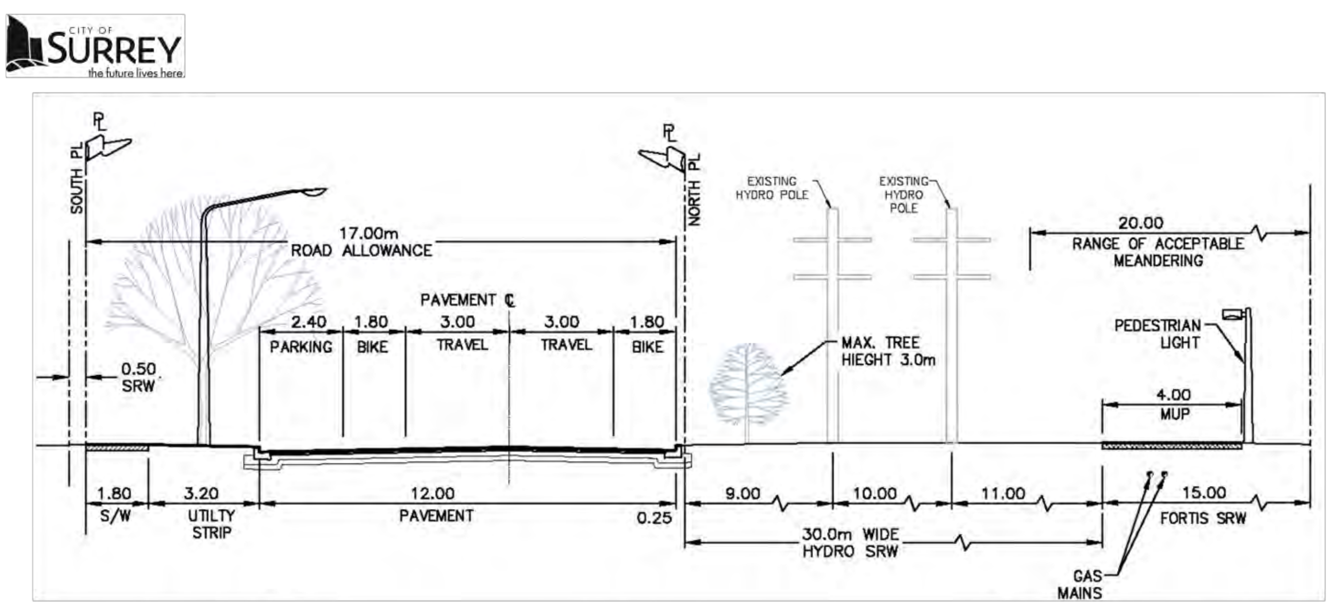
Anniedale-Tynehead NCP	92 Avenue 172 Street - Bothwell	Cross Section BB

Paved shoulder and improved Class AO ditch adjacent to the ALR boundary, plus continuation of next-to-road 4.0m wide Multi-Use Pathway



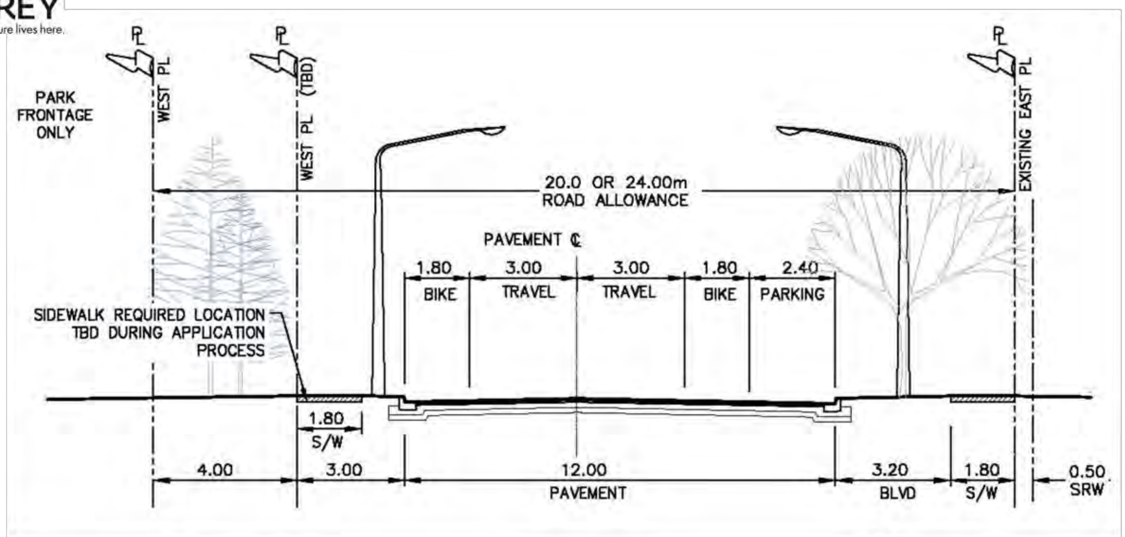
Anniedale-Tynehead NCP	92 Avenue 172 Street – 176 Street	Cross Section CC

Revised pavement location, and reduced pavement width with no on-street parking, to reflect existing offset 10.0m road allowance, anticipated Class B Ditch adjacent to ALR, plus continuation of next-to-road 4.0m wide Multi-Use Pathway, while minimizing road dedication requirements.



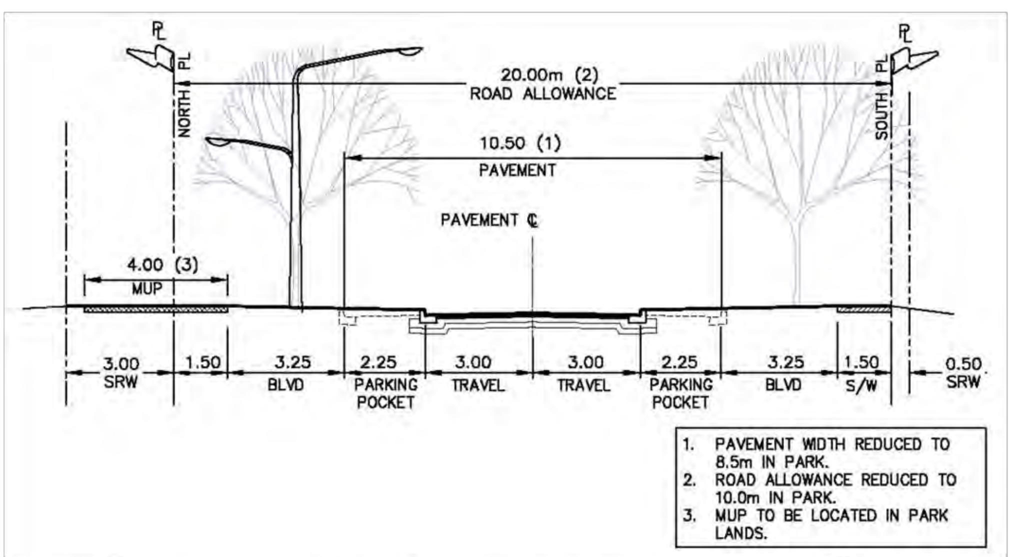
Anniedale-Tynehead NCP	95 Avenue Collector - Tynehead	Cross Section DD

Reduced pavement width, with parking one side only, that will minimize road allowance requirements, and to reflect approximate location of utilities corridor and MUP location



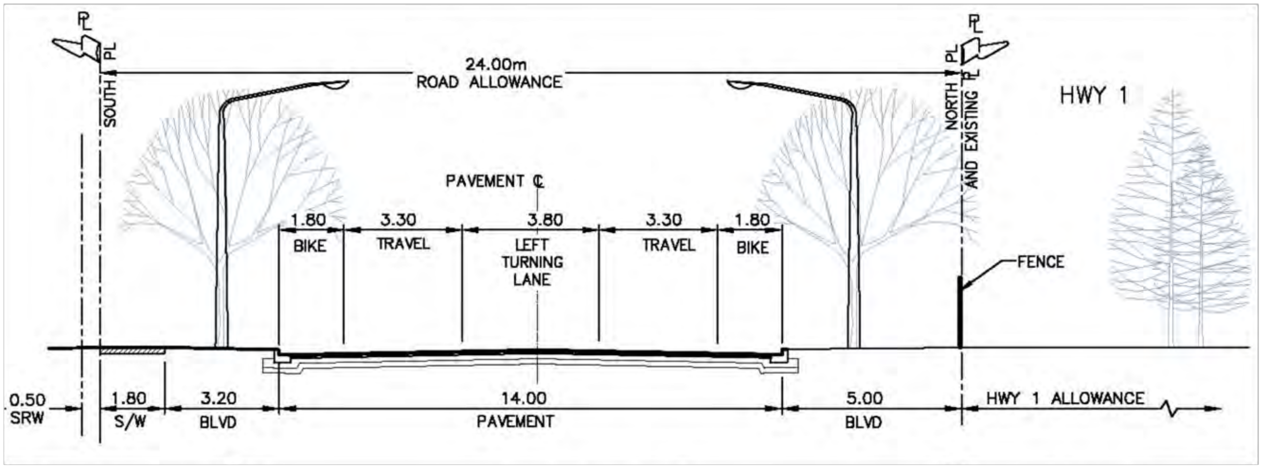
Anniedale-Tynehead NCP	175 Street Collector	Cross Section EE

Reduced pavement width in order to minimize road allowance requirements, and maximize significant tree retention with sidewalk potentially meandering into Park.



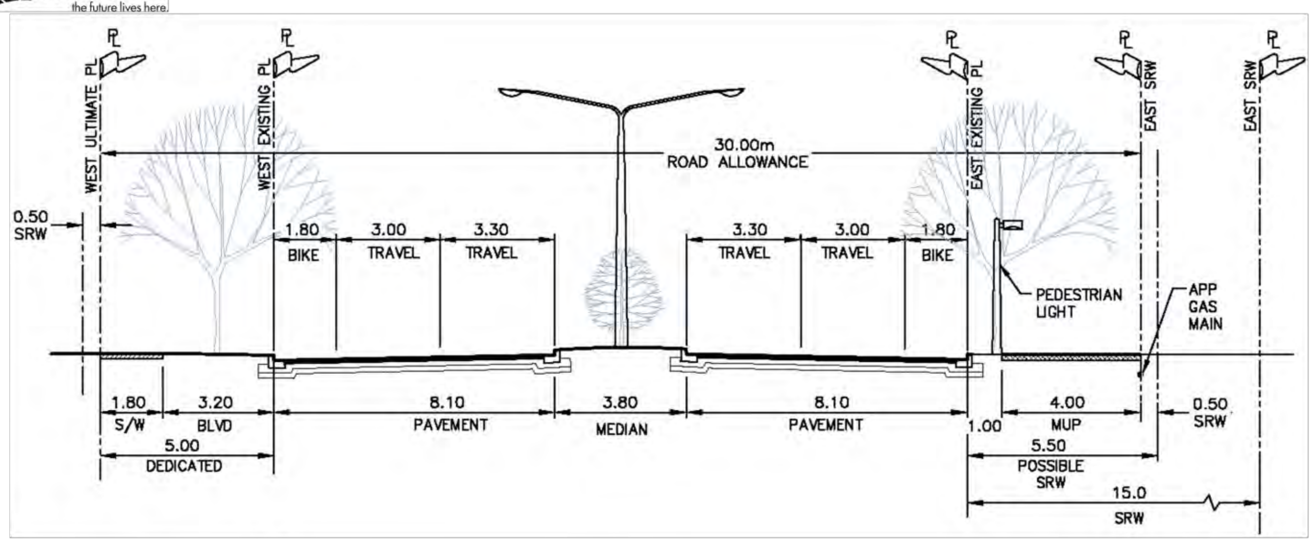
Anniedale-Tynehead NCP	Lakiotis Drive – 91 Avenue Local	Cross Section FF

Unique local road with adjacent 4.0m wide MUP, and parking both sides, with alignment through park that will have reduced road allowance and pavement width and potential for meandering and narrowing for shorter pedestrian crossing distance opportunities.



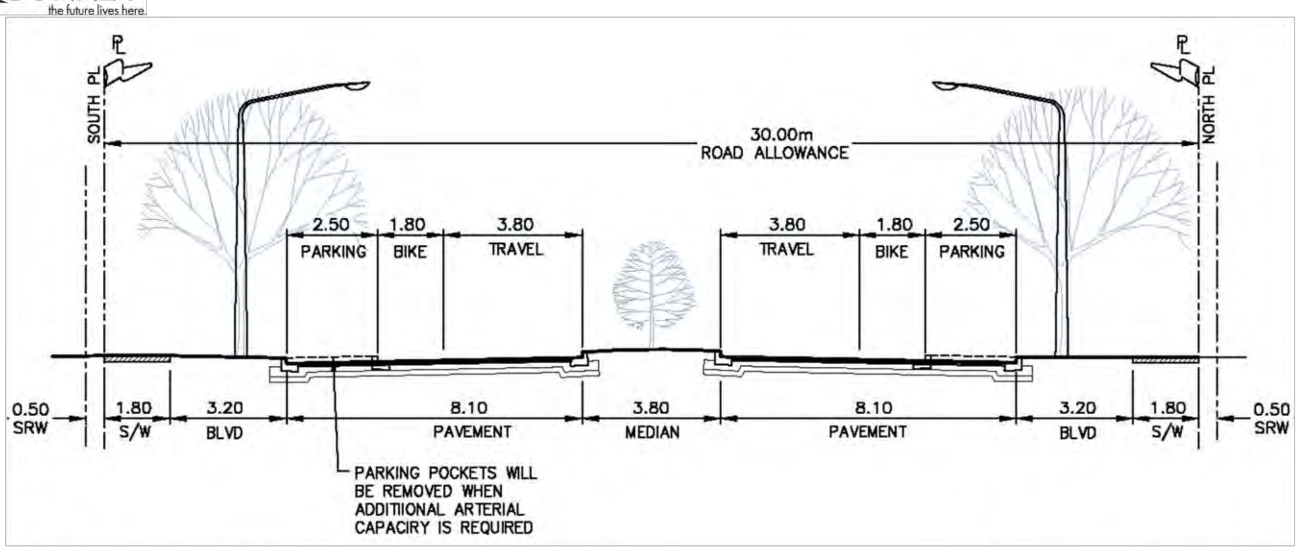
Anniedale-Tynehead NCP	Anniedale Road Collector	Cross Section GG

Industrial/Business Park service road with no sidewalk adjacent to Highway 1, replaced with potential for additional landscaping and fencing as required.



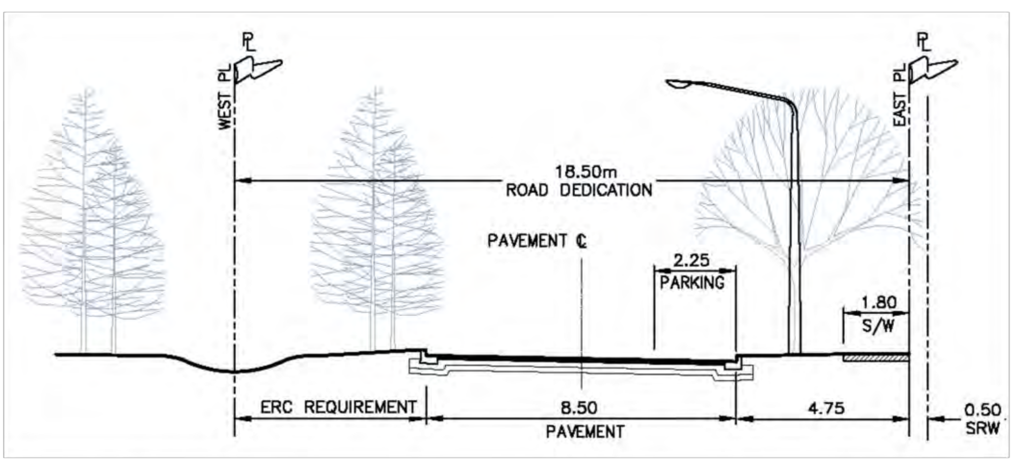
Anniedale-Tynehead NCP	180 Street Arterial	Cross Section HH

Arterial road dedication requirements off-set from existing Fortis Gas corridor and with 4.0m wide MUP in corridor.



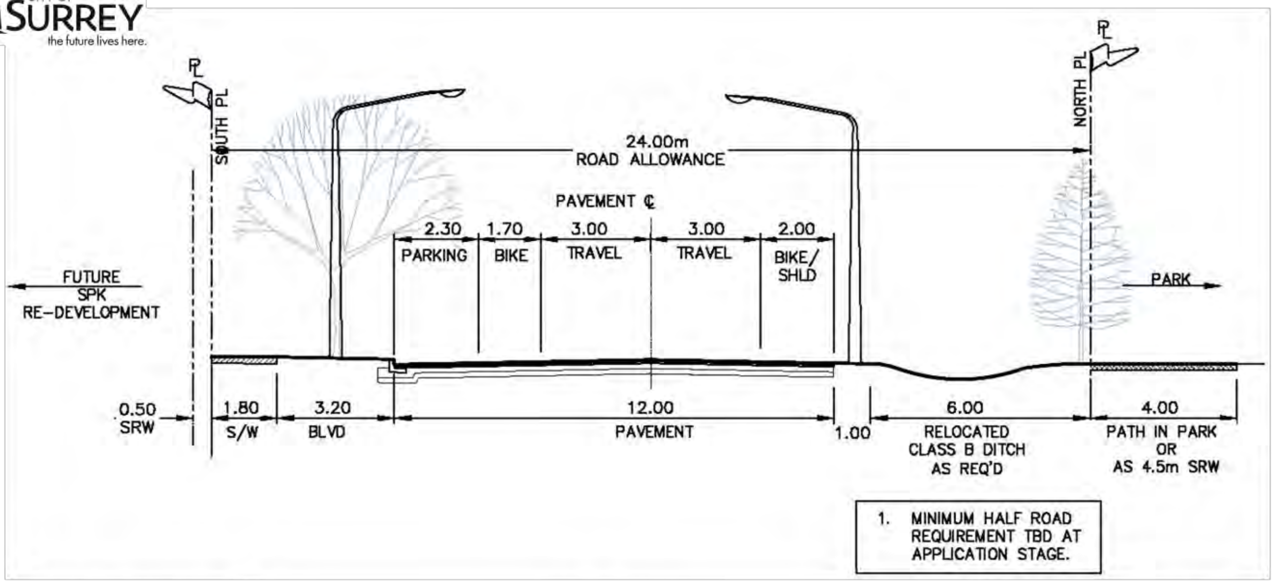
Anniedale-Tynehead NCP	92 Avenue Arterial	Cross Section II

Interim arterial with permitted on-street parking, and curb extensions that may be removed should traffic demands on 92 Avenue warrant additional on-street capacity.



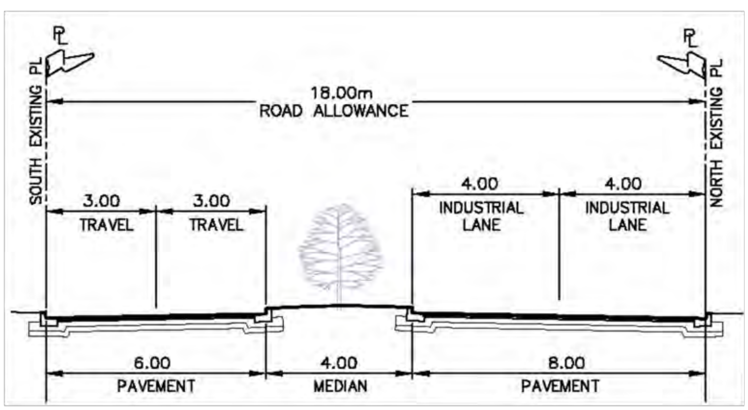
Anniedale-Tynehead NCP	186 Street 91 Avenue – 92 Avenue	Cross Section JJ

Reduced dedication and pavement width in order to protect existing Class B watercourse.



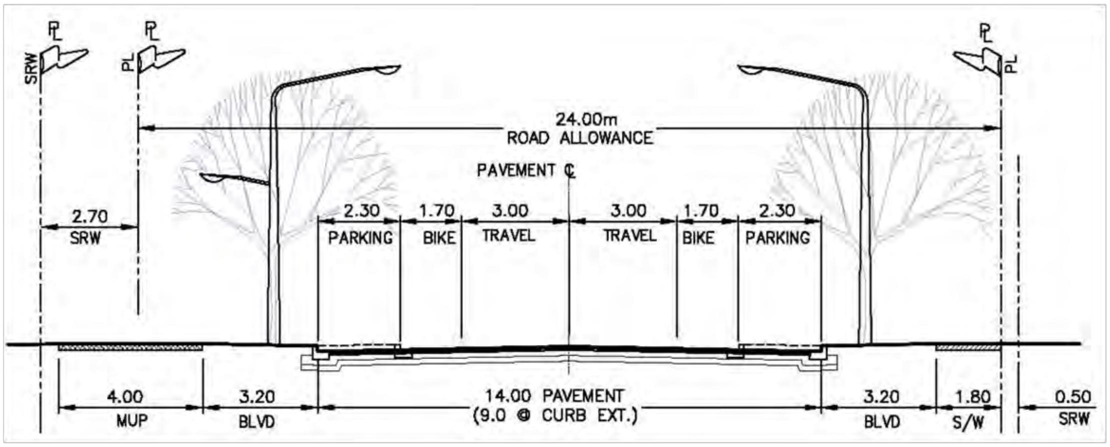
Anniedale-Tynehead NCP	90 Avenue 18500 Block – 187 Street	Cross Section KK

Reduced pavement width with parking one-side only for protection of exiting Class B watercourse, and MUP alignment in Park.



Anniedale-Tynehead NCP	Lane South of 92 Avenue 92 Avenue - Arterial	Cross Section LL

Separate residential and industrial lanes with 4.0m median buffering between land uses.



Anniedale-Tynehead NCP	172 Street, 177 Street and 93A Avenue Collector with Multiuse Pathway (MUP)	Figure

Typical next to road 4.0m wide MUP requirements.

5.4.0 TEN YEAR SERVICING PLAN AND INFRASTRUCTURE COSTS

The cost estimates for the transportation infrastructure needed for the servicing of the NCP are based on the principle that development is responsible for funding the local road and collector roads that fronts and/or are adjacent to the development lands. Because there is a higher standard for collector roads compared to local roads an upsizing approach has been utilized with the additional cost component of the higher standard being included as a DCC eligible item.

There are also collector road needs that do not front development lands or need to be funded on a wider area DCC basis, such as the collector road overpasses, Industrial Road at Golden Ears Way and 94 Avenue at Highway 15, where a component of the costs of these structures has been allocated to the NCP. There are certain other critical collector road needs the costs of which have been assigned to the overall NCP. Total Non-Arterial DDC eligible infrastructure costs are estimated at **$21,500,000**.

Arterial Road needs are usually treated on an overall City wide basis due to the fact that the impact of traffic is spread over a larger area than an individual NCP. However, because of the particular transportation challenges faced by this NCP a detailed assessment of the arterial road needs compared with the DCCs generated has been carried out. This assessment has looked at the proportionate impact on the arterial road system that this NCP generates and assigned that proportionate share to the cost of the infrastructure needed. Total Arterial DCC eligible infrastructure costs are estimated at **$75,000,000**.

Cost estimates for the transportation servicing requirements are shown in Appendix A.

Current Projects on the 10 Year Servicing Plan

There is one project identified in the 10 Year Servicing Plan that fall within the study area. Project ID 7648 Traffic Signal at 88 Ave and 192 St is included as a Long Term, 7-10 year priority.

PART 6 SANITARY SEWER INFRASTRUCTURE

PART 6: SANITARY SEWER INFRASTRUCTURE

6.0 EXISTING AND FUTURE – SERVICING CATCHMENTS AND DETAILS

Existing System

There are no existing City sanitary systems within the Anniedale-Tynehead area. All existing lots with residential dwellings are currently serviced with private septic fields.

Previous Studies

The City of Surrey previously commissioned Earth Tech (Canada) Inc. (now AECOM) to complete the *South Port Kells Sanitary Service Concept Study* in November, 2006. The study presented four gravity sewer and four pump station / forcemain servicing options. The two servicing strategy options recommended by Earth Tech were identified as Options 2b and 2c (both pump station options).

Option 2b utilized three large pump stations to service the study area (one pump station to service Port Kells[1]). Option 2c utilized five pump stations to service the study area (one pump station to service Port Kells).

Option 2c was chosen as the preferred servicing option during Stage 1, as it provides more versatile servicing flexibility for progressive development. Option 2c serves as the foundation for servicing of the Anniedale-Tynehead area.

For Stage 2 works, a parcel level review of the local sewer system was completed to confirm the serviceability of all areas in the study area. Servicing strategy Option 2c has been modified slightly to incorporate the results of the local system review. In order to minimize the number and costs of pump stations servicing the Anniedale-Tynehead area, the originally proposed 180th Street Pump Station has been removed from the servicing strategy, resulting in a total of four pump stations servicing the study area (one pump station to service Port Kells). The servicing strategy is now referred to as Option 2c-ii.

[1] Port Kells is outside the Anniedale-Tynehead study area.

6.1 DESIGN CRITERIA AND ANALYSIS

Design Criteria

The City of Surrey Design Criteria Manual has been utilized for the establishment of the servicing criteria for this NCP. A summary of key applicable design criteria is presented below with some criteria modified, for the specific requirements of the NCP.

Sanitary Flows:

- Average daily sanitary flows of 350 L/cap/day
- Peaking factor as per Harmon's formula
- An Inflow and Infiltration rate of 11,200 L/ha/day

Gravity Interceptor and Trunk Sewer Systems (Q>=40 L/s):

- Manning's 'n' of 0.013 for all pipes
- Trunk and interceptor sewer flow shall not exceed 70% of internal diameter
- Minimum velocity (at 70% peak dry weather flow (PDWF)) of 0.6 m/s
- Pipe grades less than 0.5% may be used if velocity >= 0.6 m/s at 70% PDWF

Local Gravity Sewer Systems (Q<40 L/s):

- Manning's 'n' of 0.013 for all pipes
- Local sewer flow shall not exceed 50% of internal diameter
- Terminal sections of sanitary sewer, servicing 6 (or less) house service connections, shall have a minimum grade of 1.0%
- A sanitary sewer, servicing the 7th to 12th house service connections, shall have a grade of 0.6% or greater.
- A sanitary sewer, servicing the 13th house service connection (or more), shall have a grade of 0.5% or greater.
- Pipe grades less than 0.5% may be used if velocity >= 0.6 m/s at 70% PDWF
- Sewers to be installed at a nominal depth between 2.0 m and 3.5 m from finished ground surface to pipe invert.
- Depths up to 4.5m may be tolerated for short lengths (generally less than 40m)

Forcemain and Pump Station Systems:

- Pipe flow formula: Hazen Williams, with friction coefficient C=120 for capacity (C=140 for pump over-run)
- Minimum velocity of 1.0 m/s, maximum of 2.4 m/s (max of 1.6 m/s preferred)
- Minimum pump efficiency of 70%

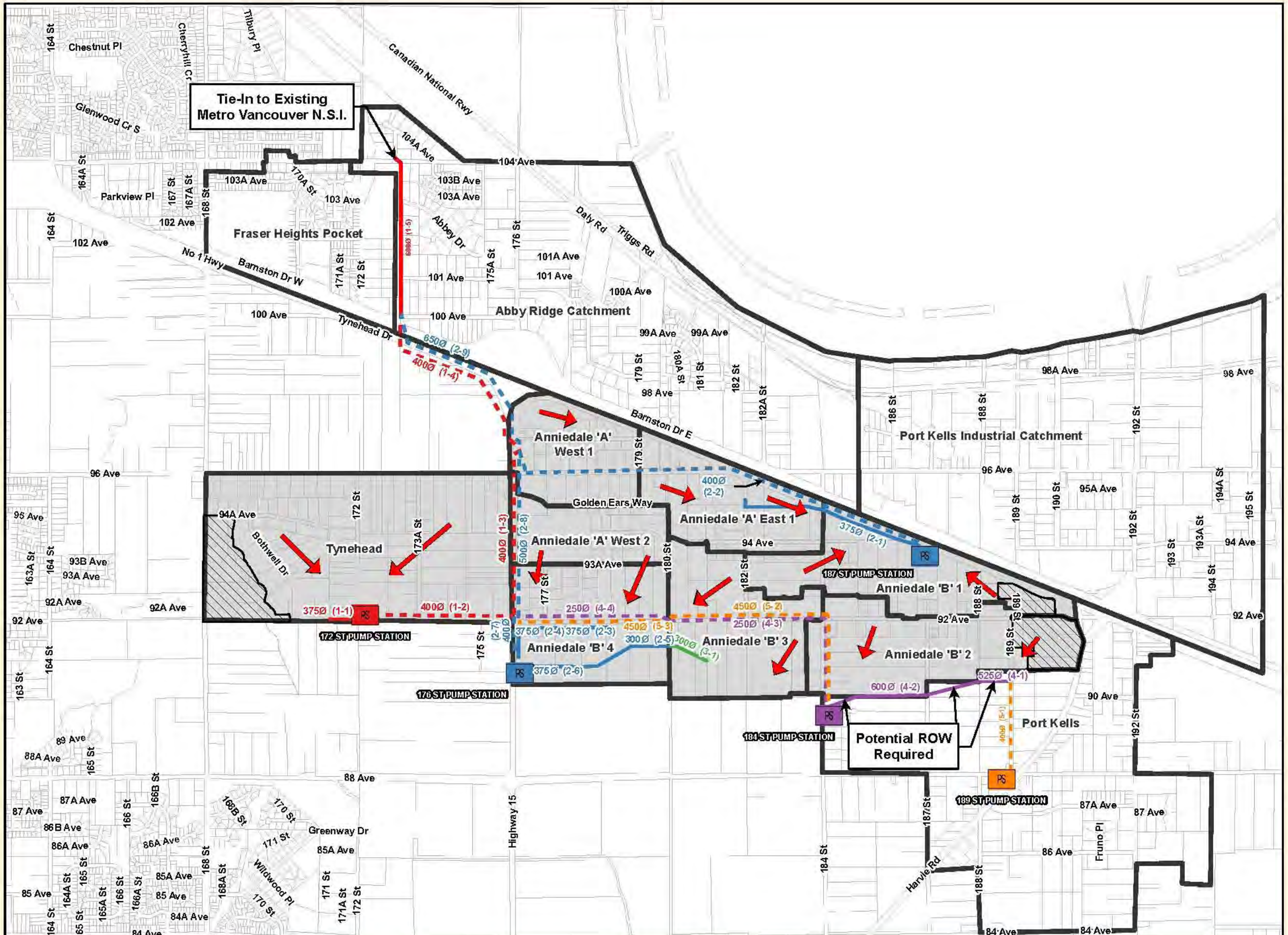
- Pumps sized to convey greater of peak wet weather flow (PWWF) and governing velocity criteria
- Common forcemain sized assuming all pumps pumping simultaneously

Servicing Strategy

Figure 6.1 outlines the conceptual layout of the future trunk sewer system (Option 2c-ii). The figure also shows development areas within the Anniedale-Tynehead Study Area. Trunk infrastructure is color-coded by phase, which has been based on anticipated development phasing. It should be noted that trunk infrastructure phasing is contingent on development occurring as anticipated and presented in this report. Should the nature or rate of development growth differ than that presented forthwith, phasing of infrastructure will need to be reconfirmed. Development Phasing is discussed in further detail in subsequent sections.

The proposed trunk sewer system is comprised of a total of four pump stations within the Anniedale-Tynehead area and one station outside the study area, and a number of trunk gravity sewers and forcemains. All sanitary sewerage from the Anniedale-Tynehead area is conveyed to a proposed gravity trunk sewer on 173 Street which ties into the existing Metro Vancouver North Surrey Interceptor (N.S.I) Sewer at 104 Avenue and 173 Street. The local systems are comprised of gravity sewers that convey sewerage to the 4 pump stations, with the exception of 3 local areas, proposed to be serviced via Low Pressure Sewer (LPS). An LPS sewer system consists of common low-pressure forcemain(s) and individual or local pumps. The low-pressure forcemain ties into the gravity system.

Figures 6.2 to 6.5 outline the conceptual layout of the future local sewer system for each pump station catchment area, based on a serviced parcel - level review. The figures outline the layout of the sewer system, for which sewer alignments generally coincide with the proposed travel corridors throughout the study area. Anticipated pipe diameters and flow directions are shown on the figures. Flow results and associated calculations are discussed in subsequent sections. It should be noted that the proposed local sewer system shown on the above noted figures are based on existing lots, as well as the current proposed land use plan. Additional sewers may be required based on proposed future developments.



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Legend

PHASE	GRAVITY	FORCEMAIN
1		
2		
3		
4		
5		

General Flow Direction

Pump Station

Anniedale / Tynehead Development Areas

Low Pressure Sewer Areas

Anniedale/Tynehead NCP Stage 2

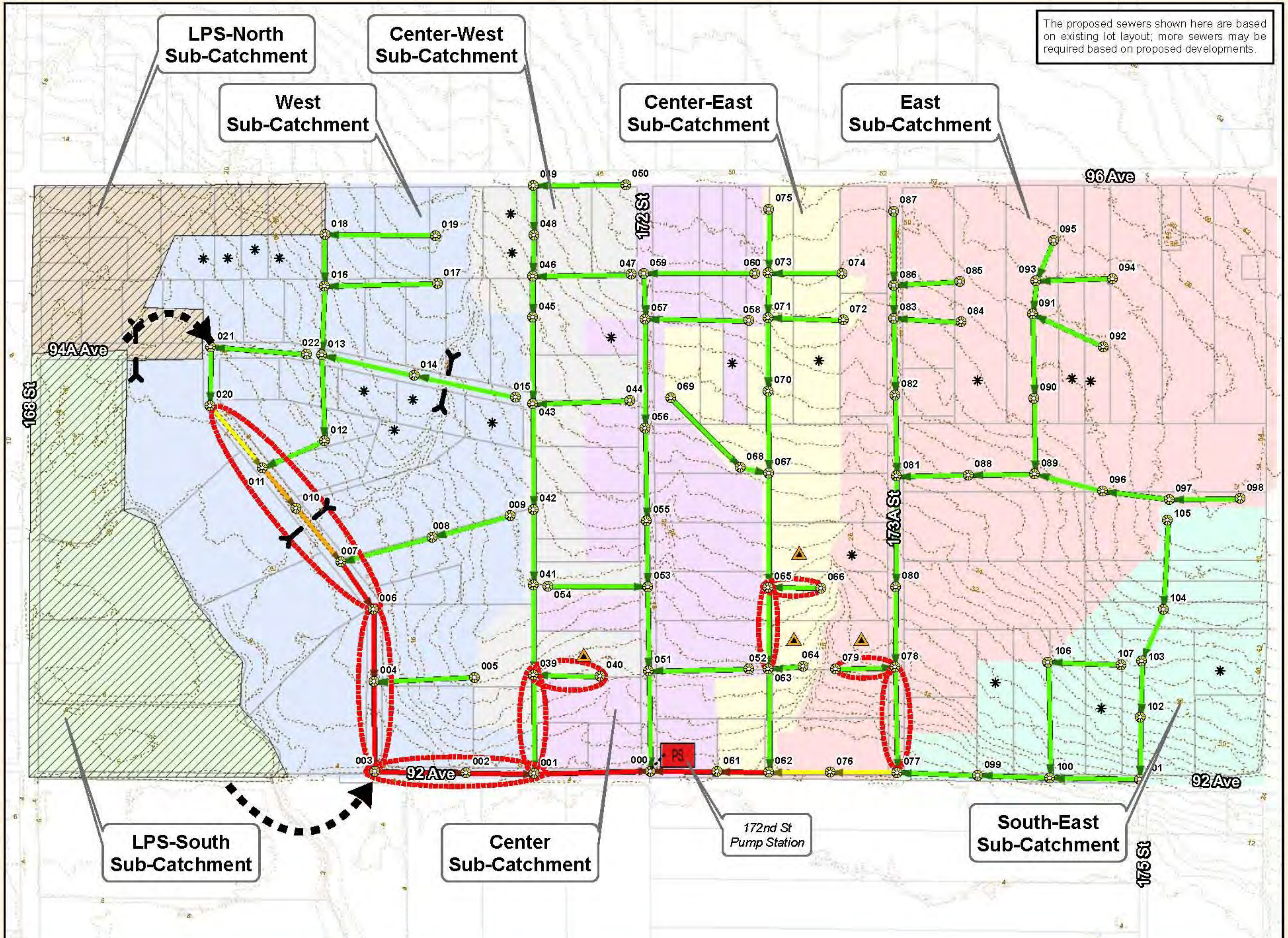
Sanitary Servicing Option 2c-ii

0 250 500 1,000
Metres

URBANSYSTEMS.

U:\Projects_VAN\1072\0173\01\D-Drafting-Design-Analysis\GIS\Projects\mxds\Sanitary_Figures_Phase2\Figure 3.4-1 - Servicing Option 2c-ii.mxd - Last revised by bpauls on 14/10/2011 at 10:48:17 AM

Figure 6.1



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Legend

- Major Culvert
- Potential Local Pumping Required
- Potential No Basement
- Pump Station
- Contour (2m)
- Critical Pipe Sections*
- Low Pressure System

Local Sanitary Mains

- 200mm
- 250mm
- 300mm
- 375mm

*Critical Sections include sewers with depths greater than 3.5m and sewers at culvert crossings of major watercourses.

Anniedale/Tynehead NCP Stage 2

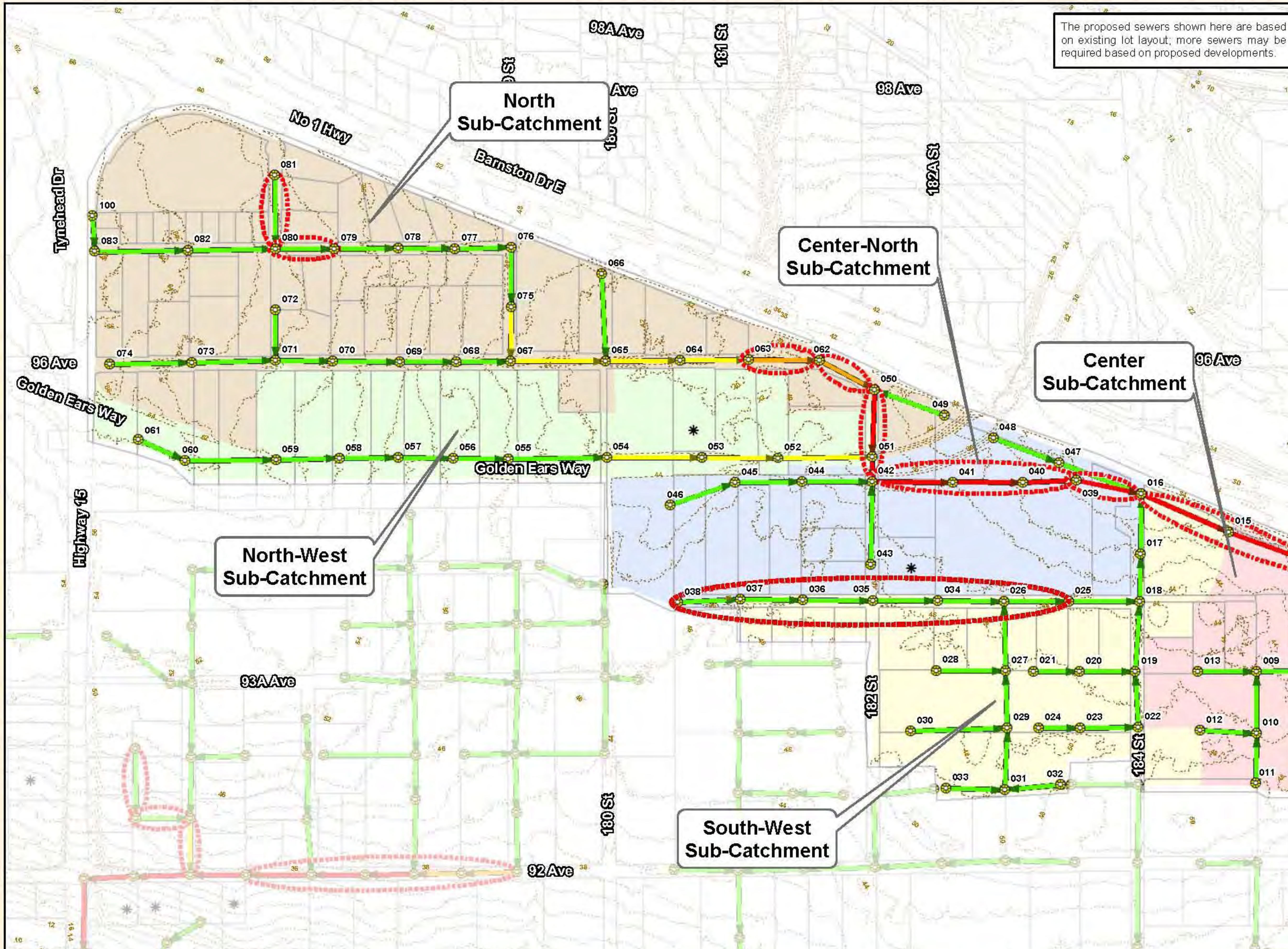
172nd Street Sanitary Pump Station Catchment

URBANSYSTEMS.

THE ACCURACY & COMPLETENESS OF INFORMATION SHOWN ON THIS DRAWING IS NOT GUARANTEED. IT WILL BE THE RESPONSIBILITY OF THE USER OF THE INFORMATION SHOWN ON THIS DRAWING TO LOCATE & ESTABLISH THE PRECISE LOCATION OF ALL EXISTING INFORMATION WHETHER SHOWN OR NOT.

Figure 6.2

U:\Projects_VAN\1072\0173\01\D-Drafting-Design-Analysis\GIS\Projects\mxds\Sanitary_Figures_Phase2\Figure 3.4-2 - Colour - Pump Station Catchment 172nd St.mxd Last revised by bpauls on 03/02/2012 at 2:57:59 PM



Legend

- ✳ Potential Local Pumping Required
- Contour (2m)
- Critical Pipe Sections*
- Low Pressure System

Local Sanitary Mains

- 200mm
- 250mm
- 300mm
- 375mm

*Critical Sections include sewers with depths greater than 3.5m and sewers at culvert crossings of major watercourses.

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Anniedale/Tynehead NCP Stage 2

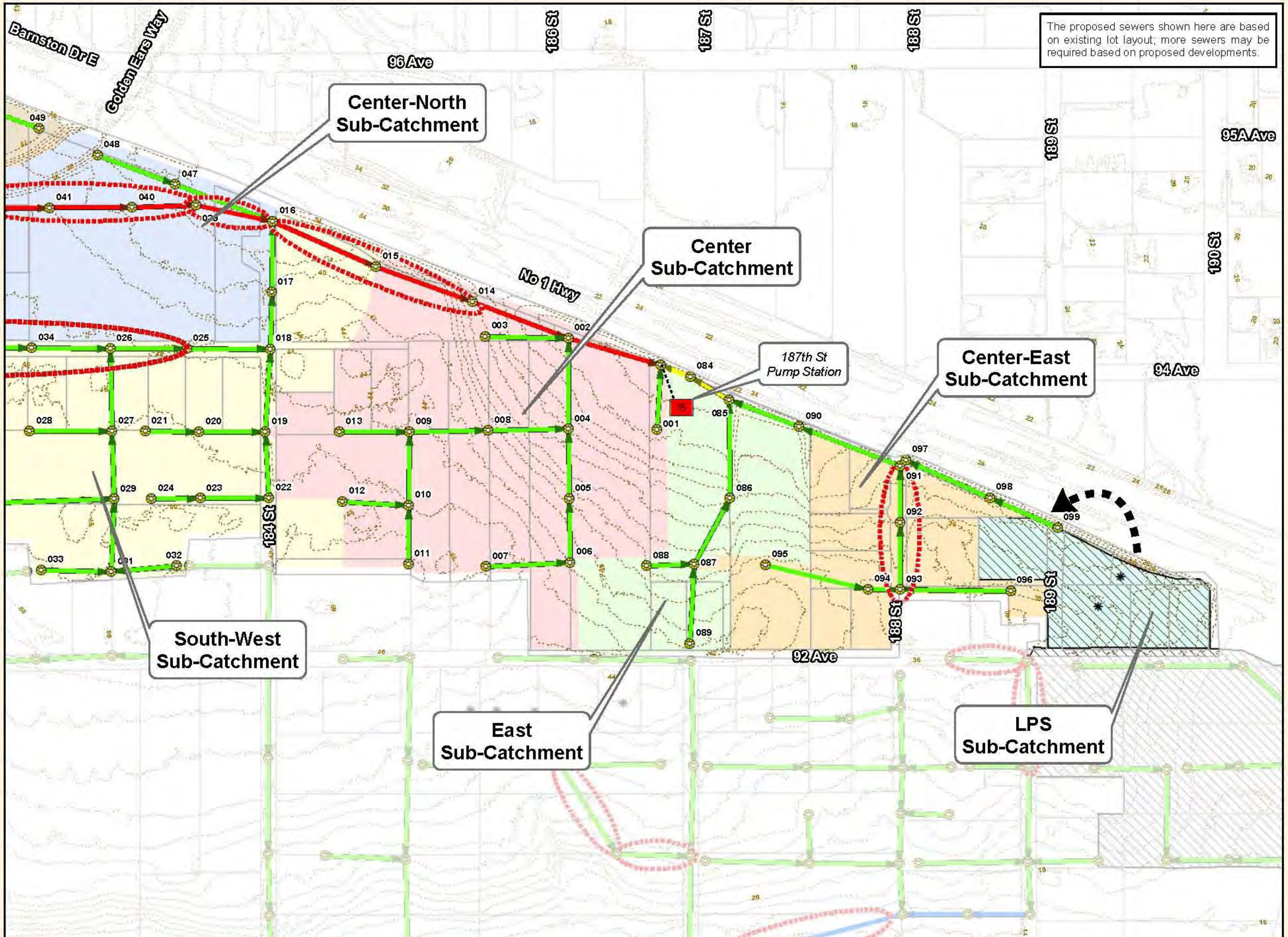
187th Street Sanitary Pump Station Catchment

Figure 6.3a

0 125 250 500
Metres

URBANSYSTEMS. THE ACCURACY & COMPLETENESS OF INFORMATION SHOWN ON THIS DRAWING IS NOT GUARANTEED. IT WILL BE THE RESPONSIBILITY OF THE USER OF THE INFORMATION SHOWN ON THIS DRAWING TO LOCATE & ESTABLISH THE PRECISE LOCATION OF ALL EXISTING INFORMATION WHETHER SHOWN OR NOT.

U:\Projects_VAN\1072\0173\01\D-Drafting-Design-Analysis\GIS\Projects\mxds\Sanitary_Figures_Phase2\Figure 3.4-3a - Colour - Pump Station Catchment Anniedale.mxd Last revised by bpauls on 03/02/2012 at 2:46:39 PM



Legend

- Potential Local Pumping Required
- Pump Station
- Contour (2m)
- Critical Pipe Sections*
- Low Pressure System

Local Sanitary Mains

- 200mm
- 250mm
- 300mm
- 375mm

*Critical Sections include sewers with depths greater than 3.5m and sewers at culvert crossings of major watercourses.

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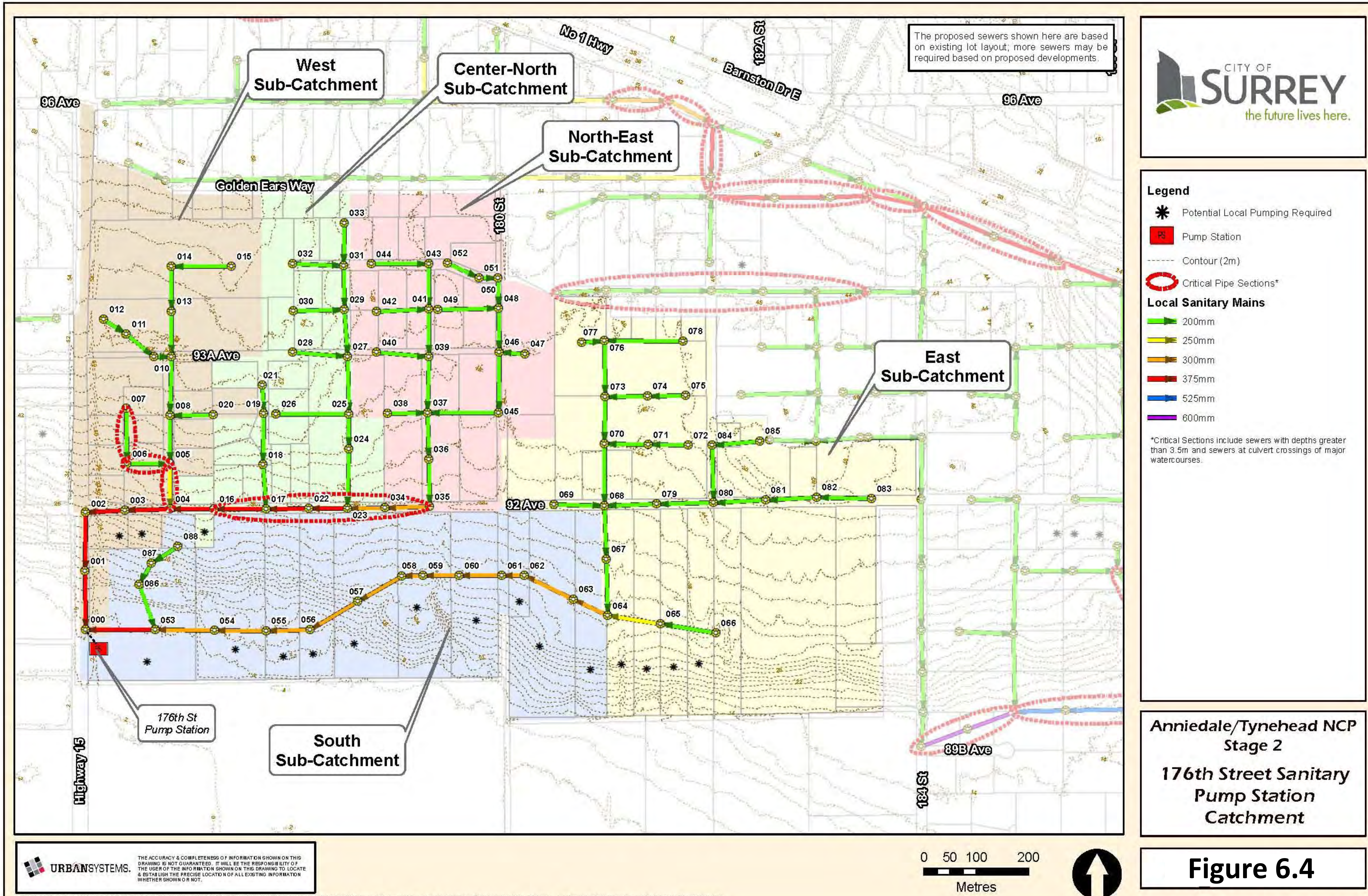
Anniedale/Tynehead NCP Stage 2

187th Street Sanitary Pump Station Catchment

0 125 250 500
Metres

URBANSYSTEMS.

Figure 6.3b



The proposed sewers shown here are based on existing lot layout; more sewers may be required based on proposed developments.
West Sub-Catchment
Center-North Sub-Catchment
North-East Sub-Catchment
East Sub-Catchment
South Sub-Catchment
176th St Pump Station
96 Ave
No 1 Hwy
Barnston Dr E
182A St
Golden Ears Way
180 St
93A Ave
92 Ave
89B Ave
184 St
Highway 15
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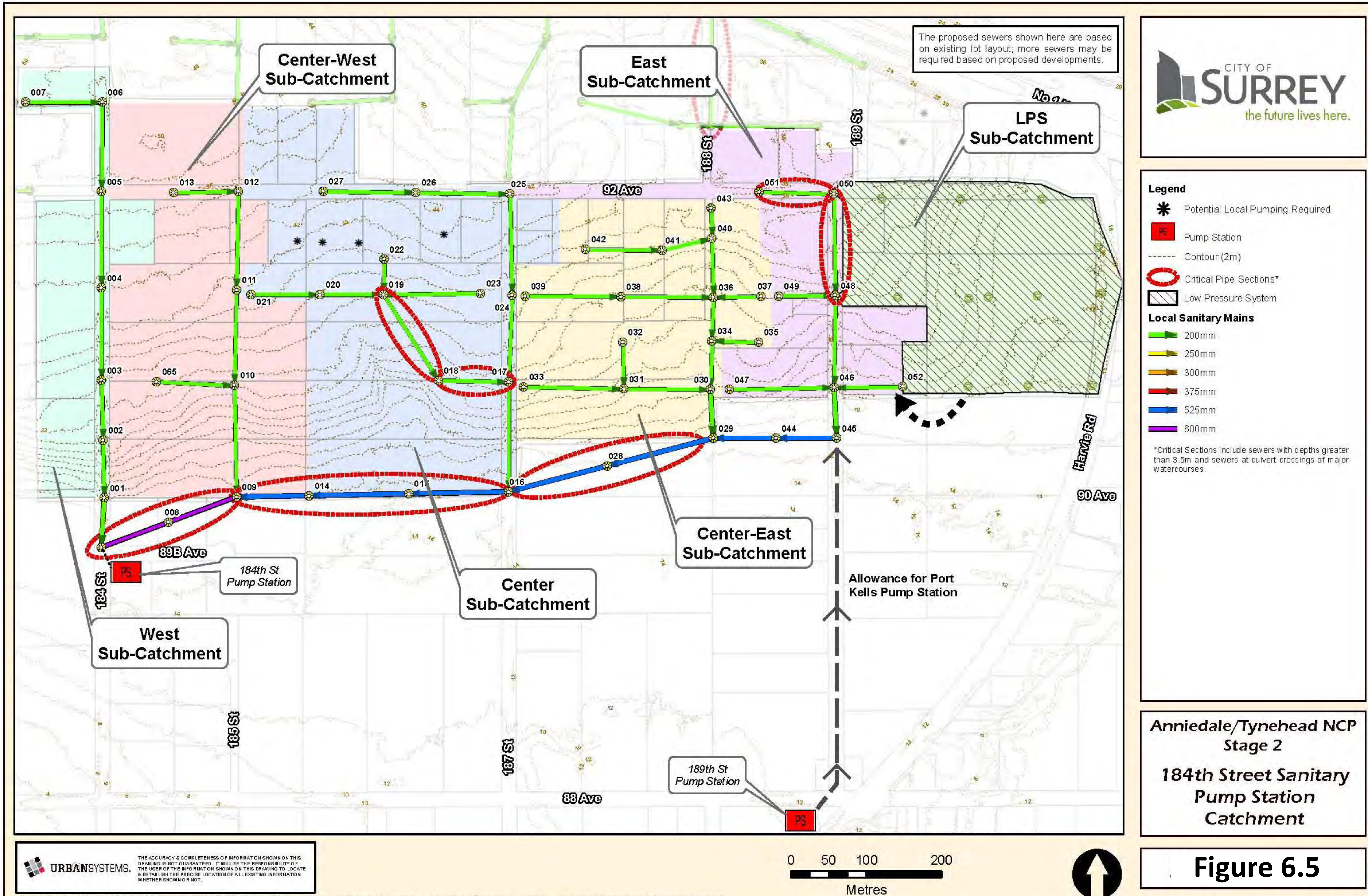
Legend
Potential Local Pumping Required
Pump Station
Contour (2m)
Critical Pipe Sections*
Local Sanitary Mains
200mm
250mm
300mm
375mm
525mm
600mm
*Critical Sections include sewers with depths greater than 3.5m and sewers at culvert crossings of major watercourses.
Anniedale/Tynehead NCP Stage 2
176th Street Sanitary Pump Station Catchment
0 50 100 200
Metres
URBANSYSTEMS.
THE ACCURACY & COMPLETENESS OF INFORMATION SHOWN ON THIS DRAWING IS NOT GUARANTEED. IT WILL BE THE RESPONSIBILITY OF THE USER OF THE INFORMATION SHOWN ON THIS DRAWING TO LOCATE & ESTABLISH THE PRECISE LOCATION OF ALL EXISTING INFORMATION WHETHER SHOWN OR NOT.

Figure 6.4



The proposed sewers shown here are based on existing lot layout; more sewers may be required based on proposed developments.
Center-West Sub-Catchment
East Sub-Catchment
LPS Sub-Catchment
Center-East Sub-Catchment
Center Sub-Catchment
West Sub-Catchment
184th St Pump Station
189th St Pump Station
Allowance for Port Kells Pump Station
92 Ave
90 Ave
89B Ave
88 Ave
184 St
185 St
187 St
188 St
189 St
Harvie Rd
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Legend
Potential Local Pumping Required
Pump Station
Contour (2m)
Critical Pipe Sections*
Low Pressure System
Local Sanitary Mains
200mm
250mm
300mm
375mm
525mm
600mm
*Critical Sections include sewers with depths greater than 3.5m and sewers at culvert crossings of major watercourses.
Anniedale/Tynehead NCP Stage 2
184th Street Sanitary Pump Station Catchment
URBANSYSTEMS.
0 50 100 200
Metres

Figure 6.5

Model Analysis

The system capacity was assessed using a standard spreadsheet method using Manning's equation to size gravity mains, and using the Hazen Williams friction method to size forcemains.

All lengths are based on the latest land use plan, with manholes located at all pipe and road intersections. Additional mid-block manholes were placed in critical areas in order to better define anticipated pipe slopes and characteristics, as well as meet the maximum allowable distance of 150m between manholes. Pipe slopes and depths were estimated using existing ground elevations from LiDAR survey.

A conceptual finished ground was developed for assessing critical sections. This is discussed in the next section.

Table 6.1 presents anticipated phasing used to assess the system.

Table 6.1: Anticipated Development Phasing (2012)

Development	Implementation Year	Phase
Tynehead – commercial	2012 – 2015	1a
Tynehead – residential	2014 – 2018	1b
Anniedale A – West 1 **Anniedale A – East 1** **Anniedale B1**	2016 – 2024	2a*
Anniedale B4 **Anniedale A – West 2**	2016 – 2024	2b*
Anniedale B3	2025 – 2031	3
Anniedale B2	2031 – 2041	4
Port Kells	2041+	5

*2a or 2b could proceed before the other.

Analysis Results

Analysis results are presented in **Appendix B**, as well as **Figures 6.1 to 6.5**.

Population Estimates and Demands

Populations for the study area were calculated using parcel size and zoning densities as outlined in Table 2.6 of the City of Surrey Engineering Department Design Criteria Manual.

The future land use for the 171 ha Port Kells area (which is outside of the Anniedale-Tynehead study area, but part of the sanitary service area) is yet to be determined. However, for purposes of this sanitary review, potential flow from Port Kells was estimated using 2 different methods:

- Using 10 upa (units per acre) density with an occupation rate of 3.2 persons/unit (corresponding to the Guilford Area, as per section 2.6 in the City of Surrey Engineering Department Design Criteria Manual)
- Using 89 PPha (corresponding to RF-12 SF Residential as per section 2.6 in the City of Surrey Engineering Department Design Criteria Manual)

The developable area was reduced to 60% of the total area, to account for RoWs, parks, etc. The resulting equivalent populations for each method were 8,100 and 9,100 persons, respectively. The average population of 8,600 persons was used in the analysis.

The total equivalent build out population is presented in **Table 6.2** below and categorized by Pump Station Catchment. Unit rates as specified above were applied to the populations to determine respective demands for each catchment.

PDWF was estimated using the Harmon peaking factor equation.

Table 6.2: Population and Catchment Flow Summary for Land Use Option

Pump Station Catchment	Development Areas	Total Equiv. Population	Gross Land Area (ha)	ADWF (L/s)	Peaking Factor (Harmon's)	PDWF (L/s)	I&I (L/s)	PWWF (L/s)
Anniedale PS	Anniedale A – West 1 Anniedale A – East 1 Anniedale B1	8082	105.1	32.7	3.05	99.7	13.6	113.3
184th St PS	Anniedale B2	3621	54.5	12.8	4.09	52.4	6.0	58.4
176th St PS	Anniedale B3 Anniedale B4 Annidale A – West 2	10674	125.1	43.2	2.93	126.6	16.2	142.8
172nd St PS	Tynehead	6661	121.0	25.4	3.49	88.6	13.7	102.3
Port Kells PS	Port Kells	8600	171.0	34.8	3.02	105.2	22.2	127.4
TOTAL		**37,638**	**376.7**	**148.9**				

6.2 SERVICING OPTIONS, PROPOSED SYSTEM AND COSTS

Local System

The majority of the system can be adequately serviced using 200 mm gravity mains, and have sufficient slope and flow to achieve the required cleansing velocity. Where cleansing velocity cannot be achieved, sewers have been proposed at minimum slopes per the design criteria as outlined in **Section 6.1**. Where parcels could not be serviced via gravity sewers, a Low Pressure Sewer (LPS) system is proposed. These areas are identified on **Figures 6.2 to 6.5**. The LPS systems tie into the gravity system and eventually to one of the four pump stations.

The figures also highlight critical sections of sewer that require further review at design stages. These critical sections include: sewers with depth greater than 3.5 m and sewers at culvert crossings for major watercourses. Profiles of the critical sections are provided in **Appendix B**. Although minimum required grades of 1.0% and 0.6% have been achieved for upstream most sections of sewer, these sections have not been included in the critical section figures for simplicity.

Critical sections of sewer also include conceptual finished ground elevations based on an assumed adjustment of the local ground elevations. It should be noted that the conceptual finished ground elevation does not take into account any review of road profiles or geometry, and is considered conceptual only.

All profiles of the proposed sewers have been based on existing topography, which is considered as the best available information, in the absence of preliminary road profiles. As such, all sewer profiles should be reconfirmed after road profiles have been developed.

Trunk System

As the timing of development of all phases is unclear at this time, it is recommended that all infrastructure sizing be reconfirmed at the time of detailed design. It is recommended that all forcemains with velocities > 1.6 m/s and below 1.0 m/s be reviewed again at the detailed design stage. Also, transient analyses will be required before the detailed design of any pump systems, including forcemains and surge attenuation measures.

Costs

Detailed costs are provided in **Appendix B** for reference. **Table 6.3** below summarizes the DCC expenditures on eligible works in the NCP Area for each phase of development, as outlined in previous sections. Costs associated with servicing of the Port Kells area have been omitted.

Table 6.3: DCC Expenditure on Eligible Works in the NCP Areas

Development	Cost
Phase 1	$ 8,800,000
Phase 2	$ 12,800,000
Phase 3	$ 300,000
Phase 4	$ 6,900,000
TOTAL	***$ 28,800,000***

Proposed System Infrastructure Phasing

As noted previously, servicing strategy Option 2c-ii (as shown on **Figure 6.1**) is the preferred sanitary system for Anniedale-Tynehead, due to the servicing flexibility congruent with development growth. Phasing of works is anticipated to follow the phasing as outlined in **Table 6.1**. Based on the anticipated phasing, the following sections outline in general terms, all major infrastructure required prior to development of each major phase. Refer to **Figure 6.1** and **Table 6.3** and **Appendix B** for additional details. Note that all forcemains are assumed to be HDPE (High-Density Polyethylene).

Table 6.4: Phase 1 - Tynehead

The following new infrastructure is required prior to development of Phase 1:

Description	Ref. No.	Nominal Dia. (mm)	Inside Dia. (mm)	Length (m)	Force Main DR-Class
Tynehead Trunk Sewer	1-1	375	375	355	-
Tynehead Forcemain	1-2	400	343	835	13.5
Tynehead – Anniedale Forcemain	1-3	400	343	980	13.5
South Port Kells Forcemain	1-4	400	343	1150	13.5
Tynehead Pump Station (172 St. PS)	-	-	-	-	-
South Port Kells Trunk Sewer	1-5	600	600	800	-

Table 6.5: Phase 2

2a: Anniedale A – West 1, Anniedale A – East 1, Anniedale B1
2b: Anniedale B4, Anniedale – West 2

The following new infrastructure is required prior to development of Phase 2:

Description	Ref. No.	Nominal Dia. (mm)	Inside Dia. (mm)	Length (m)	Force Main DR-Class
Anniedale A Trunk	2-1	375	375	1000	-
Anniedale A Forcemain	2-2	400	356	2140	17
Anniedale B4 Trunk – 1	2-3	375	375	265	-
Anniedale B4 Trunk – 2	2-4	375	375	390	-
Anniedale B3 Trunk – 2	2-5	300	300	690	-
Anniedale B3 Trunk – 3	2-6	375	375	135	-
Anniedale B4 Forcemain	2-7	400	343	200	13.5
Tynehead – Anniedale Forcemain Twin	2-8	500	428	980	13.5
South Port Kells Forcemain Twin	2-9	650	557	1150	13.5
Anniedale Pump Station (187 St. PS)	-	-	-	-	-
Anniedale B4 Pump Station (176 St. PS)	-	-	-	-	-

Twinning of the Tynehead – Anniedale Forcemain and South Port Kells Forcemain is based on the concurrent pumping from both the 172nd Street Pump Station and 176th Street Pump Station. As such, twinning of the forcemains should be completed prior to development proceeding beyond Phase 1.

Table 6.6: Phase 3 - Anniedale B3

The following new infrastructure is required prior to development of Phase 3:

Description	Ref. No.	Nominal Dia. (mm)	Inside Dia. (mm)	Length (m)	Force Main DR-Class
Anniedale B3 Trunk – 1	3-1	300	300	220	-

Table 6.7: Phase 4 - Anniedale B2

The following new infrastructure is required prior to development of Phase 4:

Description	Ref. No.	Nominal Dia. (mm)	Inside Dia. (mm)	Length (m)	Force Main DR-Class
Anniedale B2 Trunk – 1	4-1	525	525	310	-
Anniedale B2 Trunk – 2	4-2	600	600	770	-
Anniedale B2 Forcemain	4-3	250	236	1320	15.5
Anniedale B Forcemain	4-4	250	236	850	15.5
Anniedale B2 Pump Station (184 St. PS)	-	-	-	-	-

Table 6.8: Phase 5 - Port Kells

Note: This phase is outside the current NCP study area. The following information is provided to illustrate the future impact to the planned infrastructure within this NCP. Details of all proposed infrastructure within this NCP need to be reviewed once the land use of the Port Kells area has been finalized.

The following new infrastructure is required prior to development of Phase 5 (note that Port Kells is located outside of the NCP area):

Description	Ref. No.	Nominal Dia. (mm)	Inside Dia. (mm)	Length (m)	Force Main DR-Class
Port Kells Forcemain	5-1	400	380	530	32.5
Anniedale B2 Forcemain Twin	5-2	450	395	1320	15.5
Anniedale B Forcemain Twin	5-3	450	395	850	15.5
Port Kells Pump Station (189 St. PS)	-	-	-	-	-

Twinning of the Anniedale B2 Forcemain and Anniedale B Forcemain is based on full development of Phase 5. As such, twinning of the forcemains should be completed prior to development proceeding beyond Phase 4. In addition, development of Port Kells may also require further upgrades to both the Tynehead – Anniedale Forcemain and the South Port Kells Forcemain. This will need to be confirmed prior to the development of Port Kells. A review will be required to confirm the flow anticipated from the future 189 Street Pump Station.

Refer to **Part 7.2** regarding Environmental Considerations and approvals when designing the proposed system.

6.3 TEN YEAR SERVICING PLAN AND INFRASTRUCTURE COSTS

The required sanitary system will comprise the following three major components: upsizing of mains to achieve sizes greater than the base 200mm (base 250mm in industrial areas), trunk sewers for flows greater than 40 L/s, and force mains and lift stations to carry flow from the Anniedale-Tynehead NCP catchment to the North Surrey Interceptor extension. The works have been divided into five Phases. The first 4 Phases will service the Anniedale-Tynehead NCP and the 5th phase of works will include the Port Kells area.

Consistent with current practice, developers will be required to fund frontage works, including costs associated with 200 mm or 250mm sewer mains. The concept is that the DCC program will fund the upsizing of the base size to achieve the most of the trunk system.

The estimated DCC eligible infrastructure costs for the gravity sewers, force mains and pump stations (including RoW costs for the force main, land costs for the pump station, and engineering and contingency costs) to service the Anniedale-Tynehead catchment area Phases 1 to 4 is **$28.8 million**. The Phase 5 works include the 189th Street pump station and force mains that serve the future Port Kells development. This area is currently suburban and un-sewered; consequently, until this area completes a land use plan to a greater level of certainty, no contribution from these areas can be relied on at this time.

Current Projects in the 10 Year Servicing Plan

There are no projects currently identified in the 10 Year Servicing Plan that fall within the sanitary sewer study area.

PART 7 STORMWATER INFRASTRUCTURE

7.0 EXISTING & FUTURE SERVICING & CATCHMENT DETAILS
7.1 DESIGN CRITERIA & ANALYSIS
7.2 SERVICING OPTIONS, PROPOSED SYSTEM
7.3 TEN YEAR SERVICING PLAN AND INFRASTRUCTURE COSTS

Photo: Detention Pond and Park in East Clayton, Surrey

PART 7: STORMWATER INFRASTRUCTURE

7.0 EXISTING AND FUTURE – SERVICING CATCHMENTS AND DETAILS

General Description of Study Area

The proposed Anniedale-Tynehead Neighbourhood **(see Figure 7.1)**, covering an area of approximately 415 hectares, lies across a broad east to west trending ridge. The north side of the ridge (approximately 30% of the neighbourhood) drains towards the Fraser River via the Parsons Channel, while the south side of the ridge (approximately 70% of the neighbourhood) drains towards the Serpentine River **(see Figure 7.2)**. The north-eastern and southern parts of the study area are slightly steeper than the rest of the neighbourhood area. Overall, the average slope within the neighbourhood area ranges between 0% and 10%.

Numerous natural and artificial watercourses are present in Anniedale-Tynehead **(Figure 7.2)**. Many of these, including a number of roadside ditches, have identified fish habitat value, due to the presence (or potential presence) of fish (both salmonid and non-salmonid). A number of other watercourses have designated value as sources of food and nutrients to downstream fish populations. In addition, both the Fraser and Serpentine Rivers, to which runoff from the neighbourhood ultimately discharges, are fisheries. In addition to controlling runoff to prevent flooding and loss of property and life, runoff control must address maintenance of these fisheries resource values.

Land Use – Existing and Proposed Future

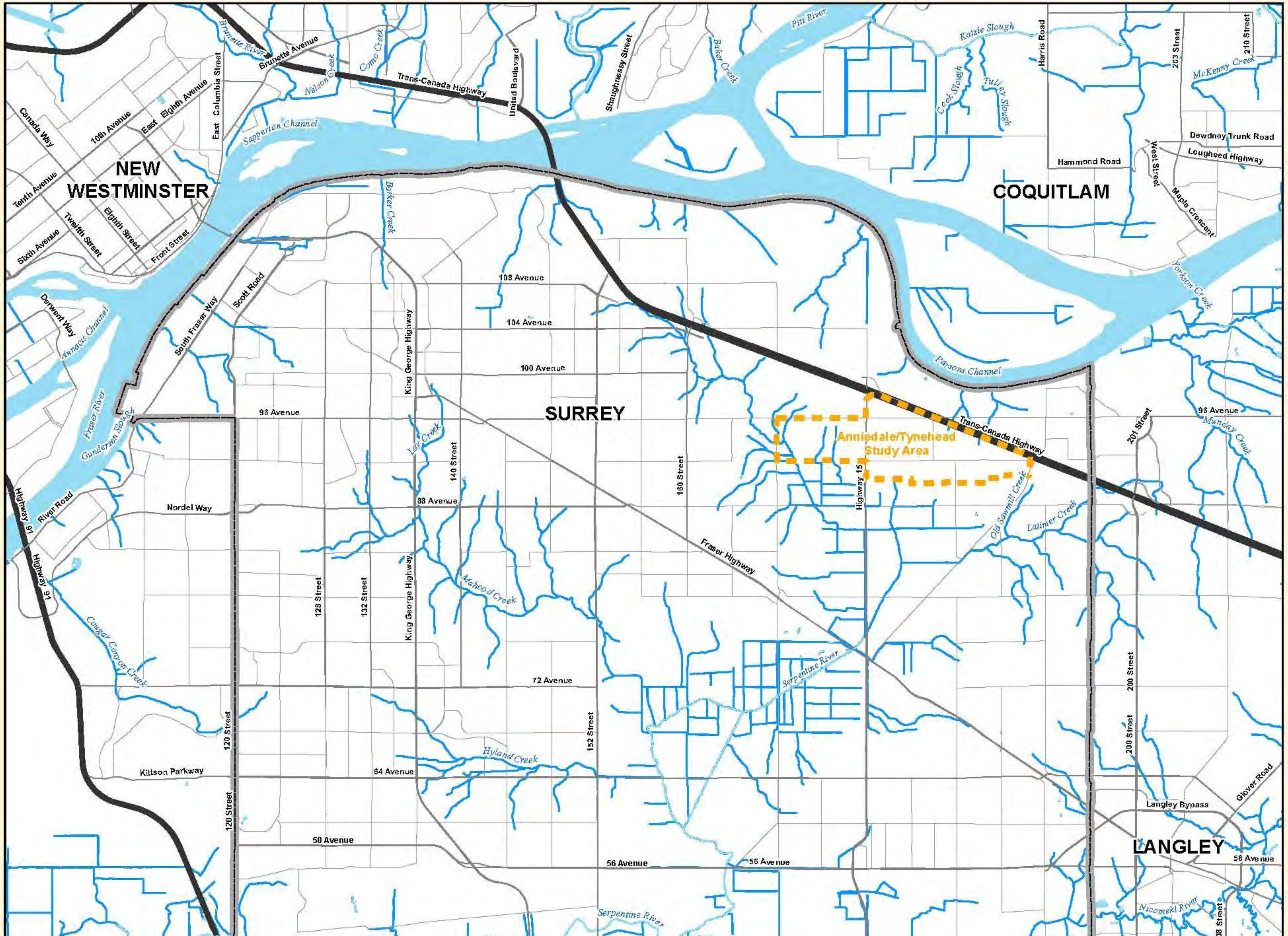
Currently the land of the proposed Anniedale-Tynehead neighbourhood is predominantly low density residential area with open spaces, large trees and pastures. As shown on **Figure 7.3**, most of the existing residential development (approximately 80%) falls within the One-Acre Residential Zone (RA), which permits one single-family residence on suburban lots of one acre or larger. The maximum allowable lot coverage of all buildings and structures is 20%. This zone also permits agricultural and horticultural uses on lots that are at least 5 acres.

Approximately 20% of the study area is currently zoned as General Agricultural area (A-1). The A-1 Zone permits agricultural uses (as well as a single family dwelling) on lots that are at least 5 acres in size. Lot coverage of buildings and structures is generally limited to 10%.

Two other zones are also present, covering only a small fraction of the area. Two lots fall into the Assembly Hall 1 Zone (PA-1), one being a church and the other a community centre. A single lot, in the northeast corner of Highway 15 and 96^{th} Avenue, is designated as Comprehensive Development Zone (CD); the site supports a convenience store and office space.

Future land development within the Study Area will be guided by this Anniedale-Tynehead NCP, which generally envisions a mix of low density, medium and medium high density residential developments and commercial/industrial employment centres. A high density residential area is proposed to the south side of the Golden Ears Way between 176th Street and 180th Street. As shown on the NCP map, the north and northeast portions of the neighbourhood are proposed for (light) industrial development. Several small village commercial areas are proposed within the neighbourhood, though the bulk of commercial development will be located south of 96 Avenue just west of Highway 15 (176 Street). As shown on the proposed land use map; the NCP also identifies significant areas of parks, trails, buffers and riparian zones to protect environmentally sensitive areas and preserve natural areas. Refer to the Land Use Plan discussed in Part 1, for details.

Overall, when compared with the current land use conditions, the proposed land use condition will decrease open space area, especially wooded areas, and increase the total amount of impervious (or "hard") surface within the area. If unmitigated or unmanaged, this will result in increased runoff, which will also carry greater levels of non-point source pollutants, than under existing conditions; this in turn will impact the receiving watercourses and could cause flooding, water quality problems or erosion downstream of the neighbourhood. The proposed servicing plan, as discussed in more detail in subsequent sections, will address these issues in order to maintain the area's watershed health and prevent loss of property or life.



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Legend

- Road
- Freeway
- Waterways
- Waterbodies
- City of Surrey Boundary
- Study Area

Anniedale/Tynehead NCP
Stage 2 - Drainage

General Location Map

Figure 7.1

URBANSYSTEMS.

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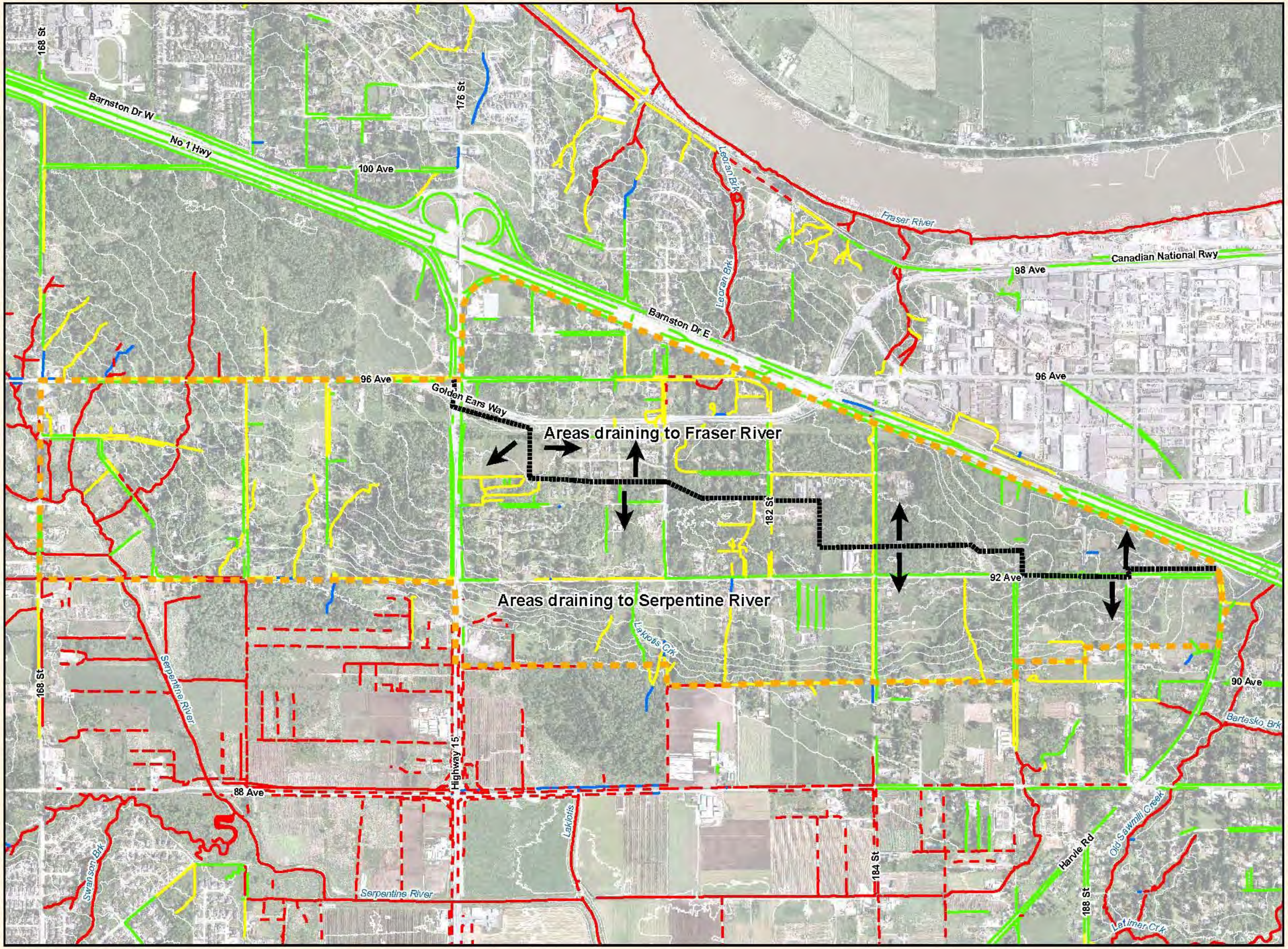
U:\Projects_VAN\1072\0173\01\D-Drafting-Design-Analysis\GIS\Projects\mxds\StormwaterFigures_Phase2\Figure 3.3-1 - General Location Map.mxd Last revised by: bpauls on 26/09/2011 at 11:40:25 AM



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Legend

Watercourse Classifications

Class A (red-coded): Year-round salmonid presence. Non-salmonid species also present.

Class A(O) (red-dash): Inhabited during overwintering periods by salmonids. Non-salmonid species present year-round.

Class B (yellow-coded): Provides food and nutrient value to downstream fish populations. No potential for fish presence.

Class C (green-coded): No fish presence. Does not provide food and nutrient value to fish bearing watercourses.

Unclassified

Contours - 5m

Major Watershed Divide

NCP Boundary

Anniedale/Tynehead NCP
Stage 2 - Drainage

Fisheries Overview

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Figure 7.2

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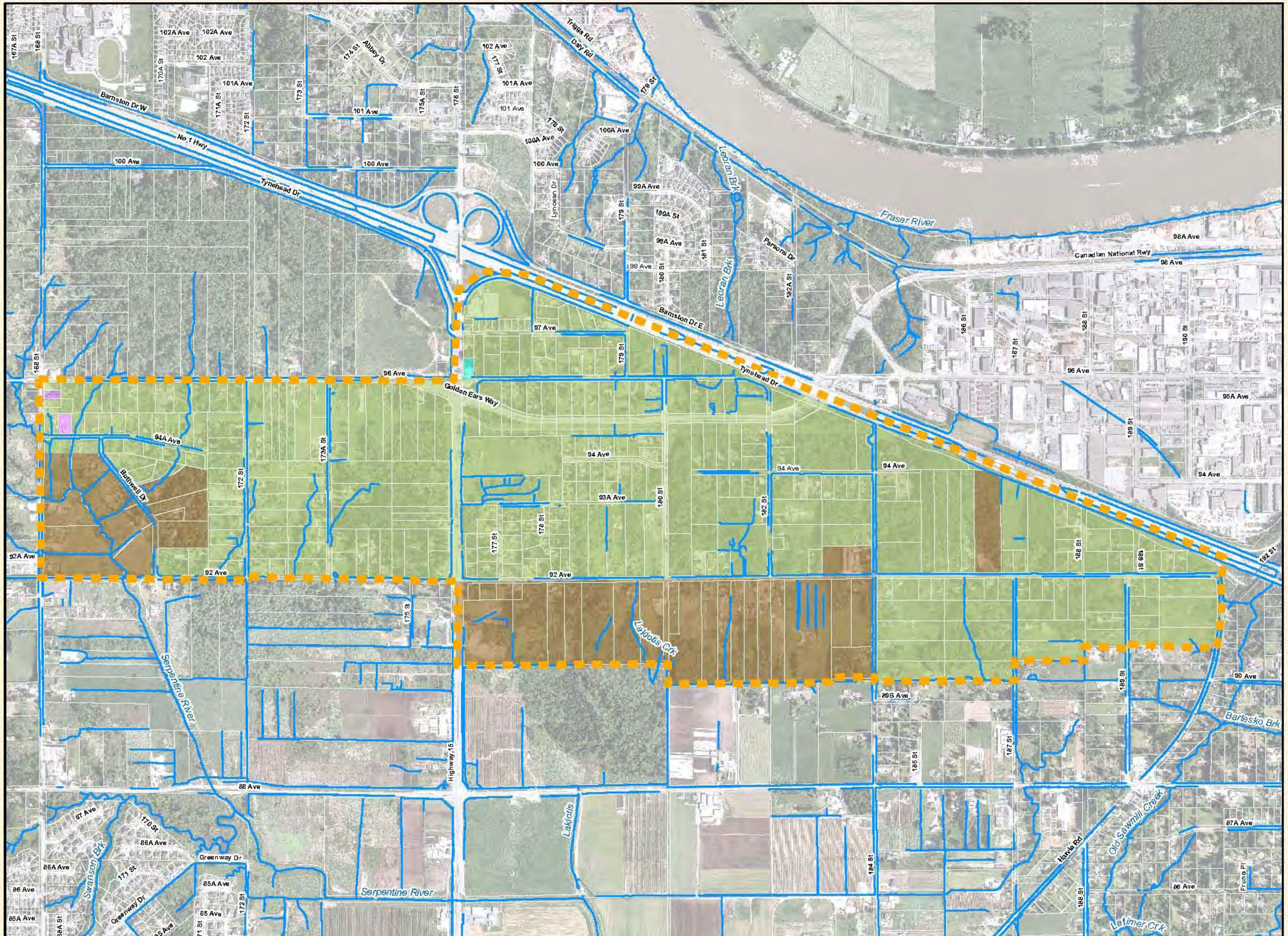

Legend

Open Channel

Zoning Classes

- Assembly Hall 1 Zone (PA-1)
- Comprehensive Development Zone (CD)
- General Agricultural Zone (A-1)
- One Acre Residential Zone (RA)
- NCP Boundary

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Anniedale/Tynehead NCP
Stage 2 - Drainage

Current Zoning

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Figure 7.3

U:\Projects_VAN\1072\0173\01\D-Drafting-Design-Analysis\GIS\Projects\mxds\StormwaterFigures_Phase2\Figure 3.3-3 - Current Zoning.mxd Last revised by: bpauls on 26/09/2011 at 11:42:13 AM

Soils and Groundwater

Understanding local soils and hydrogeologic conditions is essential to understanding local hydrology and to assessing the applicability and design of certain stormwater control methods, specifically those that are infiltration-based.

Across the City of Surrey there are generally three dominant layers of sediments that lie beneath the land surface. These layers of sediment, deposited by past glaciers and other land-forming geological activity, control the groundwater conditions of the region. The top layer, named the "Capilano Sediments", is generally between 1 and 12 metres thick and consists of a mix of permeable and less permeable sediments. It is this sediment layer that is most critical to surface runoff and to stormwater systems; further discussion of this upper sediment layer is provided later in this section. Beneath the Capilano Sediments lie highly consolidated till, sand and gravel; this layer is called the "Vashon Drift". The layer is quite impermeable and generally restricts downward movement of percolated rainwater from the upper Capilano Sediments into an aquifer below located within the third dominant layer, called the "Quadra Sands". The Quadra Sands consist of glacial outwash sand and gravel materials; it is very permeable, with high groundwater storage capacity and high hydraulic conductivity.

In some areas of Surrey, the Quadra Sands are exposed yielding groundwater in the form of springs or seeps, but under the Anniedale-Tynehead neighbourhood it is not exposed and the Quadra Sands are considered a confined aquifer. (This confined aquifer extends beyond the neighbourhood, underlying much of Surrey.) Most rainwater that percolates into the upper Capilano Sediments will be constrained, though not entirely prevented, from percolating downward when it reaches the top of the Vashon Drift layer. Instead, it will tend to move laterally downslope, forming a shallow groundwater flux or movement. This flow will generally be confined to the top metre or so of soils. Some of this shallow groundwater flow will discharge into depressions, ditches and native watercourses, while some will feed springs that occur at lower slopes, particularly in the southern, south-facing part of the neighbourhood.

Soils characteristics of the Capilano Sediments vary within the neighbourhood, but the bulk of these soils tend to be moderately well to well drained, and rapidly pervious in the upper more gravelly part but only slowly pervious in the more dense subsoils[2]. Sampling undertaken for the NCP's environmental assessment indicated that sandy loams and silt loams represent approximately 48% and 43%, respectively, of soils in the area[3]. Sandy clay loam and silt clay loam textured soils are also observed in the area.

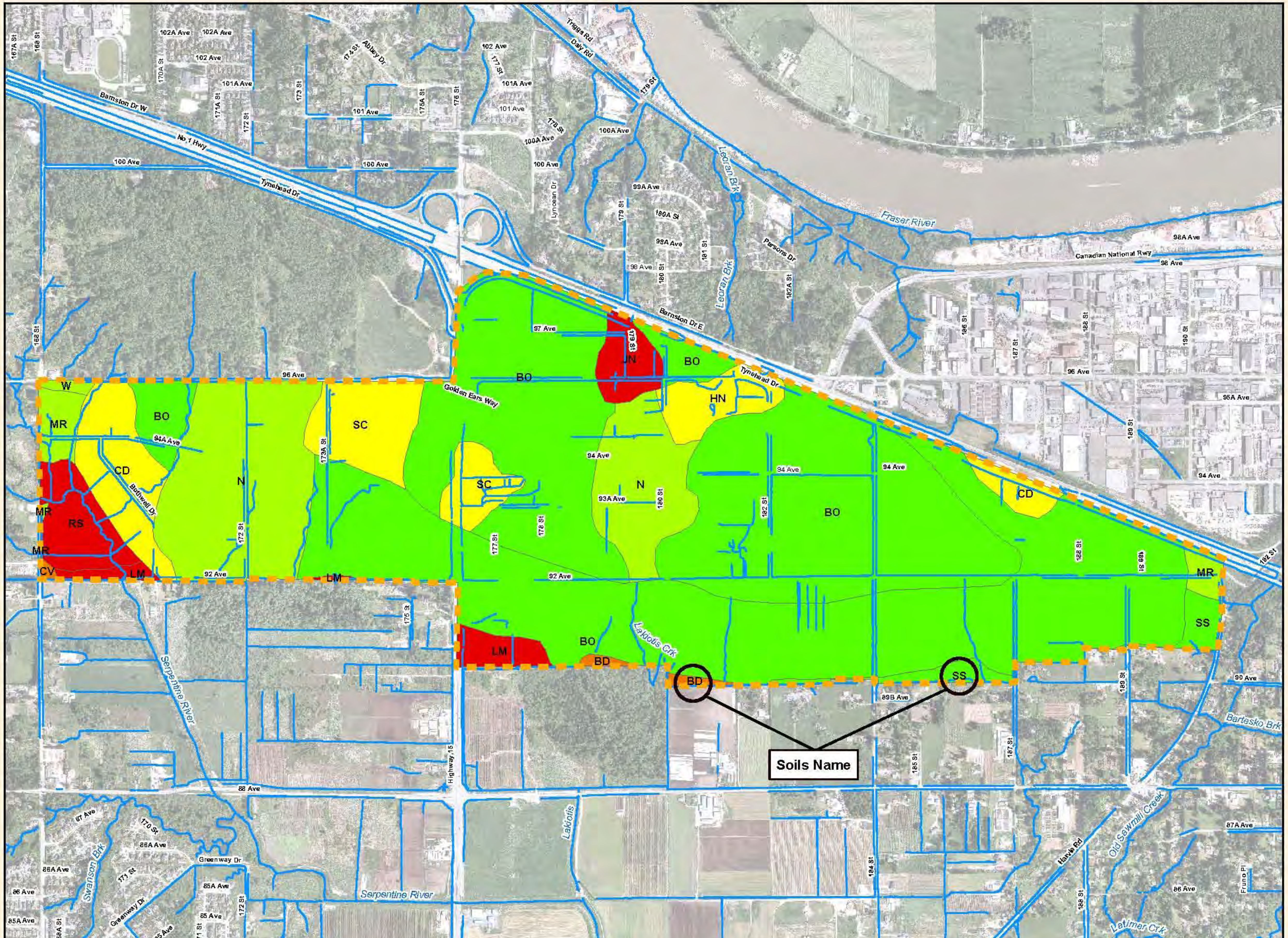
Poorly to very poorly drained soils are present in a few areas, notably in several low-lying areas along Highway 1, along the Serpentine River on the western part of the neighbourhood and just east of Highway 15 (176th) along the southern neighbourhood boundary. **Figure 7.4** shows the different soil types found in the area, categorized by general drainage (or percolation) characterization.

Those areas of the neighbourhood with moderately to well drained soils are candidates for the use of low impact runoff infiltration as a stormwater control method. Site specific conditions must be evaluated and found suitable before installing infiltration systems.

[2] Province of British Columbia. (1980). "Soils of the Langley-Vancouver Map Area", RAB Bulletin 18, Volume 3.

[3] Madrone Environmental Services. (2009).

If construction is carefully managed, the sandy to silty loam textured soils of the area are not necessarily prone to erosion or compaction; however erosion can occur under certain conditions, such as the use of heavy machinery when soils are wet. Erosion and sediment control practices must be used to prevent this erosion. In and along open watercourses, these soils will erode when hydrologic conditions change rapidly due to urbanization or other land use changes. Stormwater controls are required to mitigate stream erosion and prevent sedimentation of downstream watercourses.



Legend

- Open Channel
- NCP Boundary

Soil Drainage Characteristics

- Well to moderately well
- Moderately well
- Poor
- Poor to very poor
- Very poor

SOILS NAMES*

BO - Bose Soils
CD - Cloverdale Soils
CV - Carvolth Soils
HN - Heron Soils
JN - Judson Soils
LM - Lumbum Soils
MR - Monroe Soils
N - Nicholson Soils
RS - Ross Soils
SC - Scat Soils
SS - Sunshine Soils
W - Whatcom Soils

*Note: Soil data source - Soils of the Langley-Vancouver Map Area, RAB Bulletin 18, Ministry of Environment, 1980.

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Anniedale/Tynehead NCP
Stage 2 - Drainage

Soil Drainage Classification

Figure 7.4

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Metres

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U:\Projects_VAN\1072\0173\01\D-Drafting-Design-Analysis\GIS\Projects\mxds\StormwaterFigures_Phase2\Figure 3.3-4 - Soil Drainage Classification.mxd Last revised by: bpauls on 27/10/2011 at 11:32:55 AM

Hydrology and Hydraulics – Existing and Future Conditions

Rainwater runoff from the Anniedale-Tynehead area ultimately drains to two major watercourses, Serpentine River to the south and Fraser River to the north. There are few natural watercourses in the north side of the study area, though there are a number of drainage ditches along the roads. In the southern two-thirds of the study area, along moderately steep slopes, several natural watercourses originate from forested areas. Drainage ditches are also present here, paralleling road networks and in agricultural areas.

The existing drainage infrastructure in the study area is currently serviced to the City's rural/agricultural standard, comprising open ditches, culverts and only a few storm sewers. A recent addition is the storm sewer system along Golden Ears Way, which drains east then north under Highway 1; this system services the roadway only and is owned and maintained by the Golden Ears Bridge concessionaire (Translink). **Figure 7.5** shows the overall existing drainage infrastructure for the study area. Though satisfactory now, the existing infrastructure is inadequate to service the proposed land use plan.

Other than conveyance, at this time there are no known stormwater control systems in place within the neighbourhood. This means that runoff is collected and conveyed without intentional reductions in peak or volume and without direct application of methods for reducing or mitigating non-point source pollution in the runoff. Advanced stormwater management has been applied to the 96th Avenue corridor, along the neighbourhood's border, as part of recent water system and road upgrade projects.

For purposes of formulating a servicing strategy, the neighbourhood has been divided into four major catchments, one draining north and three draining south; these are shown in **Figure 7.6**. Briefly, the catchments are:

- 'West catchment' - drains directly to the Serpentine River via several small tributaries;
- 'North catchment' - drains directly to the Fraser River via tributaries (including Lorean Brook) and storm sewers lying north of Highway 1 in Port Kells;
- 'East catchment' - drains directly to Latimer Creek, which in turn joins the Serpentine River south of the neighbourhood; and
- 'South catchment' - drains through lowlands towards the Serpentine River, where a dyke and drainage pump station (and flood box) provide flood protection for the agricultural lowland area.

The distribution of proposed land use type and related impervious cover varies by catchment and, as will be discussed in the next section, the priority stormwater management objectives vary by catchment as well.

From the background information relevant to the Anniedale-Tynehead neighbourhood area, a summary of previously identified stormwater conditions, outstanding issues and concerns, proposed infrastructure improvements, and recommended stormwater management measures including in-stream habitat enhancements can be found in **Table A.1 (Appendix C)**. These studies identified issues primarily related to topography, watercourses and vegetation, but not specifically to drainage servicing.

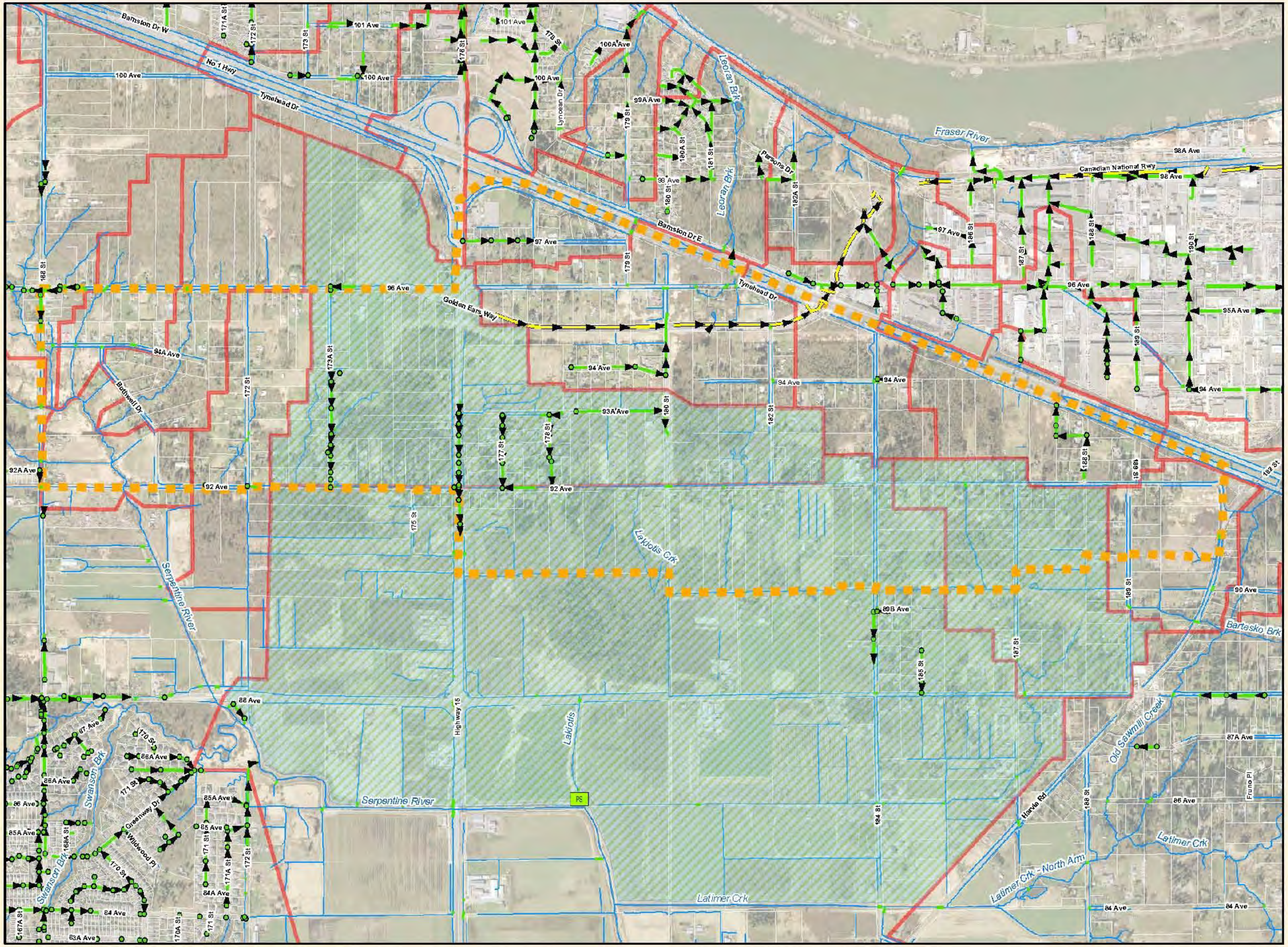
The proposed changes to land use types and patterns within the neighbourhood, as envisioned by the NCP, could have a significant impact on the hydrologic conditions of the area's watercourses if not adequately addressed. Two key factors that can be used as indices to these impacts are the total amount of impervious (“hard”) surfaces which are constructed and the total amount of vegetated, open space (in particular forested land) which remains. Significant increases in the former accompanied by decreases in the latter will lead to increased runoff volume and peak flows and to increased washoff of pollutants (sometimes called “non-point source pollution”).

For Anniedale-Tynehead, the estimated total imperviousness for existing conditions is 12% and for future conditions is 62%; this impervious surface increase will yield significant changes in hydrology (larger peak flows and greater annual volume of runoff) and non-point source pollution. As shown on the NCP land use map, there will remain significant land dedicated as riparian areas, protected forested areas, and open spaces and parks within the neighbourhood. Nonetheless, stormwater controls must be applied to maintain and enhance catchment health.

The City’s 10 year servicing plan did include a detention pond to the southeast of 95th Avenue and 168th Street, which was recommended as part of the Master Drainage Plan (MDP) for the Upper Serpentine, Fleetwood and Greenway Basin. Further, the South Port Kells General Land Use Plan (GLUP) allowed for two detention ponds to service the area, one within the Anniedale-Tynehead neighbourhood area along Highway 1 and another just outside the study area (east of Harvie Road and north of 88th Avenue). These remnants of earlier planning efforts were taken into consideration for the proposed stormwater servicing plan but they have been modified significantly to suit a more integrated stormwater management planning approach to the area.

Protection of the lowland agricultural area to the south is a key concern for the City and for land owners in the lowlands. A functional plan to provide this protection was prepared in the late 1990’s, and subsequently verified and updated shortly thereafter[4]. The two key elements of that plan are the Upper Serpentine Pump Station (along with flood box) and the extensive storage/conveyance ditch system within the lowlands. About two-thirds of the runoff from Anniedale-Tynehead will drain through the lowlands, thus these facilities must be able to handle any increases in runoff due to future development, mitigation efforts must be applied to reduce future runoff increases, or a combination of the two must be implemented.

[4] Associated Engineering. (1998). “Upper Serpentine Pump Station, Project 4898-714, Functional Plan”.



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Metres

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Legend

- Pump Station
- Drainage Manhole
- Drainage Main (Surrey)
- Drainage Main (Translink)
- Open Channel
- Drainage Catchments*
- Area Draining to Pump Station**
- NCP Boundary

* As per City of Surrey

**As per "Upper Serpentine Pump Station Project 4898-714 Functional Plan", Associated Engineering (BC) Ltd., August 1998.

Anniedale/Tynehead NCP Stage 2 - Drainage

Existing Drainage Infrastructure

Figure 7.5

URBANSYSTEMS.

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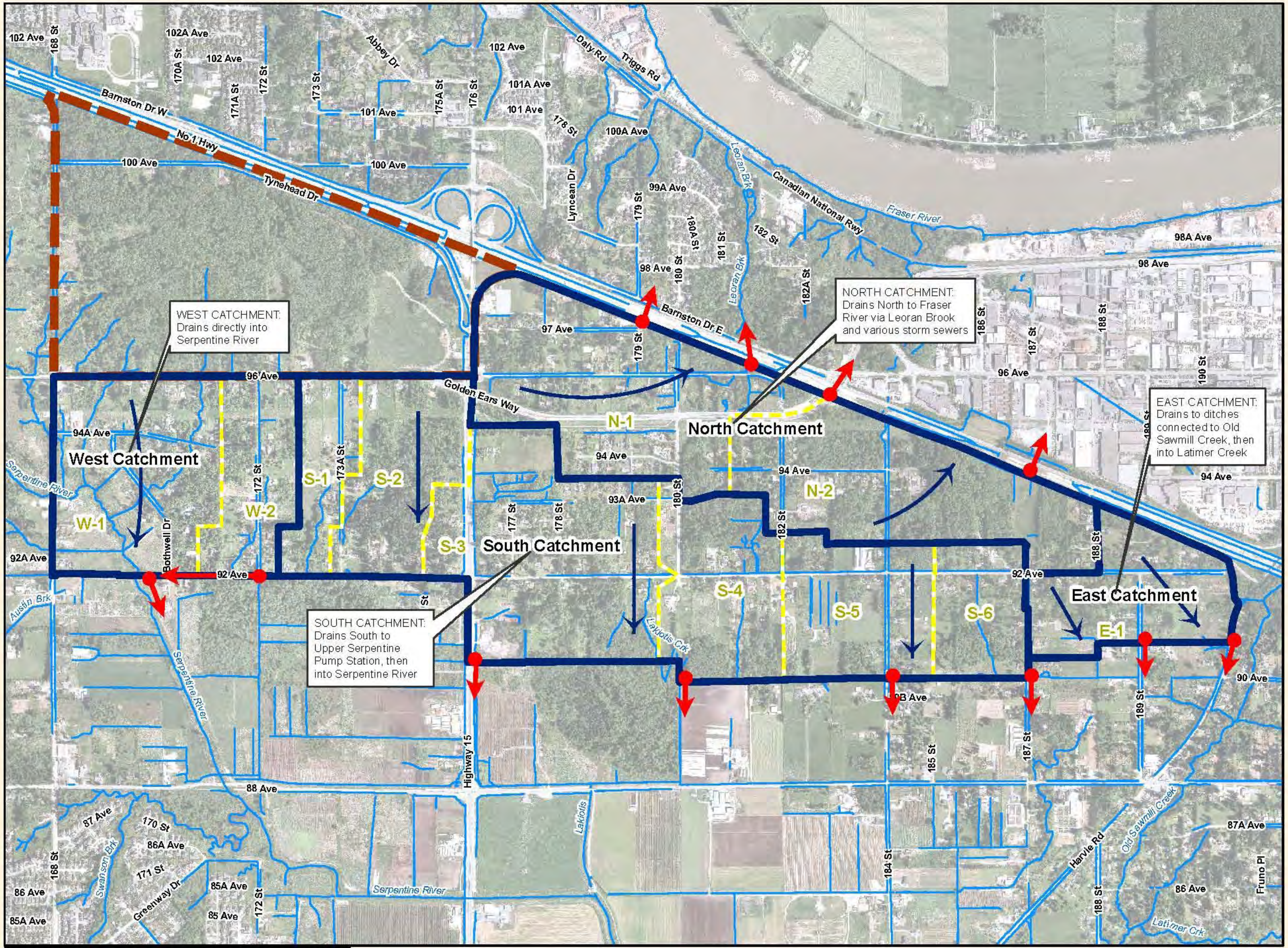

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Legend

- Existing Watercourses
- Overall Runoff Direction
- Future Sub-Catchment Boundaries
- Future Major Catchment Boundaries
- Contributing Catchments Outside NCP Area
- Discharge Points

Anniedale/Tynehead NCP Stage 2 - Drainage

Major Drainage Catchments

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Figure 7.6

URBANSYSTEMS.

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Historical Studies and Reports

The following key background reports and studies were reviewed in the course of preparing this stormwater servicing plan for the Anniedale-Tynehead neighbourhood; the most pertinent of these are relatively old and do not address the City's more recent standards for stormwater management:

- "Upper Serpentine, Fleetwood and Greenway Basin Master Drainage Plan", 1996;
- "Upper Serpentine Pump Station, Project 4898-714, Functional Plan", 1998;
- "Latimer Creek Dyke, Tie-In Functional Plan", 1998;
- "Verification of the Functional Plan for the Upper Serpentine Pump Station", 1999;
- "Verification of the Functional Plan for Latimer Creek Dyke Tie-In", 1999;
- "Latimer Creek Master Drainage Plan", 2003;
- "South Port Kells General Land Use Plan", 2005; and
- "10 Year Servicing Plan, 2010-2019", 2010.

Critical Servicing Issues

The Anniedale-Tynehead Neighbourhood is sparsely developed at this time and drainage is adequately handled by the existing infrastructure. A review of background materials indicates no significant issues have been identified. As development begins, there are several key objectives which will dictate the types and extent of stormwater management which must be applied to meet the City's servicing standards:

- Avoid or minimize local flooding;
- Protect downstream lands, particularly those in the ALR lands to the south, from uncontrolled flooding;
- Maintain current runoff volumes to the adjacent ALR lands to the south, upgrade the conveyance ditches and Upper Serpentine Pump Station capacity as required, or a combination of these;
- Manage runoff peaks within the capacity of downstream watercourses and storm sewers to the north OR upgrade the storm sewers as required;
- Protect receiving watercourses from erosion due to increased runoff;
- Maintain base flows in those creeks designated for preservation and which support fisheries values; and
- Maintain the quality of water in all drainage systems.

7.1 DESIGN CRITERIA, ANALYSIS AND SERVICING STANDARDS

Key design standards and guidelines that govern the stormwater servicing for Anniedale-Tynehead are established by the City; there are guidelines from both the provincial and federal level that were also considered in the development of this servicing plan.

Planning for drainage systems to meet the needs of growth must satisfy four basic criteria which form the fundamental aspects of the City's Drainage Policy:

- A minor system conveyance capacity up to the 1:5-year return period storm to minimize inconvenience of frequent surface runoff;
- A major system conveyance capacity up to the 1:100-year return period storm to provide safe conveyance of flows to minimize damage to life and property;
- Where erosion is a concern, satisfy the more stringent of the two following criteria:
  - Control the 5-year post-development flow to 50% of the 2-year post-development rate; or
  - Control the 5-year post-development flow to 5-year pre-development flow rate; and
- Maintain a flood control and drainage system in the lowlands that meets provincial ARDSA guidelines as follows:
  - Restrict flooding to a maximum of 5 days in duration for the 10 year, 5 day winter storm (November to February);
  - Restrict flooding to a maximum of 2 days in duration for the 10 year, 2 day growing season storm (March to October); and
  - Between storm events, maintain the base flow in ditches at 1.2 m below the average ground level to provide free outlet for drains.

In addition, though not listed here, the City's design standards cover the specific details of drainage system components, such as minimum pipe sizes and profile slopes, inlet spacing, etc.

Consistent with the City's commitment to protecting and maintaining the health of its watercourses, development must reduce the volume of runoff it generates and instead promote natural hydrologic processes such as infiltration and evapotranspiration. In order to reduce the volume of runoff generated by the neighbourhood, new development must capture 50% of the Mean Annual Rainfall[5] (MAR) at the source (building lots and streets) and infiltrate, evaporate, or reuse it. The MAR in the Anniedale-Tynehead area is approximately 70 mm in 24 hours, thus 50% of the MAR is 35 mm. Where infiltration systems are not suitable, a rate of discharge equal to the calculated release rate of an infiltration system may be applied to other on-site stormwater control practices[6]. Satisfying this requirement will serve to

[5] MAR is defined as the 24-hour rain event with a 2.33 year return period; about 90% of the total rainfall volume in a typical year occurs in rain events smaller than the MAR. For the Anniedale-Tynehead neighbourhood the MAR is approximately 70 mm, thus the requirement is to retain the first 35 mm of rainfall on-site.

[6] While general soil conditions indicate the application of infiltration methods, there may be instances where infiltration systems are not suitable. For example, a lot near a ravine is proposed to be developed; the soils at the site have an infiltration rate of 12 mm/hr. A potential choice for on-site rainwater control is a rock trench that captures ½ the MAR and exfiltrates it at that rate. However, due to proximity to the ravine, a geotechnical engineer raises concerns for ravine slope stability. In this case, the rainwater may be captured in an underground tank and then released to the ravine or a local storm sewer at a volumetric rate comparable to that which would have been used for the rock trench design.

support base flow in watercourses and to provide water quality treatment. The requirement is in general agreement with provincial and federal stormwater guidelines.

Hydrologic Analysis

Hydrologic modeling was completed to quantify both existing and future hydrologic conditions; subsequently the future conditions model was used to evaluate alternative management options. Both “design storm event” and “continuous” (or extended period) simulations were used in the modeling effort.

Briefly, the target hydrologic conditions for the neighbourhood are based on the results of an existing conditions hydrologic model developed using the software package MIKE SHE. MIKE SHE was run first in a continuous simulation mode to establish minimum base flows (summer; winter) and allowable discharges from the area’s sub-catchment. MIKE SHE is a 2-D, distributed, process-based model that links surface and subsurface flow regimes and is well-suited to simulating hydrology in a largely undeveloped area such as Anniedale-Tynehead. A separate PCSWMM model was then developed for future conditions and used to establish a mix of detention ponds and source controls to manage the neighbourhood’s rainwater using the SHE existing conditions results as the targets. PCSWMM is 1-D, lumped, process-based model that is well suited for simulating urban drainage systems.

The models used in this analysis as the basis for the stormwater servicing plan were not calibrated to local data. They are, however, based on the application of accepted modeling principles and parameter values for computing runoff in Surrey. The results should be considered reliable for purposes of this plan, but should be confirmed during the development process with more detailed analysis.

The primary purpose of modeling existing conditions was to establish key runoff flows and volumes as benchmarks for developing the future stormwater management strategy. Hydraulic capacity analysis of the existing drainage infrastructure (culverts and storm sewers) was not conducted since the projected future development will require almost complete replacement of what currently exists within the boundaries of the NCP.

“Pre-development conditions” are generally the baseline for considering the impact of future land use, and thus hydrologic, changes in an area. The City of Surrey generally defines pre-development conditions as those which existed in 1979. The Anniedale-Tynehead NCP area is very rural, and while some development has occurred since 1979, existing conditions have been used as the pre-development conditions since hydrologically there is little difference between the two. The key existing conditions are:

- Only 12% of the study area is impervious; and
- Only about 1% of impervious surfaces are directly-connected to a storm sewer.

This means that most runoff generated on impervious surfaces has a chance to infiltrate, or at least be attenuated, as it passes over pervious surfaces.

Table 7.1 and 7.2 show the key results of the existing (i.e., pre-development) conditions modeling; **Figure 7.6** shows the locations of the various catchments. The tables list peak discharges at key points around the boundary of the neighbourhood for 2, 5 and 100-year return periods and for summer and winter base flows. These results establish the benchmark to be attained by stormwater management strategies for future development conditions. The estimates include upslope contributing flow from areas outside the NCP boundaries (Sub-catchments W-1, W-2 and S-1).

Table 7.1 – Catchment Data Summary for Existing Conditions

Catchment	Catchment Area*	2 Yr, 24 hr Peak Flow	5 Yr, 24 hr Peak Flow	100 Yr, 24 hr Peak Flow
	(ha)	(m3/s)	(m3/s)	(m3/s)
West				
W-1	121.1 (47.7)	1.22 (0.48)	1.77 (0.67)	3.18 (1.25)
W-2	39.8 (23.1)	0.40 (0.23)	0.56 (0.33)	1.04 (0.61)
North				
N-1	63.9	0.50	0.67	1.06
N-2	55.9	0.44	0.58	0.92
East				
E-1	30.9	0.50	0.70	1.41
South				
S-1	53.5 (16.1)	0.46 (0.14)	0.59 (0.18)	0.85 (0.26)
S-2	30.4	0.26	0.33	0.49
S-3	64.6	0.56	0.71	1.03
S-4	32.6	0.28	0.36	0.52
S-5	30.7	0.27	0.34	0.49
S-6	18.5	0.16	0.20	0.30

*Catchment area within NCP boundaries are shown in parentheses for those sub-catchments also receiving runoff from upslope areas located outside the NCP.

Table 7.2 – Estimated Base Flow* Contributions from Major Catchments

Catchment	Catchment Area** (ha)	Summer Base Flow (L/s)	Winter Base Flow (L/s)
West Catchment: To Serpentine River	160.9	2.5-3.5	19-21
North Catchment: To Leoran Brook	119.9	2.5-3.5	3-5
East Catchment: To Harvie Rd Ditch ***	30.9	0.5-1.5	1-3
South Catchment: To Lowland Ditches	230.4	2.5-3.5	30--32

*Ranges have been listed in order to highlight that they have been estimated with an uncalibrated model.

**Includes upslope areas outside the NCP boundaries.

***Ditch eventually crosses Harvie Road and discharges to Old Sawmill Creek, a tributary of Latimer Creek.

Future ("post-development") conditions were modeled using the designated land use distribution from the Land Use Plan. The future conditions model assumes that all areas have been developed to the full extent of the NCP and that storm sewer systems have been constructed to serve the neighbourhood, but that no other stormwater controls have been applied. No land use changes beyond the NCP boundary have been assumed. The results do account for compliance with the City requirement that single family residential roof leaders discharge to lawns, not directly to storm sewers. **Table 7.3** shows the results of this analysis.

These results highlight the significant hydrologic changes that occur as a result of development within the neighbourhood as well as the necessity of applying stormwater controls. Total impervious area (TIA) fraction across the neighbourhood for the future land use condition is 62%, with about 42% effective impervious area (EIA) after accounting for roof leaders that discharge to lawns instead of storm sewers; this compares with about 12% and 1% for existing conditions, respectively.

Table 7.3 – Catchment Data Summary for Future Conditions (Without Application of Stormwater Management Controls)

Catchment	Catchment Area*	2 Yr, 24 hr Peak Flow	5 Yr, 24 hr Peak Flow	100 Yr, 24 hr Peak Flow
	(ha)	(m3/s)	(m3/s)	(m3/s)
West				
W-1	121.1 (47.7)	1.80 (1.06)	2.58 (1.45)	4.43 (2.51)
W-2	39.8 (23.1)	0.68 (0.51)	0.94 (0.70)	1.65 1.21)
North				
N-1	63.9	1.61	2.17	3.61
N-2	55.9	1.41	1.90	3.16
East				
E-1	30.8	0.80	1.11	1.71
South				
S-1	53.5 (16.1)	0.72 (0.40)	0.98 (0.57)	1.59 (0.99)
S-2	30.4	0.75	1.07	1.87
S-3	64.6	1.59	2.27	3.98
S-4	32.6	0.80	1.15	2.01
S-5	30.7	0.76	1.08	1.89
S-6	18.5	0.46	0.65	1.14

* Catchment area within NCP boundaries are shown in parentheses for those sub-catchments also receiving runoff from upslope areas located outside the NCP.

As will be described in **Part 7.2**, the proposed stormwater management system will control runoff from the neighbourhood to meet servicing and environmental objectives. **Table 7.4** shows the modeling results after application of the proposed servicing plan. The TIA fraction across the neighbourhood is still 62%, but the use of LID measures reduces the EIA fraction from 42% to about 16%. The proposed servicing plan includes both on-lot stormwater controls and City-owned and maintained detention ponds.

As determined by the Upper Serpentine Pump Station Functional Plan, the lowland flood control system (consisting of ditches, culverts and the pump station with flood boxes) will accommodate a fully developed upland area having a TIA fraction of 82% and no stormwater controls in place. The proposed land use for Anniedale-Tynehead will have a lower impervious area fraction and stormwater controls (LID measures) will be applied. Thus, the additional runoff volume generated by development of the NCP will be within the overall capacity of the Functional Plan's system. For this reason, the proposed management strategy for these south facing catchments is less focused on peak flow volume attenuation, but more on water quality and retention at the lower end of the rainfall spectrum. As a result, and as shown by **Table 7.4**, Sub-Catchments S-1 to S-6 will generate and discharge runoff to lowland agricultural areas at rates greater than existing conditions for infrequent storm events. The recommendations of the Functional Plan, upon which the NCP is dependent, have been implemented and are able to accept changed hydrology from the NCP area. However, capacity and access to conveyance systems in the transition zone between the NCP boundary and the lowland flood control systems have not yet been addressed; these are therefore included in the proposed program, as discussed later in **Part 7.2**.

Table 7.4 – Catchment Data Summary for Future Conditions (With Application of All Recommended Stormwater Management Controls)

Catchment	Catchment Area*	2 Yr, 24 hr Peak Flow	5 Yr, 24 hr Peak Flow	100 Yr, 24 hr Peak Flow
	(ha)	(m3/s)	(m3/s)	(m3/s)
West				
W-1	121.1 (47.7)	1.27 (0.53)	1.73 (0.69)	3.86 (1.93)
W-2	39.8 (23.1)	0.43 (0.26)	0.57 (0.34)	1.37 (0.93)
North				
N-1	63.9	0.50	0.67	1.39
N-2	55.9	0.44	0.58	1.22
East				
E-1	30.8	0.48	0.70	1.61
South				
S-1	53.5 (16.1)	0.49 (0.17)	0.67 (0.26)	1.41 (0.81)
S-2	30.4	0.32	0.49	1.53
S-3	64.6	0.68	1.03	3.24
S-4	32.6	0.34	0.52	1.64
S-5	30.7	0.32	0.49	1.54
S-6	18.5	0.19	0.30	0.93

* Catchment area within NCP boundaries are shown in parentheses for those sub-catchments also receiving runoff from upslope areas located outside the NCP. It is assumed that any future development within these upslope areas will meet City guidelines for runoff flow control.

Non-Point Source Pollutant Analysis

Urban development will affect not only runoff peaks and volumes but also the quality of that runoff as well as the total load of pollutants that can be carried into receiving watercourses. Typical pollutants that are conveyed in runoff include suspended sediments, nutrients such as nitrogen and phosphorous, trace metals such as copper, nickel and zinc, bacteria, and hydrocarbons. Many of these are by-products of the means of transportation upon which we rely, i.e., use of automobiles, buses and trucks, but also of such things as our use of chemicals to maintain green lawns, pet and wildlife activities, and even general littering. In order to obtain an overview of the runoff quality conditions now and for future developed conditions, a simple runoff pollutant loading model was developed as described in this section. The model uses catchment area, impervious cover, average annual precipitation and typical pollutant concentrations as the basis for the assessment.

To estimate annual pollutant loadings, one or more of six basic land use categories was assigned to each catchment. The basic categories are: residential; commercial; industrial; institutional; highways and open space. For each land use category, median pollutant concentrations were applied. The method was applied to both existing and future "unmanaged" conditions. As will be discussed in part 7.3, stormwater controls are being recommended to manage this non-point source (NPS) pollution.

Total suspended solids (TSS), oil and grease (O&G), and two trace metals (copper and zinc) were selected for demonstrating the potential change in pollutant loading due to development; all four are non-point source pollutants typically found in runoff from urban and suburban areas. TSS is often used as the surrogate measure of water quality. High levels of TSS can damage fish and aquatic invertebrates and degrade instream habitat where the material settles onto gravel and cobble substrates. Besides simply producing an unsightly sheen to water, petroleum hydrocarbons (as represented by oil and grease) can be directly toxic to aquatic life. Copper and Zinc are primary trace metals of concern because of their adverse impacts on fisheries. Copper interferes with fish sensory systems related to predator avoidance, juvenile growth and migratory success. Zinc alters behavior, blood and serum chemistry, impairs reproduction and reduces growth.

Figures A.1 to A.4 (Appendix C) show the results for both existing and future conditions. As shown, pollutant loads can be expected to increase nearly 4-fold from existing to fully developed conditions if no controls are applied. Also shown are the estimated loadings with implementation of the stormwater controls adopted for the NCP.

Reduction in total annual volume of runoff from the neighbourhood through use of low impact best management practices (BMPs) will also directly reduce discharge of runoff-generated pollutants. For example, runoff that is properly infiltrated also effectively removes pollutants from surface discharge to local streams. Absorbent landscaping (i.e., deep amended soil), disconnected roof drains, rain gardens, subsurface bioswales and similar low impact BMPs will promote infiltration. Even in specific locations where perforated under drains may be required beneath the BMP due to the presence of shallow impermeable soil layer, contact with soil and vegetation will provide substantial removal of key pollutants such as suspended sediments, trace metals and bacteria.

7.2 SERVICING OPTIONS AND PROPOSED SYSTEM

Servicing Options

Over the past decade or so, the City has begun to request and use more sustainable approaches to stormwater control that explicitly address issues such as runoff quality and preservation of base flows in watercourses; such an approach has been incorporated in recently completed ISMPs and NCPs[7] and is

[7] For example, Fergus Creek Integrated Stormwater Management Plan and Grandview Heights #2 NCP Servicing Strategy.

clearly embodied in the Provincial and DFO guidelines noted in **Part 7.1**. One specific outcome of this shift in servicing has been an increased use of low impact development (LID) best management practices (BMPs) that are not currently listed or specifically described in City design standards and guidelines. Many of these LID measures are on-site source controls which must be implemented on individual properties, although some are installed within road rights-of-way.

While it may be feasible to utilize an approach to stormwater management in the neighbourhood that relies exclusively on LID, there are a variety of reasons this might not in fact work in specific cases. Notably, there is significant concern that long-term maintenance by property owners of on-site measures will not happen, leaving such measures vulnerable to failure or at least to inadequate environmental benefits being realized. Further, enforcement of design and maintenance standards for LID measures will require an unacceptable level of effort by the City. Thus, a hybrid approach was formulated that could incorporate a variety of these emerging LID practices alongside more traditional runoff detention measures and achieve a desired level of environmental stewardship during and after development. This approach does not minimize a continued requirement and need for on-site measures.

As described in **Part 7.1**, the neighbourhood area was divided into four major catchments based on the existing drainage pattern and boundary conditions. Stormwater management objectives were formulated for each of these catchments after considering the watershed issues of most importance in each catchment:

- West Catchment - This catchment drains to the Serpentine River which is a major fisheries resource. Past studies have indicated the need for some erosion control works in the Upper Serpentine. This catchment is very small compared to the total Upper Serpentine watershed, thus downstream flood control is not the highest priority. The priority objectives of stormwater management for this catchment are:
    1. Provide adequate base flows to the Serpentine tributaries within the catchment, as well as to Serpentine River, to support fisheries;
    2. Mitigate creek erosion and reduce erosion potential; and
    3. Maintain or enhance water quality in local watercourses.

- North Catchment - This catchment drains to the Fraser River via Leoran Brook, Lyncean Creek and another unnamed water course, as well as storm sewer systems in some cases. All three watercourses are designated as 'red' coded in the fish sensitivity map. The City's 10 year Capital Plan shows long term erosion prevention works along the Leoran Brook and the Lyncean Creek E. Thus, the priority objectives of stormwater management for this catchment are:
    1. Provide adequate base flows to Leoran Brook;
    2. Mitigate creek erosion and reduce downstream erosion potential; and
    3. Maintain or enhance water quality.

- East Catchment – This catchment discharges to a ditch along Harvie Road which in turn discharges to Old Sawmill Creek (located east of Harvie Road) which is part of the Latimer Creek watershed; Old Sawmill Creek and Latimer Creek are designated as 'red' coded in the fish sensitivity map. Similar to the West Catchment, the East Catchment area is very small compared to the overall Latimer watershed thus flood control is not a high priority issue. Since there are no local creeks within the catchment, erosion control is not a critical factor. Thus, the priority objectives of stormwater management for this catchment are:

1. Provide adequate base flows in support of the Old Sawmill Creek fisheries;
2. Reduce downstream erosion potential; and
3. Maintain or enhance water quality.

- South Catchment - This catchment includes several short channels and, based on the fish sensitivity map, no fish presence has been documented in these channels. Therefore baseflow preservation or generation is not considered a priority objective within the NCP catchment. In the proposed land use plan, 15m to 30m buffers are provided for the channels and several parks and trails are proposed to promote infiltration and generation of base flow. However, the runoff from this catchment eventually reaches the Upper Serpentine Pump Station via the lowland ditches, many of which are rated highly as fisheries resources. Thus, the priority objectives for stormwater management in this catchment are:

  1. Mitigate downstream flooding due to new development;
  2. No net increase in runoff volume beyond the design capacity of the receiving ditches and Pump station; and
  3. Maintain or enhance water quality.

These objectives can only be met through a combination of detention pond storage, water quality pond treatment and on-site LID measures; the use of detention ponds alone will not meet these objectives. In some areas of the neighbourhood, application of LID practices will suffice to meet the objectives (notably in the West Catchment), while in other areas, a combination of traditional and emerging LID methods will work well. On site LID measures should capture and retain 50% of the MAR, or 350 m^3 per hectare of impervious surface.

The overall goal of LID is to minimize disruption of the predevelopment hydrologic cycle by minimizing impervious surfaces, creating hydraulic disconnects, lengthening runoff flow paths, dispersing runoff, and providing on-site water retention and infiltration. This further reduces the detrimental impacts of high runoff volumes, supports summer base flows in creeks and contributes to pollutant removal, key aspects of maintaining healthy fisheries habitat in downstream watercourses. However, not all these objectives are equally critical or important in all parts of the neighbourhood. There are areas where water quality is of higher priority than the flooding issue; similarly in some areas maintenance of base flows is more important than water quality. Site specific conditions are another important factor to consider for the design and implementation of an effective LID feature. High groundwater table, steep topography and impervious soils conditions often pose challenges to successful implementation of LID, but this should not be an obstacle if site specific conditions are accounted for. Last, but not least, costs of implementation, operation and maintenance are important aspects of the LID features.

Recently, the City has been working with an outside consultant to prepare a list of LID measures along with basic standards for their design for use in the City. The intent is not to limit use to the list, but rather to begin to standardize the designs that are being proposed based on local experience. This preliminary list was screened for applicability to Anniedale-Tynehead. **Table A.2 in Appendix C** offers potential LID options for use with the various land use types proposed for the neighbourhood. As will be discussed in the next section, with the exception of single family residential areas, developers will be able to choose which LID measures will be installed on each property and inclusion of **Table A.2** is not intended to preclude developers from proposing other applicable LID measures.

Proposed Servicing Plan

The proposed servicing plan consists of a mix of public and private measures that together will meet the stormwater servicing objectives discussed in the previous section. **Figure 7.7A** shows the locations for proposed ponds (both detention and water quality) and trunk storm sewers. A general layout of local sewers is also shown for illustrative purposes as well. **Figure 7.7B** provides additional detail of pipe routing at the proposed ponds. **Table 7.5** provides specific details related to trunk storm sewer and pond sizing, water quality control requirements and on-site stormwater measures.

The alignments and dimensions of all proposed facilities shown on **Figure 7.7A** are conceptual and must be confirmed at the time of design. Specifically, the locations for ponds may be adjusted somewhat at time of design as long as the objectives and design criteria of this servicing plan are still met.

No upgrades are proposed for the lowland flood control system identified in the Upper Serpentine Pump Station Functional Plan. As noted previously, the changes in runoff conditions within the NCP area can be accommodated by the current lowland system as long as the measures identified in this proposed servicing plan are implemented. As shown on **Figure 7.7A**, there are several ditches in the transitional zone between the NCP area and the lowland flood control system that may require general conveyance improvements to ensure that runoff reaches the lowland system; the extent of these improvements should also be confirmed at design. An allowance for this work has been included in the cost estimates for the servicing plan.

The first developer in a sub-catchment requiring a detention or water quality pond shall secure the land and construct the pond before or as development begins.

In conjunction with the proposed infrastructure features previously described, the following LID requirements are proposed:

- For single family residential properties – Provide 300 mm of amended growing media (“top soil”) for all yard area; discharge roof leaders directly to yards, not to the storm sewer[8];
- All other land use types, including high density residential, commercial and industrial land uses – Meet the requirements listed in **Table 7.5**; developers may choose from among a variety of LID measures to meet the requirements, some examples of which are provided in **Table A.2** in **Appendix C**; and
- Local roads – Use parallel exfiltration-type storm sewer systems; provide 300 mm of amended growing media (“top soil”) for boulevards; install rain gardens in traffic calming bulges.

[8] This has been standard practice in the City for a number of years. It is fully consistent with LID approaches to stormwater management and is regularly included in requirements and guidelines for LID in other jurisdictions across North America.

It shall be the responsibility of the owners of private property to maintain and repair as necessary LID features installed on that property.

Groundwater Issues

As previously discussed in Part 7.1 for "Soils and Groundwater", a local groundwater flow condition is present in the Anniedale-Tynehead in the upper, near surface soils layers. This is a result of well-drained soils overlying highly impermeable soils. Construction of roads and utilities can intercept this local groundwater, leading to the development of artificial springs in cut areas, with resulting potential for icing on pavement and sidewalks, and rerouted groundwater through the utility trenches. To control this, French drains shall be installed upslope of sidewalks and roads in cut areas and clay dams shall be installed in utility trenches on steep slopes (greater than 10% or as determined through geotechnical analysis).

Flood Control and Soil Erosion

The servicing plan proposed for the Anniedale-Tynehead neighbourhood specifically addresses the need to manage runoff to prevent flooding of areas outside the area. The proposed stormwater facilities, that is, the detention ponds and LID measures, are sized to meet the requirements of flood control. In conjunction with the proposed stormwater measures, the lowland flood control system will continue to operate as planned and, as a result, induced flooding in the agricultural area due to development will not occur.

The proposed stormwater measures are also sized to meet the requirements of erosion control of watercourses within and outside the neighbourhood. Soil erosion that could occur during construction will be addressed through application and enforcement of the City's existing Erosion and Sediment Control Bylaw.

Environmental Considerations

Department of Fisheries and Oceans Canada (DFO) recommend that the Anniedale-Tynehead NCP include measures to reduce impacts to fish and fish habitat through the application of current stormwater/rainwater management practices, and that all new (and updated) planning processes over the long-term also address stormwater based on current and relevant guidelines. Stormwater management needs to integrate stormwater infrastructure planning with relevant municipal planning processes (e.g. Official Community Plans, Neighbourhood Concept Plans, recreation and parks plans, and strategic transportation plans) in order to address the impacts of stormwater/rainwater on fish and fish habitat. DFO has been providing advice to proponents at the Environmental Review Committee on a site-by-site basis; however, DFO staff suggest that it is more appropriate and effective to consider impacts from stormwater/rainwater on a watershed scale in order to reduce adverse impacts to watercourses and aquatic life.

Additionally, DFO has requested that the GVRD standards and DFO guideline standards be met in all plans as well as for all property developments in areas under NCP, proposed local development areas and for individual property development. Stormwater/rainwater management should include application of Low Impact Development (LID) wherever technically feasible, which should be supported by infrastructure as overflow systems.

DFO recommends that planning and development processes adopt the GVRD Source Control Design Guidelines (2005), and meet at minimum the DFO **"Urban Stormwater Guidelines and Best Management Practices for Protection of Fish and Fish Habitat"**.

Preliminary discussions have taken place with DFO staff regarding the conceptual layout of city utilities, and the possible locations of watercourse crossings, all of which generally follow the conceptual road layout for the NCP. Each watercourse crossing requires DFO approval. An assessment of what is most appropriate for the crossing must be prepared by a Registered Biologist or other approved professional. DFO preference is for clear span crossings extending from bank to bank across Class 'A' watercourses. Culvert crossings may trigger the environmental review process and habitat compensation. Where approved by DFO, directional drilling is the preferred method of pipe installation over open cut construction methods. The assessment and design of all crossings should also consider wildlife migration and watercourse setbacks from top of bank.

The Bothwell Drive area is an area of interest to DFO due to the Serpentine River and may require additional assessment and riparian enhancements.

Proposed construction activitity, both on-site and off-site, may require a Sediment and Erosion Control Permit as issued by the City under the Erosion and Sediment Control By-law. The by-law sets mandatory standards ensuring Best Management Practices are implementated and managed to limit the amount of sediment and sediment laden water entering the City drainage systems.

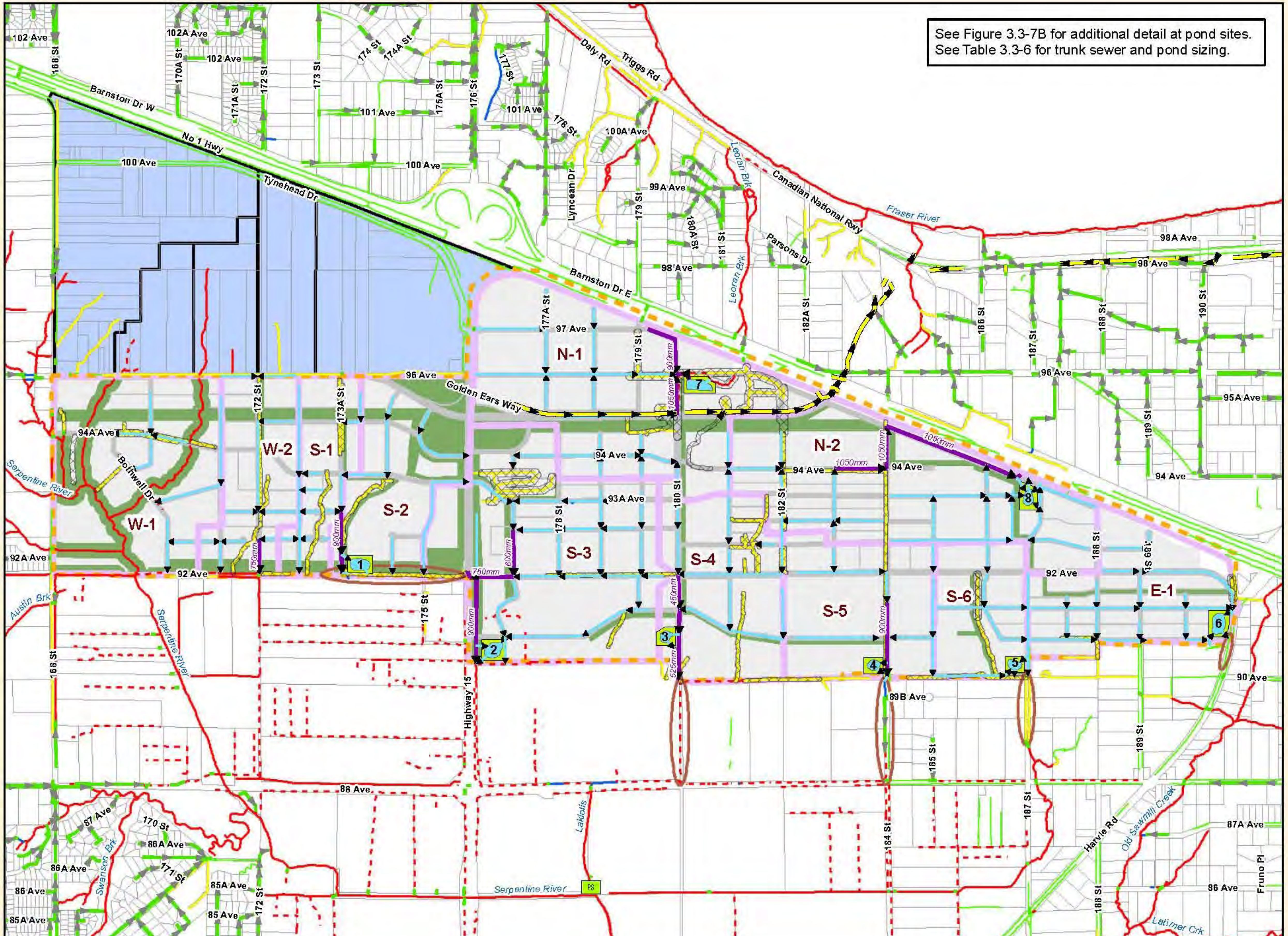
7.3 TEN YEAR SERVICING PLAN AND INFRASTRUCTURE COSTS

The cost estimates for the Development Cost Charge (DCC) eligible infrastructure are based on the principle that development is responsible for funding the services that front, and/or are adjacent to, the development lands. DCC eligible items include trunks, detention and water quality ponds and other items that serve overall catchments equal to or greater than 20 hectares in size.

Costs for Proposed Stormwater Controls

Costs for trunk storm sewers, minor ditch improvements, and detention and water quality ponds are shown in **Tables A.3 and A.4 (Appendix C)**. The total estimated DCC eligible infrastructure costs for these improvements are **$26.6 million**, including engineering, administration, contingencies and land purchase costs.

10 Year Servicing Plan
There are no projects currently identified in the 10 Year Servicing Plan that fall within the study area.



Legend

NCP Land Uses

- NCP Boundary
- NCP Area
- Future Road Network
- Proposed Trails, Buffers & Riparian Areas
- 15m and 30m Watercourse Class B Buffer

Watercourse Classifications

- Class A (red-coded)
- Class A(O) (red-dash)
- Class B (yellow-coded)
- Class C (green-coded)
- Unclassified

Existing Drainage Infrastructure

- PS Existing Pump Station
- Existing Storm Sewer (outside NCP)
- Existing Storm Sewer (Translink)

Proposed Drainage Infrastructure

- Proposed Sub-Catchments
- Contributing Catchments Outside NCP Area
- Proposed Trunk Storm Sewer
- Potential Local Storm Sewer Network
- Proposed Pond
- Land Required for Pond
- Ditch Improvement Reaches

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Anniedale/Tynehead NCP
Stage 2 - Drainage

Proposed Infrastructure

URBANSYSTEMS.

THE ACCURACY & COMPLETENESS OF INFORMATION SHOWN ON THIS DRAWING IS NOT GUARANTEED. IT WILL BE THE RESPONSIBILITY OF THE USER OF THE INFORMATION SHOWN ON THIS DRAWING TO LOCATE & ESTABLISH THE PRECISE LOCATION OF ALL EXISTING INFORMATION WHETHER SHOWN OR NOT.

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Metres

Figure 7.7a

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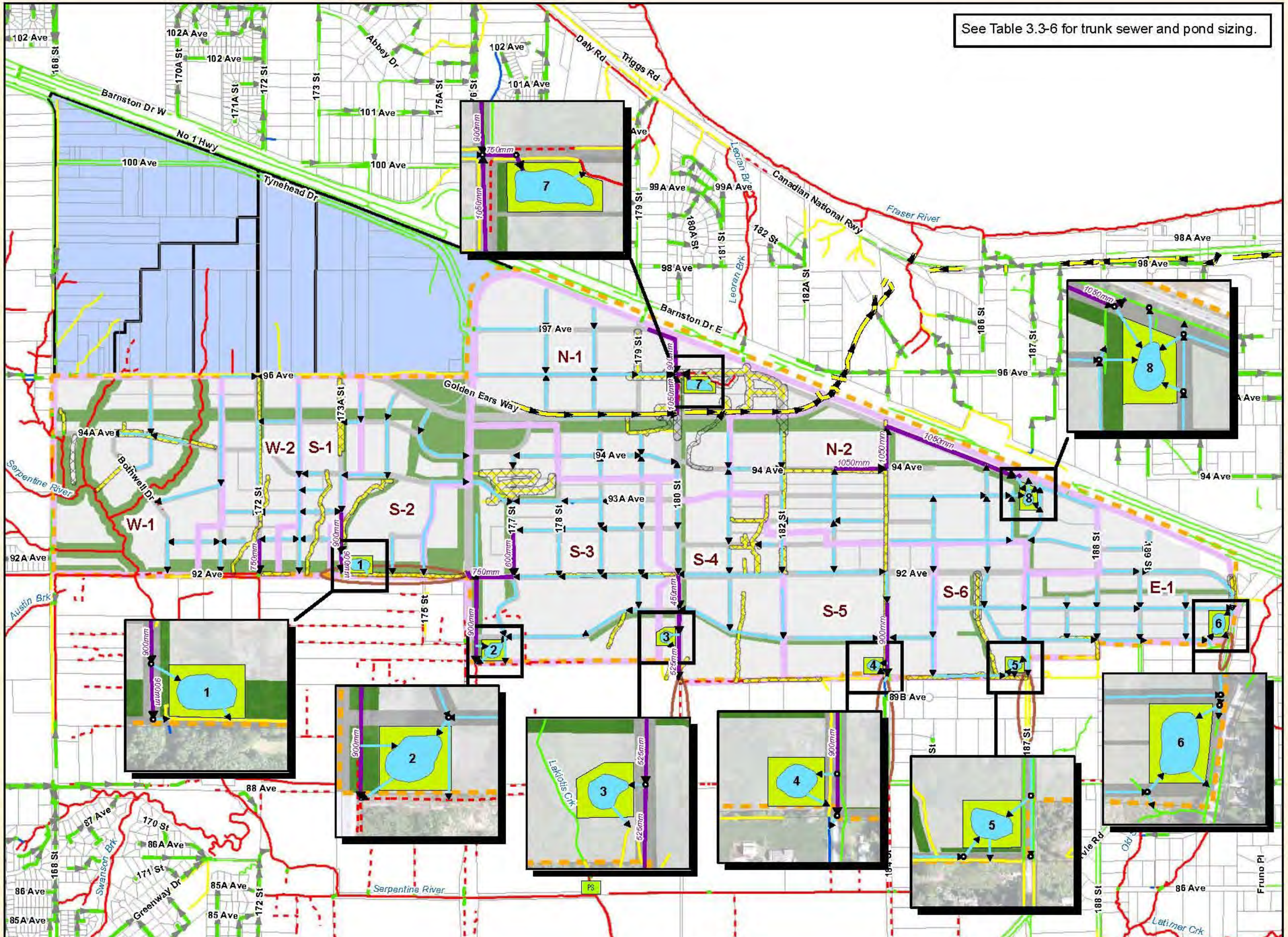

See Table 3.3-6 for trunk sewer and pond sizing.

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Legend

NCP Land Uses
- NCP Boundary
- NCP Area
- Future Road Network
- Proposed Trails, Buffers & Riparian Areas
- 15m and 30m Watercourse Class B Buffer

Watercourse Classifications
- Class A (red-coded)
- Class A(O) (red-dash)
- Class B (yellow-coded)
- Class C (green-coded)
- Unclassified

Existing Drainage Infrastructure
- Existing Pump Station
- Existing Storm Sewer (outside NCP)
- Existing Storm Sewer (Translink)

Proposed Drainage Infrastructure
- Proposed Sub-Catchments
- Contributing Catchments Outside NCP Area
- Proposed Trunk Storm Sewer
- Potential Local Storm Sewer Network
- Proposed Pond
- Land Required for Pond
- Ditch Improvement Reaches

Anniedale/Tynehead NCP Stage 2 - Drainage

Proposed Pond Details

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(Pond Detail 1:5,000)

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URBANSYSTEMS.

Figure 7.7b

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Table 7.5 Details of Proposed Stormwater Servicing Plan, by Subcatchment
(Refer to Figures 7.7A and 7.7B for general layout of proposed stormwater systems)

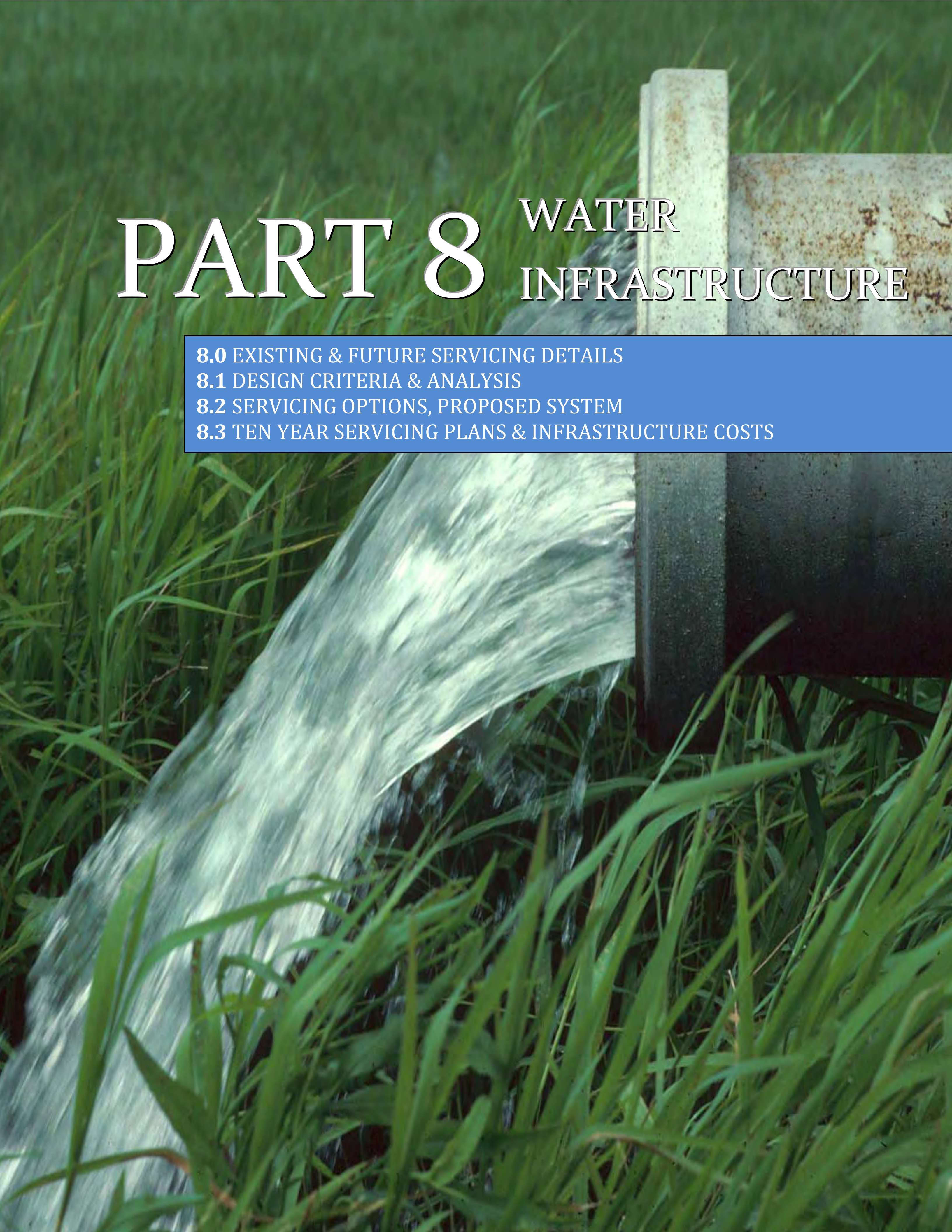
Sub-Catchment	Area (ha)	Discharge Point(s)			Peak Flows (24 hour duration) (m^3/s)		Trunk Storm Sewer Data	Pond Data	Other Requirements
		Existing	Future	Acquisition/Construction Requirements	Existing	Future, with Controls Implemented	(Design Flows based on 30 minute duration storm)		Water Quality and LID Requirements, applicable throughout Anniedale-Tynehead Neighbourhood
W-1	121.1 (47.7)	Four unnamed creeks traverse the sub-catchment; all discharge to Serpentine River	Same	N/A	2 year: 1.22 5 year: 1.71 100 year: 3.18	2 year: 1.27 5 year: 1.73 100 year: 3.86	N/A	N/A	**Water Quality Controls:** • Remove >80% of Total Suspended Solids • Remove Oil & Grease to <10 mg/L Provide oil/water separators for parking lots in commercial, industrial, institutional and multi-family residential usage. **On-Site LID Requirements:** • Provide 300 mm of amended topsoil on all single family residential lawn areas; • Discharge roof leaders in single family residential lots directly to lawns (not to the storm sewer); and • Capture and retain on site 50% of the Mean Annual Rainfall depth (that is, 35 mm in 24 hours, which is equivalent to 350 m^3 per hectare of impervious surface) on all high density and multi-family residential, commercial and industrial lots. Typical capture volumes for various land use designations are: • Village commercial (90% impervious) – 315 m3/ha • Cluster residential 4-6 upa (50% impervious) – 175 m3/ha • Cluster residential 6-10 upa (57% impervious) – 200 m3/ha • Cluster residential 10-15 upa (65% impervious) – 230 m3/ha • Low density urban 6-10 upa (57% impervious) – 200 m3/ha • Medium high density residential 10-15 upa (65% impervious) –
W-2	39.8 (23.1)	Discharge to west-flowing ditch, north side of 92 Ave	Same	N/A	2 year: 0.40 5 year: 0.56 100 year: 1.04	2 year: 0.43 5 year: 0.57 100 year: 1.37	**172 Street** Design flow (100 yr): 2.27 m^3/s Diameter: 750 mm Length: 150 m	N/A	
N-1	63.9	Discharge to upper Leoran Brook	Same	N/A	2 year: 0.50 5 year: 0.67 100 year: 1.06	2 year: 0.50 5 year: 0.67 100 year: 1.39	**97 Avenue** Design flow (100 yr): 2.14 m^3/s Diameter: 900 mm Length: 250 m **180 Street** Design flow (100 yr): 1.18 m^3/s Diameter: 1050 mm Length: 160 m **96 Avenue** Design flow (100 yr): 2.25 m^3/s Diameter: 1050 mm Length: 65 m	**Pond 7 (Detention Pond)** Design flow in (5 yr): 1.56 m^3/s Design flow out (pre-5yr): 0.67 m^3/s Active detention volume: 9,585 m^3 Estimated excavation volume: 23,000 m^3 Pond surface footprint at maximum stage: 6,420 m^2 Site footprint: 1.23 ha	
N-2	55.9	To Hwy 1 cross culvert	Same	N/A	2 year: 0.44 5 year: 0.58 100 year: 0.92	2 year: 0.44 5 year: 0.58 100 year: 1.22	**94 Avenue** Design flow (100 yr): 2.54 m^3/s Diameter: 1050 mm Length: 200 m **184 Street** Design flow (100 yr): 3.00 m^3/s Diameter: 1050 mm Length: 150 m **Along Hwy 1 Frontage** Design flow (100 yr): 3.28 m^3/s Diameter:1050 mm Length: 600 m	**Pond 8 (Water Quality Pond)** Design Flow (2 yr): 1.37 m^3/s Minimum water quality treatment volume: 2,500 m^3 Estimated excavation volume: 7,250 m^3 Pond surface footprint at maximum stage: 1,000 m^2 Site footprint: 0.50 ha Incorporate bypass system for flows exceeding the design flow	
E-1	30.9	Eastern and northern areas drain to ditch on west side of Harvie Rd, then to unnamed branch of	Same	Ditch improvements, as required, to ditch along Harvie Rd (100 m); to be	2 year: 0.50 5 year: 0.70 100 year: 1.41	2 year: 0.48 5 year: 0.70 100 year: 1.61	N/A	**Pond 6 (Detention Pond)** Design flow in (5 yr): 1.11 m^3/s Design flow out (pre-5yr): 0.70 m^3/s Active detention volume: 4,040 m^3 Estimated excavation volume: 11,720 m3	

Sub-Catchment	Area (ha)	Discharge Point(s)			Peak Flows (24 hour duration) (m^3/s)		Trunk Storm Sewer Data	Pond Data	Other Requirements
		Existing	Future	Acquisition/Construction Requirements	Existing	Future, with Controls Implemented	(Design Flows based on 30 minute duration storm)		Water Quality and LID Requirements, applicable throughout Anniedale-Tynehead Neighbourhood
		Old Sawmill Creek under the road; Western areas drain to ditches along 188 St and 189 St, which feed upper end of the same branch of Old Sawmill Creek		confirmed at design				Pond surface footprint at maximum stage: 3,100 m^2 Site footprint: 0.71 ha	230 m3/ha • Medium high density residential 15-25 upa (65% impervious) – 230 m3/ha • High density residential 25-45 upa (90% impervious) – 315 m3/ha • High density residential 30-45 upa (90% impervious) – 315 m3/ha • Industrial Low Impact (90% impervious) – 315 m3/ha • Industrial Business Park (90% impervious) – 315 m3/ha **Local Roads:** • Install parallel, exfiltration-type storm sewer systems • Provide 300 mm of amended topsoil in boulevards • Install in traffic calming bulges
S-1	16.1 (53.5)	Discharge to east-flowing ditch, north side of 92 Ave	Same	Ditch improvements, as required, west of Pond 1 site (in S-2) (200 m); to be confirmed at design	2 year: 0.46 5 year: 0.59 100 year: 0.85	2 year: 0.49 5 year: 0.67 100 year: 1.41	N/A	N/A	
S-2	30.4	Discharge to east-flowing ditch, north side of 92 Ave, thence to Hwy 15 ditch	Same	Ditch improvements, as required (350 m); to be confirmed at design	2 year: 0.26 5 year: 0.33 100 year: 0.49	2 year: 0.32 5 year: 0.49 100 year: 1.53	**173A Street** Design flow (100 yr): 3.08 m^3/s Diameter: 900 mm Length: 150 m	**Pond 1 (Water Quality Pond)** Design Flow (2 yr): 0.32 m^3/s Minimum water quality treatment volume: 1,370 m^3 Estimated excavation volume: 3,975 m^3 Pond surface footprint at maximum stage: 1,125 m^2 Site footprint: 0.64 ha	
S-3	64.6	To Hwy 15 ditches	Same	N/A	2 year: 0.56 5 year: 0.71 100 year: 1.03	2 year: 0.68 5 year: 1.03 100 year: 3.24	**177 Street** Design flow (100 yr): 0.84 m^3/s Diameter: 600 mm Length: 170 m **92 Avenue** Design flow (100 yr): 0.92 m^3/s Diameter:750 mm Length: 150 m **176 Street / Hwy 15** Design flow (100 yr): 3.87 m^3/s Diameter: 900 mm Length: 350 m	**Pond 2 (Water Quality Pond)** Design Flow (2 yr): 0.68 m3/s Minimum water quality treatment volume: 2,900 m^3 Estimated excavation volume: 8,410 m^3 Pond surface footprint at maximum stage: 1,160 m^2 Site footprint: 0.74 ha Incorporate bypass system for flows exceeding the design flow	
S-4	32.6	To lowland ditch within narrow (10 m) 180 St ROW	Same	Acquire additional 5 m ROW along existing 10 m ROW (400 m) and improve ditch, as required, south to 88 Ave (400 m);	2 year: 0.28 5 year: 0.36 100 year: 0.52	2 year: 0.34 5 year: 0.52 100 year: 1.64	**180 Street** Design flow (100 yr): 0.63 m^3/s Diameter:450 mm Length: 150 m **180 Street** Design flow (100 yr): 1.50 m^3/s Diameter:525 mm	**Pond 3 (Water Quality Pond)** Design Flow (2 yr): 0.34 m^3/s Minimum water quality treatment volume: 1,470 m^3 Estimated excavation volume: 4,250 m^3 Pond surface footprint at maximum stage: 590 m^2 Site footprint: 0.47 ha	

Sub-Catchment	Area (ha)	Discharge Point(s)			Peak Flows (24 hour duration) (m^3/s)		Trunk Storm Sewer Data	Pond Data	Other Requirements
		Existing	Future	Acquisition/Construction Requirements	Existing	Future, with Controls Implemented	(Design Flows based on 30 minute duration storm)		Water Quality and LID Requirements, applicable throughout Anniedale-Tynehead Neighbourhood
				to be confirmed at design			Length: 270 m	Incorporate bypass system for flows exceeding the design flow	
S-5	30.7	Ditch and short section (200 m) of 450 mm storm sewer along 184 St	Same	Remove storm sewer and restore / improve ditch system south to 88 Ave (400 m); to be confirmed at design (Note: Work could be coordinated with upgrade of 184 St in future)	2 year: 0.27 5 year: 0.34 100 year: 0.49	2 year: 0.32 5 year: 0.49 100 year: 1.54	**184 Street** Design flow (100 yr): 3.47 m^3/s Diameter:900 mm Length: 290 m	**Pond 4 (Water Quality Pond)** Design Flow (2 yr): 0.32 m^3/s Minimum water quality treatment volume: 1,380 m^3 Estimated excavation volume: 4,000 m^3 Pond surface footprint at maximum stage: 550 m^2 Site footprint: 0.46 ha Incorporate bypass system for flows exceeding the design flow	
S-6	18.5	Ditch along west side of 187 St	Same	Ditch improvements, as required south to culvert under Harvie Rd (250 m); to be confirmed at design	2 year: 0.16 5 year: 0.20 100 year: 0.30	2 year: 0.19 5 year: 0.30 100 year: 0.93	N/A	**Pond 5 (Water Quality Pond)** Design Flow (2 yr): 0.19 m^3/s Minimum water quality treatment volume: 830 m^3 Estimated excavation volume: 2,410 m^3 Pond surface footprint at maximum stage: 375 m^2 Site footprint: 0.45 ha Incorporate bypass system for flows exceeding the design flow	

Notes:

1. Refer to **Figures 7.7A and 7.7B** for general layout of proposed trunk storm sewers and ponds.
2. Areas listed in parentheses are for the NCP portion of the sub-catchment only.
3. Ditch improvements include general cleaning, establishing consistent cross section and profile slope, and minor capacity expansion, as required.
4. Pond footprints are based on a minimum 10 m buffer around the pond at maximum stage plus 600 mm freeboard.
5. Sizes and dimensions for trunk sewers and ponds are preliminary and must be confirmed at desig



PART 8 WATER INFRASTRUCTURE

8.0 EXISTING & FUTURE SERVICING DETAILS
8.1 DESIGN CRITERIA & ANALYSIS
8.2 SERVICING OPTIONS, PROPOSED SYSTEM
8.3 TEN YEAR SERVICING PLANS & INFRASTRUCTURE COSTS

PART 8: WATER INFRASTRUCTURE

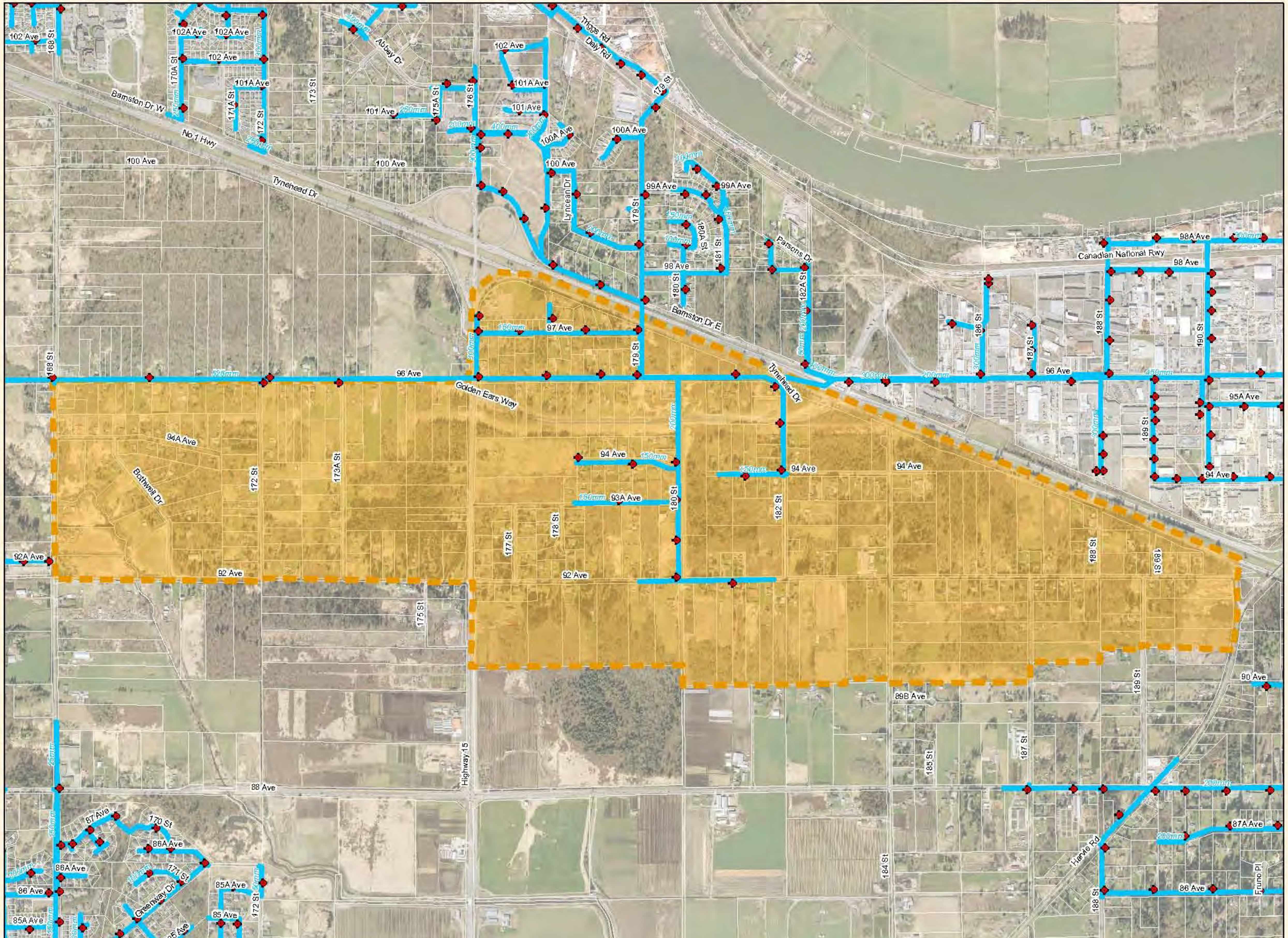
8.0 EXISTING AND FUTURE SERVICING DETAILS

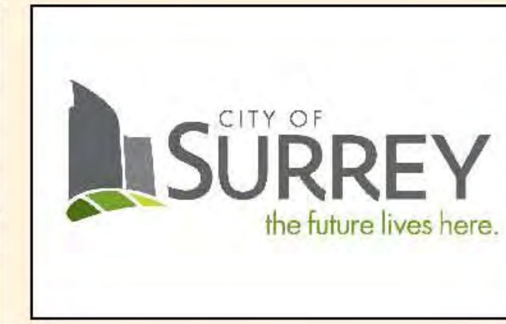
Existing System

The existing water system for the study area is shown on **Figure 8.1**, along with the study area boundary. The majority of the Anniedale-Tynehead NCP area is currently serviced by private wells, with a small portion of the area being serviced from small diameter City water mains which connect to the existing 525mm City feeder main on 96 Avenue. The existing system in the study area operates within the 90m HGL (Hydraulic Grade Line) pressure zone.

The aforementioned 525mm City feeder main supplies the existing North Port Kells industrial area, as well as the existing residential areas north of Hwy 1 and north of the study area. The existing 525mm main is directly connected to the main Metro Vancouver supply trunk at 95 Avenue and 164 Street. It should be noted that the existing 525mm main on 96 Avenue was financed by and committed to service the North Port Kells area only. As such, no capacity from this main has been allocated to provide service to the Anniedale-Tynehead area.

No reservoirs are located in the Anniedale-Tynehead area. Metro Vancouver is proposing to construct a new reservoir in Fleetwood with an estimated in-service date of 2017. The new reservoir would be located off Fleetwood Way in Meagan Anne MacDougall Park and have a Top Water Level (TWL) of 96m. For the purpose of the analysis for this study, an average HGL of 94m was assumed to be provided from the new reservoir.





Legend

- NCP Area
- Existing Water Main
- Hydrant

0 250 500 1,000

Metres

Anniedale/Tynehead NCP Stage 2

Existing Water System

Figure 8.1

URBANSYSTEMS.

Future System

The Anniedale-Tynehead area is expected to be redeveloped over a 30 year horizon and include a mix of land uses from industrial to high-density residential. As such, the Anniedale-Tynehead area will need an extensive water distribution system to support development.

Due to the topography within the study area, two separate pressure zones are proposed. The existing 90m HGL pressure zone, and a higher 135m HGL pressure zone. With an operating HGL of 94m, it is assumed that the proposed Fleetwood reservoir will supply the lower 90m pressure zone by gravity.

In order for the Fleetwood Reservoir to supply the upper pressure zone, a booster station would be required. However, an alternate supply source from upstream of the existing Cherry Hill Pressure Reducing Valve (PRV) would be available to supply water to the upper pressure zone of the Anniedale-Tynehead area. This connection point receives water from the City's Whalley Pump Station, which operates at an HGL of 135m. This connection could provide supply to the higher pressure zone without additional pressure boosting. The Cherry Hill connection is proposed to service the upper pressure zone of the Anniedale-Tynehead area to build-out. Further details are provided in subsequent sections.

8.1 DESIGN CRITERIA AND ANALYSIS

Design Criteria

The City of Surrey Design Criteria Manual has been utilized for the establishment of the servicing criteria for this NCP. A summary of key applicable design criteria is presented below with some criteria modified, for the specific requirements of the NCP

- Average Day Demand (ADD) of 500 L/cap/day
- Maximum Day Demand (MDD) of 1,000 L/cap/day
- Peak Hour Demand (PHD) of 2,000 L/cap/day
- Hazen-Williams Coefficient of 125 for all water mains 250mm nominal diameter and larger
- Hazen-Williams Coefficient of 100 for all water mains 200mm nominal diameter and smaller
- A minimum required residual of 28m hydraulic head (275 kPa) at all nodes under PHD
- A minimum required residual fire flow pressure (Pff) at the fire flow node of the greater of:
    - a) 14m or
    - b) $P_{ff} = 7 + 1083*Q^2$ m (where Q is the flow rate through each hydrant in m^3/s)
- A minimum residual fire flow pressure at all non-fire flow nodes of 14m within 400m of flow hydrant, 21m outside.
- Fire Flow Design Requirements derived from Table 3.2(b) of the Design Criteria Manual
- Hydraulic grade in mains larger than 250mm diameter shall not exceed 0.5%
- The velocity of flow shall not exceed 2 m/s for PHD ultimate design flows

- Interim fire flow velocity shall not exceed 3.25 m/s
- The minimum size of a new water main shall be 200 mm nominal diameter, except in the City and Town Centers where the minimum size of a new water main shall be 250mm nominal diameter. Minimum size of water main servicing any industrial zoned lots shall be 300mm nominal diameter.

Servicing Strategy

The following guidelines were followed in developing a conceptual layout of the water system for the study area:

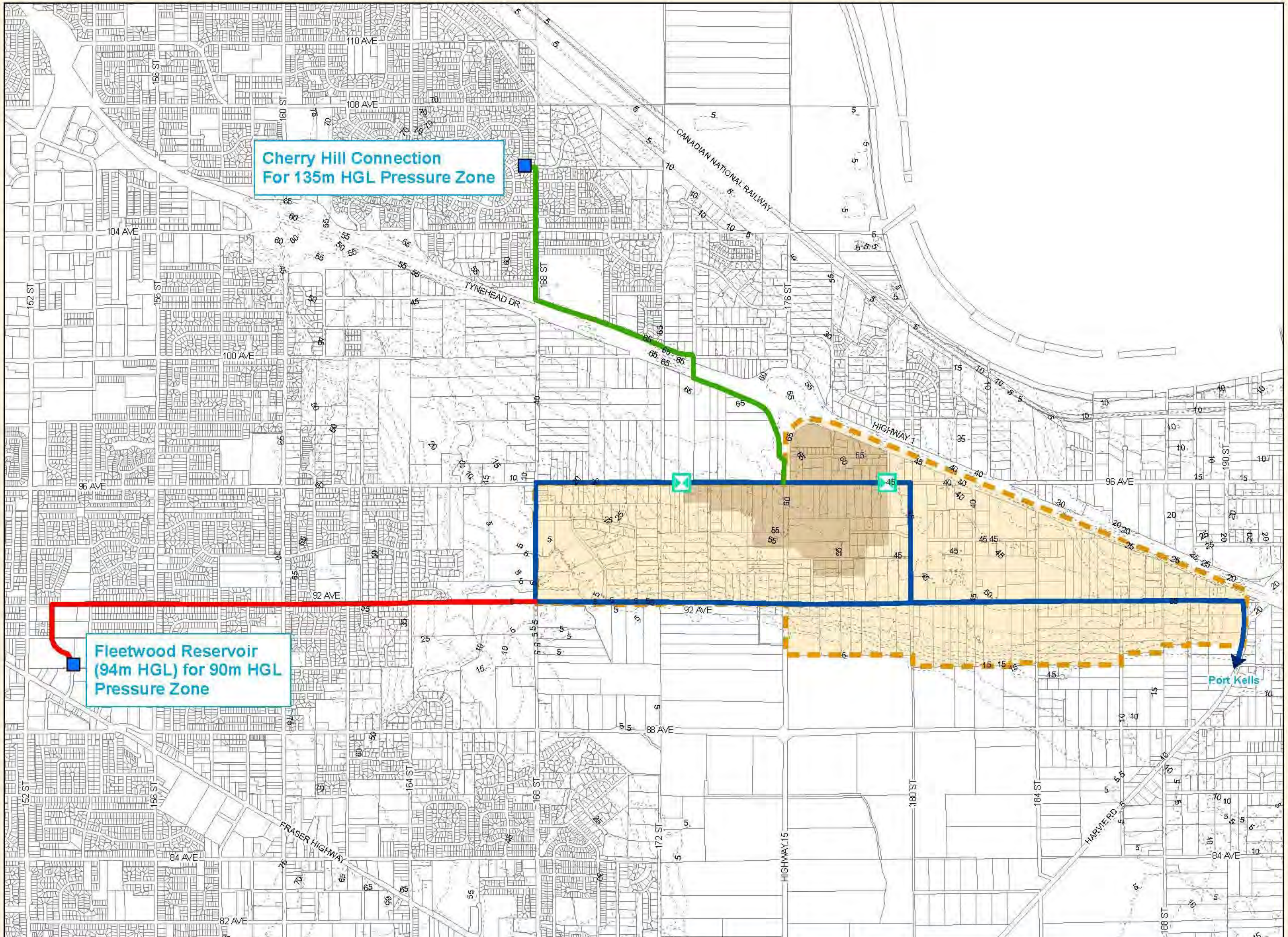
- Provide service to all lots
- Ensure there are no dead-end mains in the system, except in single family residential cul-de-sacs where the length is limited to no more than 100m and the maximum water main size is 100mm
- Limit hydrant spacing to a maximum 200m on all fronting roads

Figure 8.2a outlines the conceptual layout of the future trunk water system. **Figure 8.2b** outlines the conceptual layout of the future local water system; and **Figure 8.2c** outlines the total future water system. The figures outline supply sources for the various analysis scenarios, as well as PRV locations.

Water main alignments have been based on the conceptual road network layout for Land Use Option C (December, 2010). The proposed boundary of the 135m HGL pressure zone is also shown on the figures. The alignment of the pressure zone boundary has been based on current topography to provide service to build-out of the upper pressure zone.

The feeder main system (**Figure 8.2a**) for Anniedale-Tynehead will consist of a loop around the core of the study area which runs east-west on 92 Avenue and 96 Avenue from 168 Street to 180 Street, extending to Harvie Road on 92 Avenue. Feeder main also runs north-south on 168 Street and 180 Street from 92 Avenue to 96 Avenue. In order to account for providing service to the Port Kells area, a nominal length of feeder main was accounted for in the analysis, which would extend to the core of Port Kells. The cost for infrastructure required to service the Port Kells area is presented separately from the total costs, as Port Kells is not included in the Anniedale-Tynehead study area. This is discussed further in subsequent sections.

As previously noted, the future Fleetwood Reservoir is proposed to be the main supply source for the lower pressure zone in Anniedale-Tynehead under normal operating conditions. The proposed Cherry Hill Connection is proposed to be the sole supply source for the upper pressure zone in Anniedale-Tynehead under normal operating conditions.



Legend

- NCP Area
- 135m HGL Pressure Zone (all other areas 90m HGL)
- Proposed Feeder Main
- Cherry Hill Supply Main
- Fleetwood Supply Main
- PRV
- Contour (5m Interval)

Anniedale/Tynehead NCP Stage 2

Future Major Water System (Build Out)

0 250 500 1,000
Metres

Figure 8.2a

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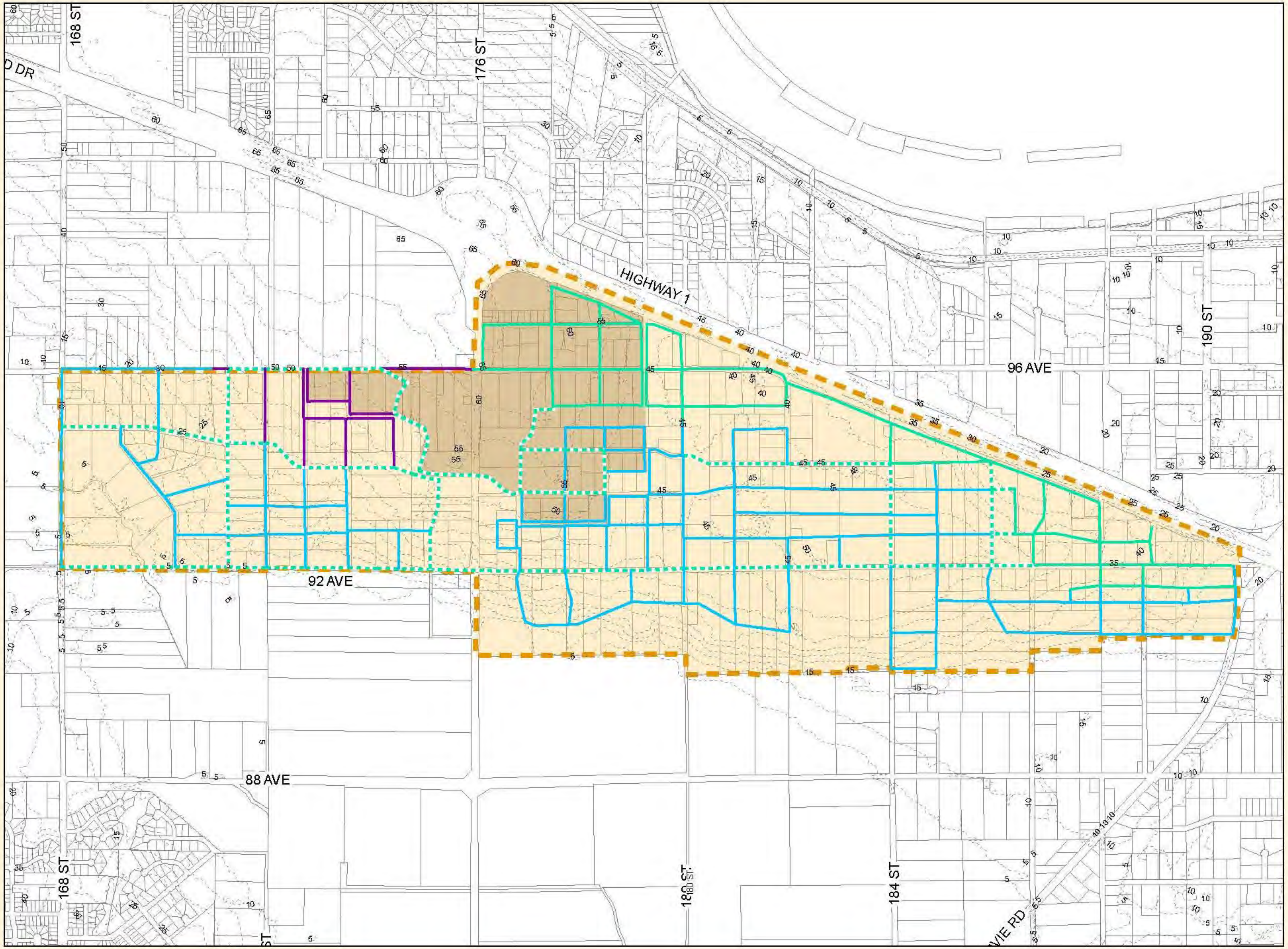
U:\Projects_VAN\1072\0173\01\D-Drafting-Design-Analysis\GIS\Projects\mxds\Water_Figures_Stage_2\Figure 3.5-2a - Future System.mxd Last revised by bpauls on 25/07/2011 at 11:03:37 AM



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Legend

- NCP Area
- 135m HGL Pressure Zone (all other areas 90m HGL)
- 200 Ø
- 250 Ø
- 300 Ø
- Water Main upsized to 300 Ø (see note below)
- Contour (5m Interval)

Note: In recognition that the ultimate looped system will be constructed over time, with some areas requiring larger pipes to provide adequate service and fire protection in the interim, some local water mains have been upsized from minimum sizes to account for staged development.

Anniedale/Tynehead NCP Stage 2

Future Local Water System (Build Out)

0 250 500 1,000
Metres

Figure 8.2b

URBANSYSTEMS.

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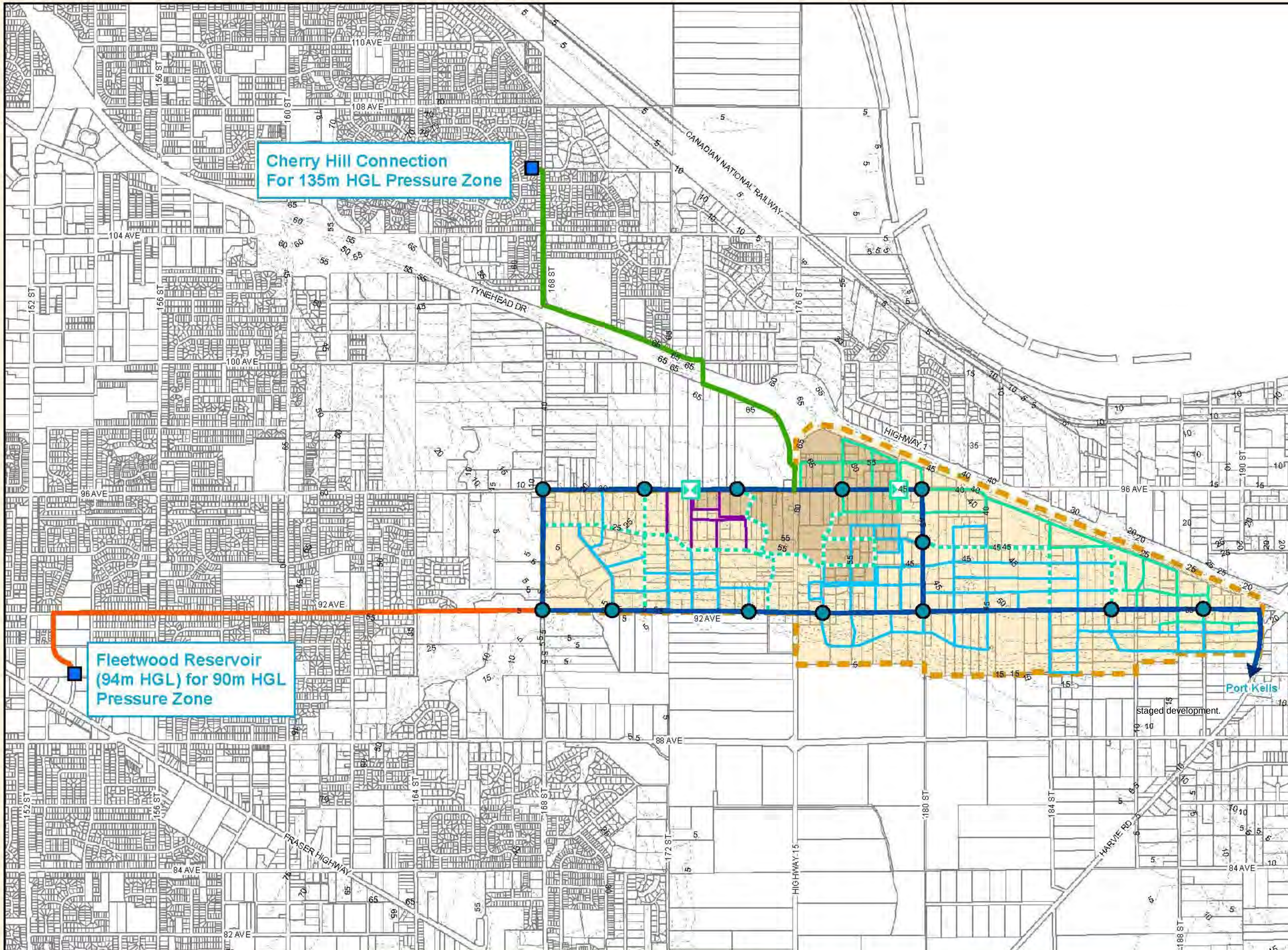

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Legend

- NCP Area
- 135m HGL Pressure Zone (all other areas 90m HGL)
- 200 Ø
- 250 Ø
- 300 Ø
- Water Main upsized to 300 Ø (see note below)
- Proposed Feeder Main
- Cherry Hill Supply Main
- Fleetwood Supply Main
- PRV
- Contour (5m Interval)
- Assumed (modeled) Local System Connections to Trunk Main (Actual connection points to be confirmed as part of design)

Note: In recognition that the ultimate looped system will be constructed over time, with some areas requiring larger pipes to provide adequate service and fire protection in the interim, some local water mains have been upsized from minimum sizes to account for staged development.

Anniedale/Tynehead NCP Stage 2

Future Water System (Build Out)

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0 250 500 1,000
Metres

U:\Projects_VAN\1072\0173\01\D-Drafting-Design-Analysis\GIS\Projects\mxds\Water_Figures_Stage_2\Figure 3.5-2c - Future Water System.mxd Last revised by bpauls on 08/08/2011 at 2:55:39 PM

Figure 8.2c

As the Fleetwood Reservoir has an estimated in-service date of 2017, any development occurring in the lower pressure zone prior to the new reservoir coming online could be fed through a PRV via the Cherry Hill Connection. This connection would be considered as a temporary supply source only. PRVs between the two pressure zones will remain in place for future conditions for emergency supply only, with no inter-pressure zone flow under normal demand scenarios.

No hydrants or service connections will be connected directly from the proposed feeder mains. The local water system as shown on **Figure 8.2b** includes mains that run parallel to the trunk infrastructure. All hydrant and service connections are to be made from these local mains.

It is recognized that the ultimate looped system will be constructed over time and some areas will require larger pipes to provide adequate service and fire protection in the interim. As such, a number of water mains in the local water system have been upsized from their minimum required sizes (based on a grid system capable of servicing the ultimate development) in order to account for staged development. The upsized mains are shown on **Figure 8.2b**.

There would be a number of required connections between the feeder main system and local water main system for water distribution. For the purposes of this study, several connections were made, which are shown on **Figure 8.2c**. These connection locations are only conceptual in nature. The actual connection locations may differ than those shown, and should be confirmed through the preliminary and detailed design stages.

Model Analysis

The City of Surrey - North Surrey Distribution System model (Bentley WaterCAD V8*i)*, was used to complete the analysis. Review of the water system included analysis of 3 separate, strategically selected development horizons. These include:

- Initial development scenario

○ Includes anticipated development in the initial short term (1-2 year timeframe)

- 2016 development horizon scenario

○ Includes all anticipated development to occur prior to the commissioning of the Fleetwood Reservoir (est. 2017)

- Full build-out scenario

○ Includes full development to build-out of the study area

Table 8.1 below outlines the anticipated development phasing in the Anniedale-Tynehead area.

Table 8.1: Anticipated Development Phasing (2012)

Development	Implementation Year	Phase
Tynehead – commercial	2012 – 2015	1a
Tynehead – residential	2014 – 2018	1b
Anniedale A – West 1 **Anniedale A – East 1** **Anniedale B1**	2016 – 2024	2a*
Anniedale B4 **Anniedale A – West 2**	2016 – 2024	2b*
Anniedale B3	2025 – 2031	3
Anniedale B2	2031 – 2041	4
Port Kells	2041+	5

*2a or 2b could proceed before the other.

The following capacities (domestic flow under PHD) are available from the Cherry Hill Connection for the listed scenarios (see **Table 8.2**). Required fire flows are confirmed to be available from this supply point at build-out. The available capacity is greatest under the initial development scenario and decreases over time due to other increased City demands.

Table 8.2 Cherry Hill Connection Available Domestic Capacity

Development Scenario	Capacity (L/s) under PHD
Initial development scenario	200
2016 development horizon scenario	120
Full build-out scenario	120

Although the available capacity under PHD for the initial development scenario is 200 L/s, as the capacity reduces to 120 L/s beyond 2016, 120 L/s is considered as the maximum available domestic flow capacity for all development scenarios. Demands are summarized in the subsequent sections.

To build the model, the proposed Anniedale-Tynehead bulk water supply and feeder main infrastructure was incorporated into the existing North Surrey model. The model was then used to size the feeder mains to meet both PHD and MDD + Fire Flow conditions. The model was also used to model required PRVs.

As no reservoirs are proposed to be constructed in the Anniedale-Tynehead area, supply infrastructure has been sized to provide the higher flow between PDD and MDD + fire flow. PRVs have been configured to provide the required zone HGL. PRVs separating the pressure zones have been configured for ultimate emergency supply only, with no inter-pressure zone flow under normal demand scenarios. However, the PRVs may provide domestic and fire flow to the lower pressure zone, on a temporary basis, via the Cherry Hill Connection Supply point, as noted previously.

The local pipe distribution system (as shown in **Figure 8.2b**) was modeled as part of the analysis to confirm fire flow delivery adequacy.

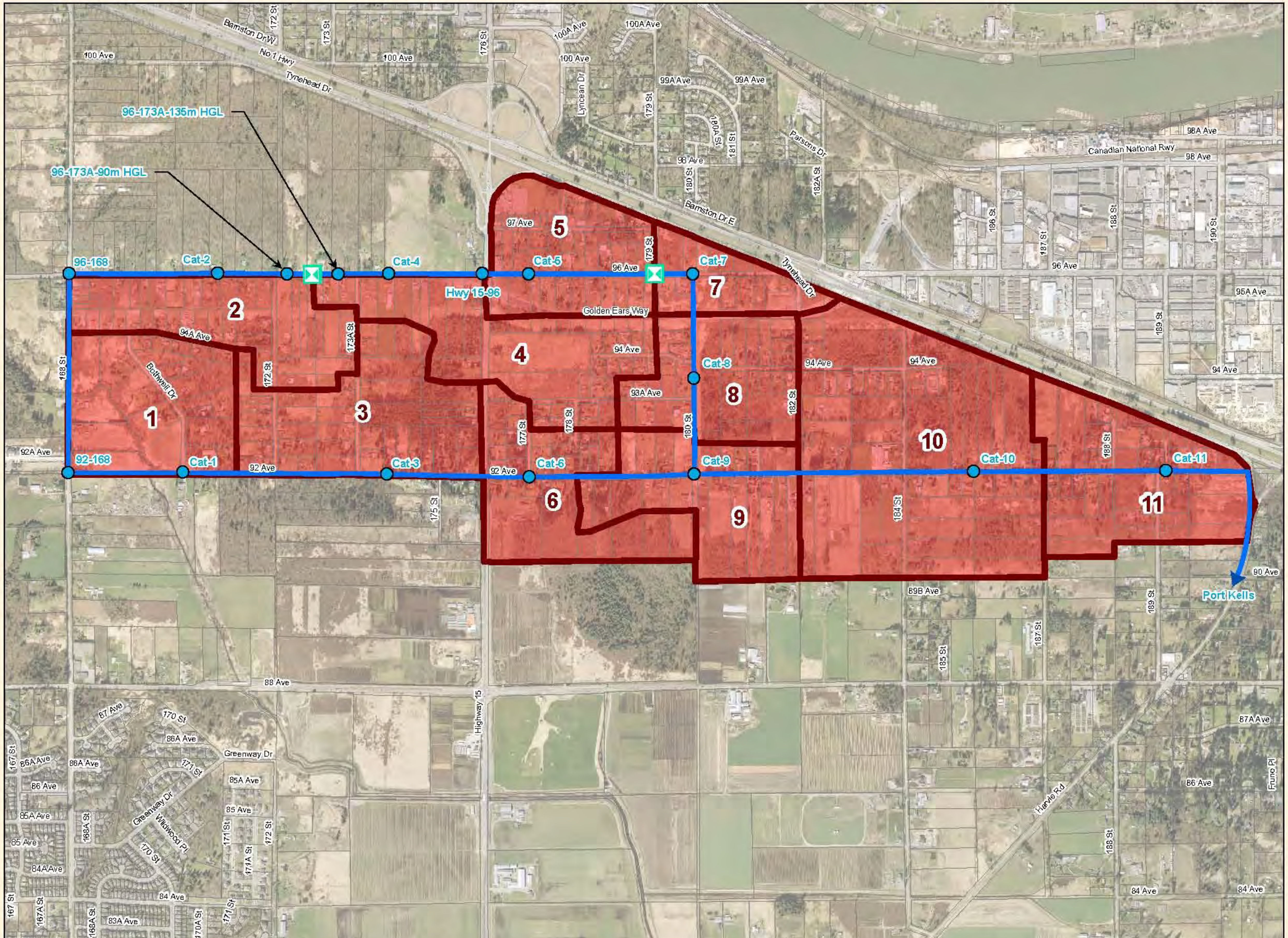
Load Allocation

Domestic demands were allocated to 12 nodes (11 in the Anniedale-Tynehead study area, and 1 in the Port Kells area). Fire flows were also allocated to the nodes, along with 5 other nodes (to ensure adequate fire flow coverage). The demand allocation nodes are shown on **Figure 8.3**, along with corresponding service areas. Node elevations used in the analysis correspond to the highest development parcel elevation to ensure that the pressure requirements are met at all points within each service area.

The proposed land use and estimated residential populations were used to estimate future water demands for the Anniedale-Tynehead area. The anticipated demands from Institutional, Commercial and Industrial (ICI) areas were estimated using an Equivalent Population Factor of 90 PPha as per Table 2.6 in the City of Surrey Engineering Department Design Criteria Manual.

The residential population for the 171 ha Port Kells area was estimated per the methodology outlined in the **Sanitary Sewer Part 6.1.**

The total equivalent build-out population is presented in **Table 8.3** and categorized by service area. Unit rates per the listed design criteria were applied to the populations to determine respective demands for each service area.



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Legend

- Service Area
- Proposed Feeder Main
- Node For Model
- PRV

Anniedale/Tynehead NCP Stage 2

Water Service Areas

Figure 8.3

0 250 500 1,000
Metres

URBANSYSTEMS.

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Table 8.3. Full Build Out Population

Service area	Estimated Population	ICI Equivalent Population	Total Equivalent Population
1	915	0	915
2	2,152	561	2,713
3	1,436	482	1,918
4	2,764	351	3,115
5	0	2,053	2,053
6	2,993	0	2,993
7	0	761	761
8	2,098	154	2,252
9	2,758	196	2,954
10	5,334	518	5,852
11	1,197	1,314	2,511
Port Kells	8,600	0	8,600
TOTAL	**30,247**	**6,390**	**36,637**

Initial Development Scenario

Based on City derived growth projections, the initial development has been identified to occur on the west side of 176 Street designated 'commercial'. The equivalent population for this area equates to 500 persons at build-out. The estimated current population in the Anniedale-Tynehead area is 1,540. Therefore, the anticipated total serviced population for this scenario is 2,040 persons.

It should be noted that while the existing population has been included in calculating the anticipated maximum demand for this scenario, existing services on existing water mains and existing wells would remain in service until new fronting infrastructure (from new supply connections) is constructed.

2016 Scenario

City derived growth projections estimate an increase in residential population in the Anniedale-Tynehead study area of 1,000 persons. If we include the equivalent population of 500 persons from the initial commercial development west of 176 Street, the anticipated total serviced population for this scenario is 3,040 persons.

Fire Flow Requirements

Fire flow demand is based on the highest required fire flow for all land use types within each service area. **Table 8.4** outlines the fire flow requirements of each service area.

Table 8.4 Fire Flow Requirements per Demand Service Area

Service Area	Junction	Land Use / Zoning with Highest Fire Flow Demand	Required Fire Flow (L/s)
1	Cat-1	Cluster Residential, 6-10	120
2	Cat-2	High Density Residential, 25-45	120
3	Cat-3	High Density Residential, 25-45	120
4	Cat-4	Commercial	120
5	Cat-5	Industrial	250
6	Cat-6	High Density Residential, 25-45	120
7	Cat-7	Industrial	250
8	Cat-8	High Density Residential, 25-45	120
9	Cat-9	Cluster Residential, 10-15	120
10	Cat-10	Industrial	250
11	Cat-11	Industrial	250
Port Kells	Port Kells	Village Commercial	90

** Fire flows above 120 L/s are assumed to be delivered via a minimum of 2 hydrants.*

Supply Capacity

As previously noted, the maximum available capacity of the Cherry Hill connection is 120 L/s. This capacity is meant to supply only the upper 135m HGL pressure zone in the study area at build-out. However, in the interim, this capacity could be used to provide service to all areas within Anniedale-Tynehead on a first come, first served basis until the capacity is reached, which will be prioritized by a completed building permit.

In order for part of this capacity to service the lower 90m HGL pressure zone on an interim basis, at least one PRV would need to be constructed. It is assumed that the PRV(s) and all associated infrastructure required to service development in the 90m HGL pressure zone would be front-ended or constructed via a latecomer agreement where appropriate.

The 120 L/s capacity (PHD) equates to an equivalent population of 5,184 persons. Once the demand from the supply has reached this limit, any new services will need to be serviced from an alternate source (ie. Fleetwood Reservoir). As development proceeds towards build-out, the Cherry Hill connection will become the sole supply for the upper pressure zone, and the Fleetwood Reservoir will become the sole supply for the lower pressure zone.

It should be noted that once the maximum capacity of the Cherry Hill connection is reached, a developer and/or the City may be required to frontend the cost of the Fleetwood Supply Infrastructure to support any additional development.

Analysis Results

Analysis results are presented on **Figure 8.4** and **Figure 8.5**. Both figures outline node information such as available fire flows and residual pressures.

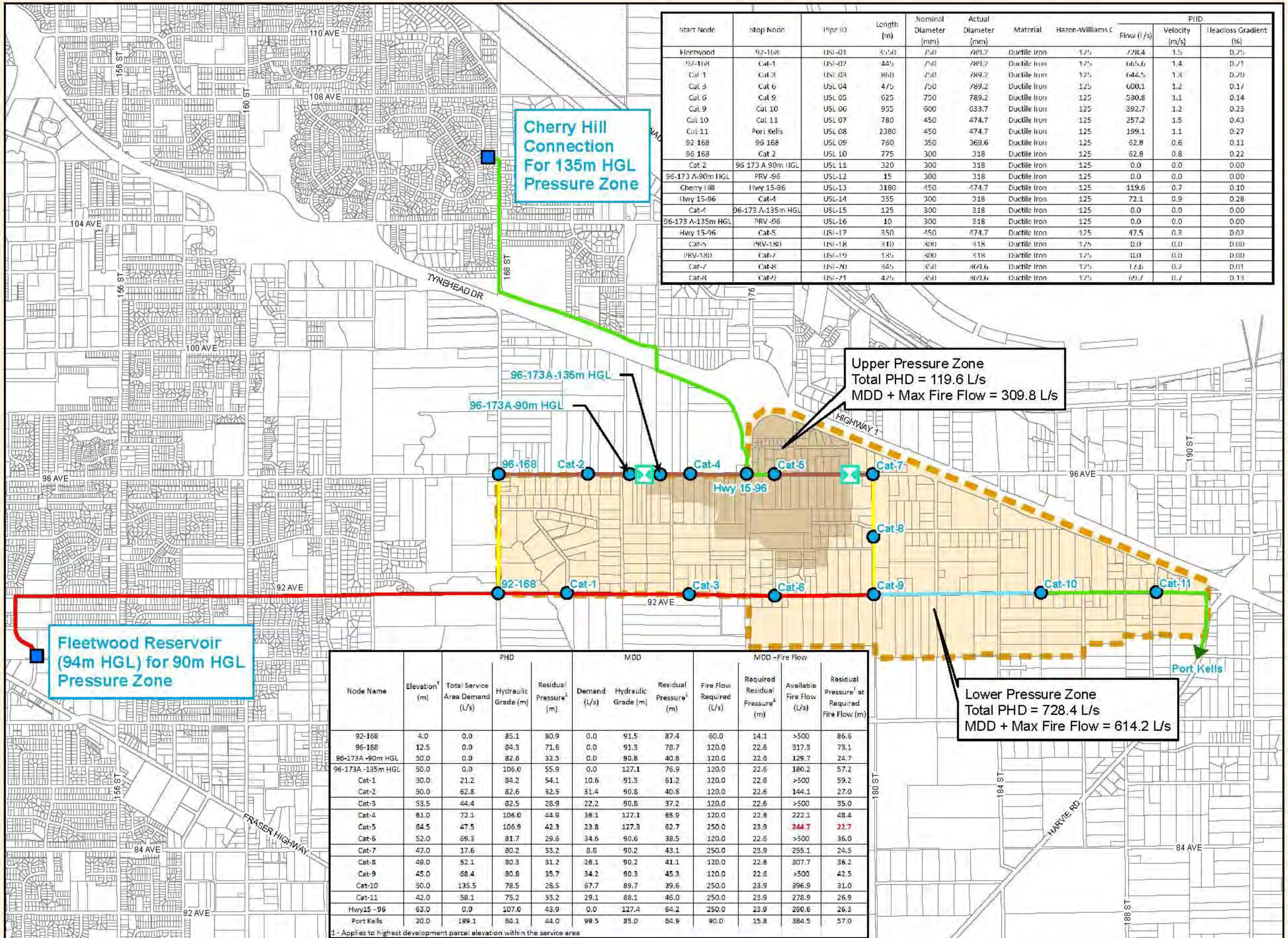
8.2 SERVICING OPTIONS, PROPOSED SYSTEM AND COSTS

Full Build-Out

Analysis results for the Full Build-Out scenario are presented on **Figure 8.4**. As shown on the figure, the connection from the future Fleetwood Reservoir is sized at 750mm diameter. This diameter is needed in order to limit the maximum pipe velocity to 2 m/s (which occurs under PHD). The Cherry Hill Connection to the study area is sized at 450mm diameter. This diameter is needed to meet MDD + Fire Flow requirements.

The remaining feeder main system has been sized to meet PHD pressure and MDD + fire flow requirements. Feeder mains vary in size from 300mm to 750mm in diameter. PRVs are shown on the feeder mains at the boundary between the 90m and 135m HGL pressure zones.

For the 90m HGL pressure zone, both PHD pressure requirements and MDD + fire flows can be supplied from the Fleetwood Reservoir without the need for additional pressure boosting. The 135m HGL pressure zone can also be supplied both PHD pressure requirements and MDD + fire flows via the Cherry Hill Connection without the need for additional pressure boosting.



Start Node	Stop Node	Pipe ID	Length (m)	Nominal Diameter (mm)	Actual Diameter (mm)	Material	Hazen-Williams C	PHD Flow (l/s)	PHD Velocity (m/s)	PHD Headloss Gradient (%)
Fleetwood	92-168	USL-01	3550	750	789.2	Ductile Iron	125	728.4	1.5	0.25
92-168	Cat-1	USL-02	445	750	789.2	Ductile Iron	125	665.6	1.4	0.21
Cat 1	Cat 3	USL 03	860	750	789.2	Ductile Iron	125	644.5	1.3	0.20
Cat 3	Cat 6	USL 04	475	750	789.2	Ductile Iron	125	600.1	1.2	0.17
Cat 6	Cat 9	USL 05	625	750	789.2	Ductile Iron	125	530.8	1.1	0.14
Cat 9	Cat 10	USL 06	955	600	633.7	Ductile Iron	125	392.7	1.2	0.23
Cat 10	Cat 11	USL 07	780	450	474.7	Ductile Iron	125	257.2	1.5	0.43
Cat 11	Port Kells	USL 08	2380	450	474.7	Ductile Iron	125	199.1	1.1	0.27
92 168	96 168	USL 09	760	350	369.6	Ductile Iron	125	62.8	0.6	0.11
96 168	Cat 2	USL 10	775	300	318	Ductile Iron	125	62.8	0.8	0.22
Cat 2	96 173 A 90m HGL	USL 11	320	300	318	Ductile Iron	125	0.0	0.0	0.00
96-173 A-90m HGL	PRV-96	USL-12	15	300	318	Ductile Iron	125	0.0	0.0	0.00
Cherry Hill	Hwy 15-96	USL-13	3180	450	474.7	Ductile Iron	125	119.6	0.7	0.10
Hwy 15-96	Cat-4	USL-14	355	300	318	Ductile Iron	125	72.1	0.9	0.28
Cat-4	96-173 A-135m HGL	USL-15	125	300	318	Ductile Iron	125	0.0	0.0	0.00
96-173 A-135m HGL	PRV-96	USL-16	10	300	318	Ductile Iron	125	0.0	0.0	0.00
Hwy 15-96	Cat-5	USL-17	350	450	474.7	Ductile Iron	125	47.5	0.3	0.02
Cat-5	PRV-180	USL-18	310	300	318	Ductile Iron	125	0.0	0.0	0.00
PRV-180	Cat-7	USL-19	135	300	318	Ductile Iron	125	0.0	0.0	0.00
Cat-7	Cat-8	USL-20	345	350	369.6	Ductile Iron	125	17.6	0.2	0.01
Cat-8	Cat-9	USL-21	425	350	369.6	Ductile Iron	125	69.7	0.7	0.13

Node Name	Elevation[1] (m)	PHD Total Service Area Demand (L/s)	PHD Hydraulic Grade (m)	PHD Residual Pressure[1] (m)	MDD Demand (L/s)	MDD Hydraulic Grade (m)	MDD Residual Pressure[1] (m)	MDD +Fire Flow Fire Flow Required (L/s)	MDD +Fire Flow Required Residual Pressure[1] (m)	MDD +Fire Flow Available Fire Flow (L/s)	MDD +Fire Flow Residual Pressure[1] at Required Fire Flow (m)
92-168	4.0	0.0	85.1	80.9	0.0	91.5	87.4	60.0	14.1	>500	86.6
96-168	12.5	0.0	84.3	71.6	0.0	91.3	78.7	120.0	22.6	317.3	73.1
96-173A -90m HGL	50.0	0.0	82.6	32.5	0.0	90.8	40.8	120.0	22.6	129.7	24.7
96-173A -135m HGL	50.0	0.0	106.0	55.9	0.0	127.1	76.9	120.0	22.6	180.2	57.2
Cat-1	30.0	21.2	84.2	54.1	10.6	91.3	61.2	120.0	22.6	>500	59.2
Cat-2	50.0	62.8	82.6	32.5	31.4	90.8	40.8	120.0	22.6	144.1	27.0
Cat-3	53.5	44.4	82.5	28.9	22.2	90.8	37.2	120.0	22.6	>500	35.0
Cat-4	61.0	72.1	106.0	44.9	36.1	127.1	65.9	120.0	22.6	222.1	48.4
Cat-5	64.5	47.5	106.9	42.3	23.8	127.3	62.7	250.0	23.9	244.7	22.7
Cat-6	52.0	69.3	81.7	29.6	34.6	90.6	38.5	120.0	22.6	>500	36.0
Cat-7	47.0	17.6	80.2	33.2	8.8	90.2	43.1	250.0	23.9	255.1	24.5
Cat-8	49.0	52.1	80.3	31.2	26.1	90.2	41.1	120.0	22.6	307.7	36.2
Cat-9	45.0	68.4	80.8	35.7	34.2	90.3	45.3	120.0	22.6	>500	42.5
Cat-10	50.0	135.5	78.5	28.5	67.7	89.7	39.6	250.0	23.9	396.9	31.0
Cat-11	42.0	58.1	75.2	33.2	29.1	88.1	46.0	250.0	23.9	278.9	26.9
Hwy15 - 96	63.0	0.0	107.0	43.9	0.0	127.4	64.2	250.0	23.9	260.6	26.3
Port Kells	20.0	199.1	64.1	44.0	99.5	85.0	64.9	90.0	15.8	384.5	57.0

1 - Applies to highest development parcel elevation within the service area

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Legend

- NCP Area
- 135m HGL Pressure Zone (all other areas 90m HGL)
- 300 Ø
- 350 Ø
- 450 Ø
- 500 Ø
- 600 Ø
- 750 Ø
- Node For Model
- PRV

Anniedale/Tynehead NCP Stage 2

Water Model Results Full Build Out

0 500 1,000 2,000
Metres

Figure 8.4

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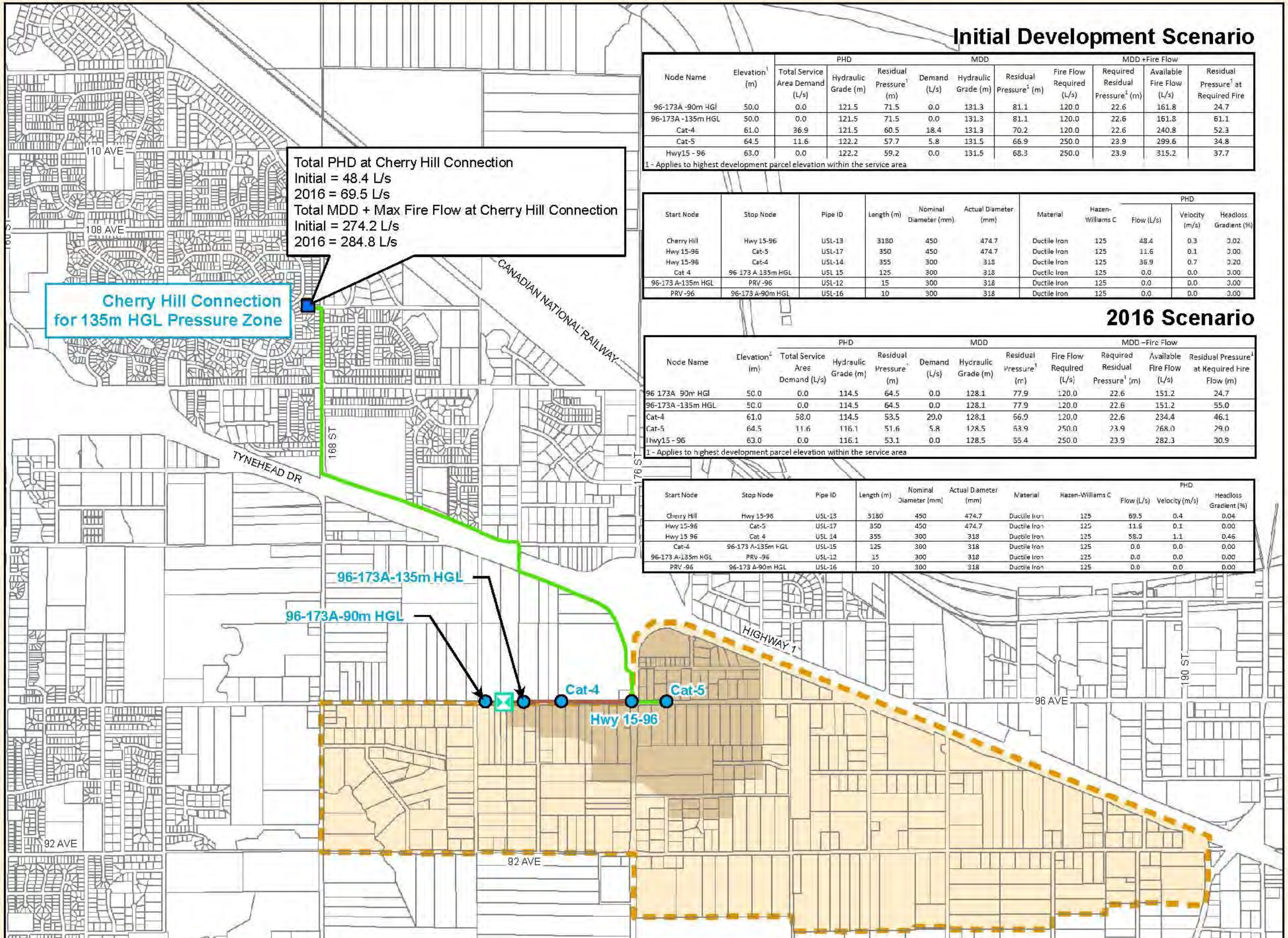

Initial Development Scenario

Node Name	Elevation[1] (m)	PHD: Total Service Area Demand (L/s)	PHD: Hydraulic Grade (m)	PHD: Residual Pressure[1] (m)	MDD: Demand (L/s)	MDD: Hydraulic Grade (m)	MDD: Residual Pressure[1] (m)	MDD +Fire Flow: Fire Flow Required (L/s)	MDD +Fire Flow: Required Residual Pressure[1] (m)	MDD +Fire Flow: Available Fire Flow (L/s)	MDD +Fire Flow: Residual Pressure[1] at Required Fire
96-173A -90m HGl	50.0	0.0	121.5	71.5	0.0	131.3	81.1	120.0	22.6	161.8	24.7
96-173A -135m HGL	50.0	0.0	121.5	71.5	0.0	131.3	81.1	120.0	22.6	161.8	61.1
Cat-4	61.0	36.9	121.5	60.5	18.4	131.3	70.2	120.0	22.6	240.8	52.3
Cat-5	64.5	11.6	122.2	57.7	5.8	131.5	66.9	250.0	23.9	299.6	34.8
Hwy15 - 96	63.0	0.0	122.2	59.2	0.0	131.5	68.3	250.0	23.9	315.2	37.7

1 - Applies to highest development parcel elevation within the service area

Start Node	Stop Node	Pipe ID	Length (m)	Nominal Diameter (mm)	Actual Diameter (mm)	Material	Hazen-Williams C	PHD: Flow (L/s)	PHD: Velocity (m/s)	PHD: Headloss Gradient (%)
Cherry Hill	Hwy 15-96	USL-13	3180	450	474.7	Ductile Iron	125	48.4	0.3	0.02
Hwy 15-96	Cat-5	USL-17	350	450	474.7	Ductile Iron	125	11.6	0.1	0.00
Hwy 15-96	Cat-4	USL-14	355	300	318	Ductile Iron	125	36.9	0.7	0.20
Cat 4	96 173 A 135m HGL	USL 15	125	300	318	Ductile Iron	125	0.0	0.0	0.00
96-173 A-135m HGL	PRV -96	USL-12	15	300	318	Ductile Iron	125	0.0	0.0	0.00
PRV -96	96-173 A-90m HGL	USL-16	10	300	318	Ductile Iron	125	0.0	0.0	0.00

2016 Scenario

Node Name	Elevation[1] (m)	PHD: Total Service Area Demand (L/s)	PHD: Hydraulic Grade (m)	PHD: Residual Pressure[1] (m)	MDD: Demand (L/s)	MDD: Hydraulic Grade (m)	MDD: Residual Pressure[1] (m)	MDD –Fire Flow: Fire Flow Required (L/s)	MDD –Fire Flow: Required Residual Pressure[1] (m)	MDD –Fire Flow: Available Fire Flow (L/s)	MDD –Fire Flow: Residual Pressure[1] at Required Fire Flow (m)
96 173A 90m HGl	50.0	0.0	114.5	64.5	0.0	128.1	77.9	120.0	22.6	151.2	24.7
96-173A -135m HGL	50.0	0.0	114.5	64.5	0.0	128.1	77.9	120.0	22.6	151.2	55.0
Cat-4	61.0	58.0	114.5	53.5	29.0	128.1	66.9	120.0	22.6	234.4	46.1
Cat-5	64.5	11.6	116.1	51.6	5.8	128.5	63.9	250.0	23.9	268.0	29.0
Hwy15 - 96	63.0	0.0	116.1	53.1	0.0	128.5	55.4	250.0	23.9	282.3	30.9

1 - Applies to highest development parcel elevation within the service area

Start Node	Stop Node	Pipe ID	Length (m)	Nominal Diameter (mm)	Actual Diameter (mm)	Material	Hazen-Williams C	PHD: Flow (L/s)	PHD: Velocity (m/s)	PHD: Headloss Gradient (%)
Cherry Hill	Hwy 15-96	USL-13	3180	450	474.7	Ductile Iron	125	69.5	0.4	0.04
Hwy 15-96	Cat-5	USL-17	350	450	474.7	Ductile Iron	125	11.6	0.1	0.00
Hwy 15 96	Cat 4	USL 14	355	300	318	Ductile Iron	125	58.0	1.1	0.46
Cat-4	96-173 A-135m HGL	USL-15	125	300	318	Ductile Iron	125	0.0	0.0	0.00
96-173 A-135m HGL	PRV -96	USL-12	15	300	318	Ductile Iron	125	0.0	0.0	0.00
PRV -96	96-173 A-90m HGL	USL-16	10	300	318	Ductile Iron	125	0.0	0.0	0.00

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Legend

- NCP Area
- 135m HGL Pressure Zone (all other areas 90m HGL)
- 300 Ø
- 450 Ø
- Node For Model
- PRV

Anniedale/Tynehead NCP Stage 2

Water Model Results Initial Development / 2016

URBANSYSTEMS.

0 500 1,000 2,000
Metres

Figure 8.5

The PHD flow for build-out of the higher 135m HGL pressure zone is estimated to be 119.6 L/s, which is just below the estimated capacity of the Cherry Hill connection of 120 L/s. The PHD flow for build-out of the lower 90m HGL pressure zone is estimated to be 728.4 L/s.

Initial Development Scenario

Analysis results for the Initial Development scenario are presented on **Figure 8.5**. Due to the interim nature of this scenario, further analysis was not completed to determine required interim infrastructure. However, the total demand for the Initial Development Scenario is less than the total demand for the upper pressure zone at build-out. Feeder mains are only shown to the core of the proposed initial industrial development area, east of Highway 15, and to the west boundary of the upper pressure zone.

2016 Scenario

Analysis results for the 2016 scenario are also presented on **Figure 8.5**. Although this scenario assumes some development in the lower pressure zone, feeder mains are only shown to the same limits as described for the Initial Development Scenario. Any development in the lower pressure zone under this scenario would require additional trunk infrastructure. This additional infrastructure has been omitted in the presentation and costs, as the level and extent of development in the lower pressure zone for the 2016 scenario is unknown.

Table 8.5 summarizes flows (under PHD) from each of the supply sources for different development horizons.

Table 8.5. Supply Demands under PHD Flow

Development Horizon	Cherry Hill Connection	Fleetwood Reservoir
	PHD Flow (L/s)	PHD Flow (L/s)
Initial	48.4	N/A
2016	69.5	N/A
Build-Out	119.6	728.4

Port Kells

Although the new supply main from the proposed Fleetwood Reservoir and feeder main on 92 Avenue is required to service the lower pressure zone in Anniedale-Tynehead, extension of this infrastructure can also provide service to Port Kells. In order to account for an apportionment to Port Kells for this infrastructure, a separate analysis scenario was completed in WaterCAD to determine the upsizing requirements of adding future Port Kells demand to the system.

Costs

Costs associated with the Port Kells area are not included in the development scenario costs, and are provided separately. All costs provided below include 10% Engineering fees and a 5% allowance for tender increases (additional contingency is not included). Costs pertaining to permitting, RoW and land acquisition have been omitted. Note that costs do not include local distribution system costs (fronting mains). However, upsizing costs from minimum required pipe sizes for the local system have been accounted for and are included in the costs below. Detailed cost estimates are provided in **Appendix D** for reference.

Initial Development Scenario

Table 8.6 outlines costs for required trunk infrastructure from the proposed Cherry Hill Connection to service the upper pressure zone (135m HGL) in the Anniedale-Tynehead area. The limit of works is the core of the proposed industrial area east of Highway 15 and the western boundary of the upper pressure zone, immediately downstream of the 96 Avenue PRV. The costs below do not include any costs associated with the Fleetwood Reservoir or its connection to the Anniedale-Tynehead area.

Table 8.6 - Initial Development Trunk Infrastructure Costs

(Major Distribution System from Cherry Hill)

Subtotal Pipe Works	$ 3,374,200
Subtotal Other Fees/Works	$ 115,000
Construction Total	**$ 3,500,000**

Full Build-Out

Table 8.7 outlines the additional costs for required trunk infrastructure to fully service the Anniedale-Tynehead area at build-out. The costs below do not include the costs summarized in **Table 8.6**. Costs do not include any costs associated with construction of the proposed Fleetwood Reservoir by Metro Vancouver.

Table 8.7 Full Build-Out Trunk Infrastructure Costs

(Major Distribution System from Fleetwood)

Subtotal Pipe Works	$ 16,393,300
Subtotal Other Fees/Works	$ 115,000
Construction Total	**$ 16,600,000**

Port Kells
The above costs do not include the proposed 450mm diameter feeder water main from node 'Cat-11' to node 'Port Kells' (nominal distance to Port Kells core), as this section of water main is required to service the Port Kells area only. The cost of this section of water main is estimated to be **$2.1M**.

Apportioned costs for Port Kells for upsizing of infrastructure, as discussed in the previous section, are estimated to be **$1.4M** (upsizing of main from Fleetwood Reservoir to 'Cat-11').

Proposed System
The Cherry Hill Connection can adequately service proposed development of the upper pressure zone in Anniedale-Tynehead to final build-out. This supply connection could also potentially service the lower pressure zone in Anniedale-Tynehead through PRVs in the interim on a first come, first served basis, prior to commissioning of the Fleetwood Reservoir. However, the extent to which interim supply could be provided is dependent on the actual rate of growth, which is unclear at this time.

The proposed Fleetwood Reservoir will supply the lower pressure zone in Anniedale-Tynehead once the reservoir is commissioned. The trunk infrastructure has been sized to convey required flows via gravity, without the need for pressure boosting.

Refer to **Part 7.2** regarding Environmental Considerations and approvals when designing the proposed system.

Total cost for bulk water servicing to build-out is approximately **$20.1M**.

8.3 TEN YEAR SERVICING PLAN AND INFRASTRUCTURE COSTS

To satisfy anticipated peak hour demands and provide adequate fire flows, the Anniedale-Tynehead NCP will ultimately need a new reservoir in Fleetwood, additional feeder water mains, as well as new PRVs on 96th Avenue. As previously noted there are two Phases to service the Anniedale-Tynehead NCP excluding the Port Kells area. The initial development period is prior to the construction of the new Fleetwood reservoir and the full build-out scenario follows completion of the new reservoir. The construction cost of the initial development Phase is estimated at **$3.5 million** and the additional cost to allow for full build-out is estimated at **$16.6 million**. The total costs of DCC eligible infrastructure is **$20.1 million.**

Further details on the initial, full build-out development and Port Kells upsizing cost estimates are included in **Appendix D**.

10 Year Servicing Plan

There are no projects currently identified in the 10 Year Servicing Plan that fall within the study area.

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PART 9 Services, Amenities & Implementation

Photo: Tynehead Cycling and Pedestrian Overpass Spanning Highway #1 at 168 St

PART 9: SERVICES, AMENITIES AND IMPLEMENTATION

9.0 COMMUNITY SERVICES AND AMENITIES

To address the amenity needs of the proposed new development in Anniedale-Tynehead, all development proposals at the time of rezoning or building permit issuance will be required to make a monetary contribution toward the provision of new police, fire protection and library services and toward the development of the parks, open spaces and pathways.

The monetary contributions toward police, fire and library materials will offset the capital costs of providing these services to the new development and are applied on a standardized basis in all of Surrey's Neighbourhood Concept Plan areas. The monetary contributions toward parks, open spaces and pathway development are based upon an estimate of the capital costs of these improvements for this particular NCP area. The total cost is divided by the anticipated number of dwelling units and acreages in the case of non-residential development to ensure an equitable contribution arrangement.

Parkland Development

The Anniedale-Tynehead community will contain six neighbourhood park sites, and several riparian areas and trails. The Open Space areas include the Lakiotis Ridge Trail, Green Timber Greenway, and a proposed trail by the Serpentine River.

Entrance features are planned in three areas of the plan. One will be located at 172 Street and 96 Avenue to mark the entrance into Tynehead Park, another at 176 Street and 96 Avenue as an entrance into the northern end of neighbourhood, the third feature at 184 Street and 90 Avenue as the southern entrance into the community park.

The estimated cost of developing park and related amenities in the future Anniedale-Tynehead community is approximately $8,416,931.00. This results in a contribution of $1,294.91 (in 2012 dollars) per dwelling unit.

Library and Library Material

A study of library requirements in Surrey's new neighbourhoods has established that a contribution of $ 141.15 (in 2012 dollars) per dwelling unit (non-residential development is exempt) is necessary to cover the capital costs for library materials and services, which is sensitive to population growth. Consequently, a total of approximately $917,475.00 will be collected from Anniedale-Tynehead towards materials such as books, computers and CDs.

Fire and Police Protection

Future development in this neighbourhood will drive the need to upgrade existing fire and police protection facilities. A study of fire protection requirements in Surrey's new neighbourhoods has established that a contribution of $ 271.01 per dwelling unit and $1,084.07 per acre of non-residential development (in 2012 dollars) will cover the capital costs for fire protection. A contribution of $ 62.74 per dwelling unit and $ 250.90 per acre of non-residential development (in 2012 dollars) will cover the capital costs for police protection. This will result in a total capital contribution from Anniedale-Tynehead of approximately $2,032,582.50 toward fire protection and $470,535.00 toward police protection.

Summary of Amenity Funding Arrangements

A summary of the applicable amenity contributions (per dwelling unit or hectare/acre) and the estimated revenue the City can expect to receive from the Anniedale-Tynehead NCP area is documented in the following table.

The per unit amenity contributions are derived from estimated base densities in the residential designations and the number of dwelling units (excluding any coach houses and secondary suites) anticipated. The estimated costs of the various amenities are distributed evenly to each dwelling unit. Therefore, if the number of dwelling units in a proposed development is lower than that anticipated by the NCP, the applicant will be expected to "top up" the amenity fees based on the number of the dwelling units used to calculate the amenity charge to ensure that there is no shortfall in the funding for the proposed amenity.

ANNIEDALE-TYNEHEAD NEIGHBOURHOOD CONCEPT PLAN AMENITY CONTRIBUTIONS			
	Per Unit Contribution All Residential *Approx. 6500 dwelling units (@ base densities*	**Per Acre Contribution All Non-Residential *Approx. 250 acres* *(101 ha.)***	**Anticipated Revenue**
Police Protection	$62.74 per dwelling	$ 250.90 per acre	$470,535.00
Fire Protection	$ 271.01 per dwelling	$ 1,084.07 per acre	$2,032,582.50
Development of Park/Pathways and Placemaking Features	$1,294.91 per dwelling	n/a	$8,416,915.00
Library Materials	$ 141.15 per dwelling	n/a	$917,475.00
Total Contribution (per unit or per acre)	**$1,769.81 per dwelling**	**$1,334.97 per acre**	
Total Anticipated Revenue	$11,503,765.00	333,742.50$	$11,837,507.50

9.1 EXTERNAL UTILITY AGENCIES

The external utility agencies were included in the planning process for the NCP and Interagency Meetings held on June 17, 2009 and October 16, 2009. Subsequent to those meetings, all external utilities including BC Hydro, Fortis (formally Terason Gas), Telus and Shaw Cable were provided with the final growth projections, Land Use Plan and Engineering Services Plan. The external utilities have indicated that they will include this NCP in the planning of their service distribution systems. At this time, no details of the new works or upgrades required to provide utility servicing are available from the agencies. Infrastructure for providing servicing is normally constructed as development takes place.

BC Hydro and Fortis Comments

Comments from BC Hydro and Fortis have been received on the use of their 96 Avenue transmission line right of way for trail purposes. BC Hydro has requested that no pathways be constructed in between the poles and guy wires/anchors and that pathways should go around these structures. Plans of any proposed pathways should be sent to BC Hydro for their review to ensure safe electrical clearance and a review of any other impact to their facilities within the transmission line.

BC Hydro has also provided a preliminary comment stating that underground piping should be non-metallic on the BC Hydro right of way and should have a 6.0 meter minimum horizontal off-set from poles and anchors. Any metallic pipes must have a minimum 10 meter off-set. In addition, detailed plans are required for each proposal showing vertical and horizontal distances from transmission and distribution works. BC Hydro approval and Work Safe BC requirements are necessary prior to working within their right-of-way.

Fortis commented that they encourage the City’s use of its rights of way as multi-use pathways as they are compatible uses and are easier to maintain than gas rights of ways through multiple private properties. For the 96 Avenue transmission line the gas right of way is 50 ft (15.24 m) wide (on the north side) and BC Hydro’s is 100 ft (30.48 m) wide. Fortis needs to review any proposed pathways prior to construction and review any proposed roads that cross any of their rights of way.

Both BC Hydro and Fortis will not permit any lands within their rights of way to be dedicated as park, as the lands need to remain as titled lots to avoid the extinguishment of rights.

Other External Agency Comments

Transportation Investment Corporation, a Provincial Crown Corporation, requested that any future utility crossings of the Highway 1 mainline and interchange ramps be premised on the assumption that trenchless means of construction will be required in order to minimize traffic disruptions on these high volume corridors.

Department of Fisheries and Oceans Canada comments are included in **Part 7.2** Environmental Considerations.

9.2 PLAN IMPLEMENTATION

OCP Amendments

The entire area covered by the Anniedale-Tynehead NCP is currently designated Suburban in the OCP. Although the NCP Land Use Plan anticipates changes to the OCP designations in Anniedale-Tynehead , the determination of the precise boundaries of these changes cannot be established until a detailed survey plan is presented. It is, therefore, recommended that any necessary changes to the OCP designations in the Anniedale-Tynehead area proceed concurrently with site specific rezoning applications as has been the City's normal practice.

Zoning Amendments

The residential lands will need to be rezoned before development can proceed. Rezoning will be completed in a logical staged manner. Areas suitable for development will be rezoned when owners make application consistent with this plan.

Subdivision

Future subdivision will be consistent with both the NCP and the ultimate zoning. As noted in the section on phasing, subdivision will be dependent upon market conditions and at a pace determined by the landowners. Detailed subdivision patterns will be determined at the subdivision application stage.

Development Permit Area Guidelines

Multiple unit residential, commercial, and industrial and business park developments will be reviewed in accordance with the Development Permit Guidelines of the Official Community Plan and the requirements of this NCP.

Design Guidelines

The Neighbourhood Concept Plan contains design guidelines for land uses that are intended to provide general direction to achieve the desired neighbourhood character, preserve and enhance natural space, encourage pedestrian access to destination areas, and achieve the overall development objectives defined in the final Neighbourhood Concept Plan.

The design guidelines make recommendations regarding the interface between residential areas and public spaces, residential areas and agricultural lands, viewscapes, ecosystem management areas, stormwater corridors and on-site drainage works, as well as architectural elements appropriate for residential and commercial buildings.

These guidelines will be used by City staff to guide the developers in coordinating the design among individual development applications and to ensure that the desired neighbourhood character is achieved in Anniedale-Tynehead. The Design Guidelines will be implemented through Building Schemes for single family developments, which will be registered on the lots and administered by design consultants hired by the developers and approved by the City. For row housing, town housing and other multiple unit residential developments, commercial, industrial and business park developments, the Design Guidelines will be implemented through Development Permits.

Amenity Contributions

Surrey's policy is that NCPs address funding arrangements for the provision of community facilities, amenities, and services (such as park development, police, fire, and library materials) that are translated into specific contribution requirements and adopted by Council in the Zoning Bylaw. The amenity contribution is payable upon subdivision for single-family subdivisions or upon issuance of building permits for multiple development and other uses.

The bylaw provides that the base rates for amenity contributions are adjusted annually on March 1st based on Vancouver's annual average consumer price index (CPI) for the preceding year.

Zoning By-law Amendments

To enact the amenity contribution requirements, the Zoning By-law requires an amendment to add Anniedale-Tynehead to the list of Neighbourhood Concept Plans within which monetary contributions are required. The proposed amendments to Schedule G of the Zoning By-law, to incorporate the amenity fees for Anniedale-Tynehead , were proposed concurrently with the approval of the Stage 2 plan.

NCP Amendments

Any proposed major or minor amendments to this Neighbourhood Concept Plan must be undertaken in accordance with Council's approved Neighbourhood Concept Plan amendment policy contained in Part 5, Division A of the OCP.

Cost Recovery of NCP Preparation

Several Consultants were retained to assist with the preparation of the Anniedale-Tynehead NCP. The cost of the Engineering and Environmental consultant services to the City was $648,480.00. In order to recover the NCP preparation costs through the payment of application surcharge fees, the Fee Imposition By-law will be amended with the approval of this NCP.

The surcharge fee per unit is based on the anticipated 6500 units at the mid-range density, and would result in a per unit fee of $86.46. Should the actual number of proposed units fall below the number anticipated on site, the applicant will be required to make up the shortfall in the surcharge fee to ensure the NCP costs are fully recovered. For non-residential development, similar to other NCPs, the equivalent application surcharge fee will be based on the lot area at a rate of 10 units per hectare (4 units per acre).

PART 10 INFRASTRUCTURE SUMMARY AND FINANCIAL ANALYSIS

PART 10: INFRASTRUCTURE SUMMARY AND FINANCIAL ANALYSIS

Table 10.1 summarizes the projected DCC revenues and construction costs for the infrastructure projects that are required to service development within this NCP area. The revenues are based on the current DCC rates that came into effect on March 15, 2012. The revenues include the DCC municipal assist factor for each utility.

Table 10.1 - Projected DCC revenues and costs for the infrastructure projects in Anniedale-Tynehead NCP

Services	Estimated DCC Revenues	DCC Expenditures on Eligible Works in the NCP Area	Shortfall
Sanitary Sewer	$17,100,000	$28,800,000	$11,700,000
Water	$13,100,000	$20,100,000	$7,000,000
Drainage	$21,800,000	$26,600,000	$4,800,000
Non-Arterial Roads	$14,400,000	$21,500,000	$7,100,000
Arterial Roads	$66,200,000	$75,000,000	$8,800,000

As is documented in the preceding table, the estimated DCC revenues from the NCP area cannot support the financing of projects in any of the engineering services.

Appendix E provides the list of the sanitary sewer, water, drainage and transportation infrastructure projects, respectively, to support development within this NCP area and that are eligible to be included in the City's 10-Year Servicing Plan. It also provides for each project the component of its total cost that will need to be covered by DCCs.

Financing Alternatives

The costs to service this NCP area are very high due to the limited amount of infrastructure in and around the area, its topography, and its location. At the time of approval of the Stage 1 component of the NCP, Council was advised that any financial strategy for servicing this NCP area may need to include an area-specific DCC program, such as similar programs that have been developed for Campbell Heights and the Highway 99 Corridor.

Establishing area-specific DCC rates provides an equitable way to distribute the costs of needed infrastructure. An area-specific DCC program is also administratively simple to implement and manage in comparison to other approaches to finance the installation of engineering services. Staff has concluded that an area-specific DCC program should be developed for this NCP area.

Table 10.2 provides a comparison of current DCC rates in Surrey with an estimate of area-specific DCC rates for the Anniedale-Tynehead NCP area. These were developed in accordance with guidelines contained in the DCC Best Practices Guide as published by the Ministry of Community, Sport and Cultural Development.

Table 10.2 - Comparison of current DCC rates in Surrey with an estimate of area-specific DCC rates for the Anniedale-Tynehead NCP

Land Use	Existing DCC Rate (effective March 15, 2012)	Proposed Area-Specific DCC Rate	Proposed as a % of Existing
SF (RF, RF-12, RFC)	$26,248 / lot	$36,356 / lot	139%
SF Small Lot (RF-9, RF-SD)	$22,779 / lot	$31,494 / lot	138%
RM-10, RM-15 & RM-30	$14.90 / sq. ft.	$19.63 / sq. ft.	132%
RM-45 and RM-70	$16.46 / sq. ft.	$21.91 / sq. ft.	133%
Commercial (ground floor)	$9.37 / sq. ft.	$13.66 / sq. ft.	146%
Industrial	$72,879 / acre	$108,017 / acre	148%

The initial developers in this area will be required to construct a considerable amount of infrastructure to service the overall NCP. These developers will then typically enter into a DCC Front-ending Agreement with the City by which they will recover over time from the DCC revenues collected by the City from other development within the NCP area the costs that they incurred in constructing the eligible front-ended engineering servicing works. This approach has been successfully applied in other NCP areas in Surrey.

Implementation

In January 2012, Council adopted an updated 10-Year (2012-2021) Servicing Plan and related DCC By-law. The Servicing Plan is reviewed annually. The most recent Servicing Plan review was undertaken in late 2011 and the related adjustments to the DCC rates took effect on March 15, 2012.

The City's 10-Year (2012-2021) Servicing Plan needs to be revised to include DCC-eligible infrastructure projects for this NCP area as documented in Appendix VII, and the City's DCC Bylaw needs to be amended to include area-specific DCCs for this NCP area. As per Councils approval of the recommendations in the April 23' 2012, Engineering Servicing Strategy and Related Financial Strategy for Anniedale-Tynehead Neighbourhood Concept Plan (NCP) – Stage 2 Corporate Report No. R077, city staff will forward for Council's consideration a Corporate Report on May 28, 2012 including recommendations related to amending the City's 10-Year (2012-2021) Servicing Plan and DCC By-law in accordance with the above-stated intentions.

APPENDICES: ENGINEERING, IMPLEMENTATION AND FINANCING

What are the Engineering, Implementation and Financing Appendices?

A collection of separate and supporting materials such as tables, charts and graphs derived for the Anniedale-Tynehead Neighbourhood Concept Plan Engineering section, which include:

APPENDIX A - TRANSPORTATION
APPENDIX B - SANITARY SEWER
APPENDIX C - STORMWATER
APPENDIX D – WATER
APPENDIX E – FINANCING

APPENDIX A: TRANSPORTATION

- ☐ Base and Unit Price Component Cost Estimates
- ☐ Road Construction Cost Estimates

BASE AND UNIT COST ESTIMATES

Anniedale-Tynehead NCP
Class D Cost Estimate - Unit Price Components

Road Construction Unit Cost

Section AA - Collector Road (94A Avenue)
14.0 metre pavement, 23 metre R/W, 1 sidewalk, shoulder and ditch on south

12m r/w to developer; 11m r/w to DCC
7m pvmt to dev; 7 m pvmt to DCC

	Qty	unit	unit cost	Qty to Dev	Qty to DCC	cost to dev	cost to DCC	Total
clear & grub	28	sq.m.	3.00	13.00	12.00	$ 39.00	$ 36.00	$ 84.00
excavation	6	cu.m.	20.23	3.10	2.90	$ 62.71	$ 58.67	$ 121.38
sub-grade fill & preparation	6	cu.m.	18.67	3.10	2.90	$ 57.88	$ 54.14	$ 112.02
sub-base gravel	10.5	tonne	23.00	5.25	5.25	$ 120.75	$ 120.75	$ 241.50
base gravel	4.2	tonne	28.50	2.10	2.10	$ 59.85	$ 59.85	$ 119.70
asphalt	3.5	tonne	112.00	1.75	1.75	$ 196.00	$ 196.00	$ 392.00
median	0	l.m.	60.00			$ -	$ -	$ -
new curb	1	l.m.	53.27	1.00	0.00	$ 53.27	$ -	$ 53.27
new sidewalk	1	l.m.	87.83	1.00	0.00	$ 87.83	$ -	$ 87.83
shoulder	1	l.m.	11.00	0.00	1.00	$ -	$ 11.00	$ 11.00
restoration	10	sq.m.	12.00	5.50	4.50	$ 66.00	$ 54.00	$ 120.00
drainage allowance	1	l.m.	600.00	1.00	0.00	$ 600.00	$ -	$ 600.00
ditch	1	l.m.	50.00	0.00	1.00	$ -	$ 50.00	$ 50.00
lighting allowance	1	l.m.	122.05	0.50	0.50	$ 61.03	$ 61.03	$ 122.05
pavement markings	6	l.m.	2.80	3.00	3.00	$ 8.40	$ 8.40	$ 16.80
Total for 14 m Collector Road Section AA		l.m.				$ 1,412.72	$ 709.84	$ 2,131.55
					use:	**$ 1,420.00**	**$ 710.00**	

Section BB - Local Road at ALR (92 Avenue)
10.0 metre pavement, 22 metre R/W, 1 sidewalk, shoulder and ditch on south

10m r/w to developer; 12m r/w to DCC
6.0m pvmt to dev; 4.0 m pvmt to DCC

	Qty	unit	unit cost	Qty to Dev	Qty to DCC	cost to dev	cost to DCC	Total
clear & grub	24	sq.m.	3.00	13.00	12.00	$ 39.00	$ 36.00	$ 72.00
excavation	6	cu.m.	20.23	2.70	3.30	$ 54.62	$ 66.76	$ 121.38
sub-grade fill & preparation	6	cu.m.	18.67	2.70	3.30	$ 50.41	$ 61.61	$ 112.02
sub-base gravel	8.4	tonne	23.00	5.00	3.40	$ 115.00	$ 78.20	$ 193.20
base gravel	4.2	tonne	28.50	2.50	1.70	$ 71.25	$ 48.45	$ 119.70
asphalt	2.5	tonne	112.00	1.50	1.00	$ 168.00	$ 112.00	$ 280.00
median	0	l.m.	60.00			$ -	$ -	$ -
new curb	1	l.m.	53.27	1.00	0.00	$ 53.27	$ -	$ 53.27
new sidewalk	1	l.m.	87.83	1.00	0.00	$ 87.83	$ -	$ 87.83
shoulder	1	l.m.	11.00		1.00	$ -	$ 11.00	$ 11.00
restoration	10	sq.m.	12.00	6.00	4.00	$ 72.00	$ 48.00	$ 120.00
drainage allowance	1	l.m.	600.00	1.00	0.00	$ 600.00	$ -	$ 600.00
enhanced ditch	1	l.m.	100.00	0.00	1.00	$ -	$ 100.00	$ 100.00
lighting allowance	1	l.m.	122.05	0.50	0.50	$ 61.03	$ 61.03	$ 122.05
pavement markings	6	l.m.	2.80	3.00	3.00	$ 8.40	$ 8.40	$ 16.80
Total for 10 m Local Road Section BB		l.m.				$ 1,380.81	$ 631.45	$ 2,009.25
					use:	**$ 1,380.00**	**$ 635.00**	

Section CC - Local Road at ALR (92 Avenue)
10.0 metre pavement, 20 metre R/W, 1 sidewalk, shoulder and ditch on south

9.4m r/w to developer; 10.6m r/w to DCC
6.0m pvmt to dev; 4.0 m pvmt to DCC

	Qty	unit	unit cost	Qty to Dev	Qty to DCC	cost to dev	cost to DCC	Total
clear & grub	22	sq.m.	3.00	10.50	11.50	$ 31.50	$ 34.50	$ 66.00
excavation	5	cu.m.	20.23	2.40	2.60	$ 48.55	$ 52.60	$ 101.15
sub-grade fill & preparation	5	cu.m.	18.67	2.40	2.60	$ 44.81	$ 48.54	$ 93.35
sub-base gravel	8.4	tonne	23.00	5.00	3.40	$ 115.00	$ 78.20	$ 193.20
base gravel	4.2	tonne	28.50	2.50	1.70	$ 71.25	$ 48.45	$ 119.70
asphalt	2.5	tonne	112.00	1.50	1.00	$ 168.00	$ 112.00	$ 280.00
median	0	l.m.	60.00			$ -	$ -	$ -
new curb	1	l.m.	53.27	1.00	0.00	$ 53.27	$ -	$ 53.27
new sidewalk	1	l.m.	87.83	1.00	0.00	$ 87.83	$ -	$ 87.83
multi-use trail	1	l.m.	107.35	1.00		$ 107.35		$ 107.35
shoulder	1	l.m.	11.00		1.00	$ -	$ 11.00	$ 11.00
restoration	10	sq.m.	12.00	6.00	4.00	$ 72.00	$ 48.00	$ 120.00
drainage allowance	1	l.m.	600.00	1.00	0.00	$ 600.00	$ -	$ 600.00
enhanced ditch	1	l.m.	100.00	0.00	1.00	$ -	$ 100.00	$ 100.00
lighting allowance	1	l.m.	122.05	0.50	0.50	$ 61.03	$ 61.03	$ 122.05
pavement markings	6	l.m.	2.80	3.00	3.00	$ 8.40	$ 8.40	$ 16.80
Total for 10 m Local Road Section CC		l.m.				$ 1,468.99	$ 602.72	$ 2,071.70
					use:	**$ 1,470.00**	**$ 605.00**	

Section DD - Collector Road
12 metre pavement, 17 metre R/W, 1 sidewalk, remote multi-use path

17.0 r/w to developer; 0m r/w to DCC
11.0m pvmt to dev; 1.0 m pvmt to DCC

	Qty	unit	unit cost	Qty to Dev	Qty to DCC	cost to dev	cost to DCC	Total
clear & grub	19	sq.m.	3.00	19		$ 57.00	$ -	$ 57.00
excavation	5	cu.m.	20.23	5		$ 101.15	$ -	$ 101.15
sub-grade fill & preparation	5	sq.m.	18.67	5		$ 93.35	$ -	$ 93.35

	Qty	unit	unit cost	Qty to Dev	Qty to DCC	cost to dev	cost to DCC	Total
sub-base gravel	9.5	tonne	23.00	8.6	0.90	$ 197.80	$ 20.70	$ 218.50
base gravel	3.9	tonne	28.50	3.5	0.40	$ 99.75	$ 11.40	$ 111.15
asphalt	3.1	tonne	112.00	2.8	0.30	$ 313.60	$ 33.60	$ 347.20
median	0	l.m.	60.00	0		$ -	$ -	$ -
new curb	2	l.m.	53.27	2		$ 106.54	$ -	$ 106.54
new sidewalk	1	l.m.	87.83	1		$ 87.83	$ -	$ 87.83
multi-use path	1	l.m.	195.17	1		$ 195.17	$ -	$ 195.17
restoration	10	sq.m.	12.00	10		$ 120.00	$ -	$ 120.00
drainage allowance	1	l.m.	600.00	1		$ 600.00	$ -	$ 600.00
lighting allowance	1	l.m.	122.05	1		$ 122.05	$ -	$ 122.05
pavement markings	6	l.m.	2.80	5	1.00	$ 14.00	$ 2.80	$ 16.80
Total for 12 m Collector Road Section DD		l.m.				$ 2,108.24	$ 68.50	$ 2,176.74
					use:	**$ 2,100.00**	**$ 70.00**	

Section EE - Collector Road

12 metre pavement, 20 metre R/W, 1 sidewalk, remote multi-use path

10m r/w to developer; 10m r/w to DCC
6.0m pvmt to dev; 6.0 m pvmt to DCC

	Qty	unit	unit cost	Qty to Dev	Qty to DCC	cost to dev	cost to DCC	Total
clear & grub	22	sq.m.	3.00	11	11.00	$ 33.00	$ 33.00	$ 66.00
excavation	5	cu.m.	20.23	2.5	2.50	$ 50.58	$ 50.58	$ 101.15
sub-grade fill & preparation	5	sq.m.	18.67	2.5	2.50	$ 46.68	$ 46.68	$ 93.35
sub-base gravel	9.5	tonne	23.00	4.75	4.75	$ 109.25	$ 109.25	$ 218.50
base gravel	3.9	tonne	28.50	1.95	1.95	$ 55.58	$ 55.58	$ 111.15
asphalt	3.1	tonne	112.00	1.55	1.55	$ 173.60	$ 173.60	$ 347.20
median	0	l.m.	60.00	0		$ -	$ -	$ -
new curb	2	l.m.	53.27	1.00	1.00	$ 53.27	$ 53.27	$ 106.54
new sidewalk	2	l.m.	87.83	1.00	1.00	$ 87.83	$ 87.83	$ 175.66
multi-use path	0	l.m.	195.17			$ -	$ -	$ -
restoration	10	sq.m.	12.00	5.00	5.00	$ 60.00	$ 60.00	$ 120.00
drainage allowance	1	l.m.	600.00	1.00		$ 600.00	$ -	$ 600.00
lighting allowance	1	l.m.	122.05	0.50	0.50	$ 61.03	$ 61.03	$ 122.05
pavement markings	6	l.m.	2.80	3.00	3.00	$ 8.40	$ 8.40	$ 16.80
Total for 12 m Collector Road Section EE		l.m.				$ 1,339.20	$ 739.20	$ 2,078.40
					use:	**$ 1,340.00**	**$ 740.00**	

Section FF is local - no estimate

Section GG - Collector Road

14.0 metre pavement, 22 metre R/W, 1 sidewalk, Noise fence against highway

12m r/w to developer; 10m r/w to DCC
8m pvmt to dev; 6 m pvmt to DCC

	Qty	unit	unit cost	Qty to Dev	Qty to DCC	cost to dev	cost to DCC	Total
clear & grub	24	sq.m.	3.00	13.00	12.00	$ 39.00	$ 36.00	$ 72.00
excavation	6	cu.m.	20.23	3.30	2.70	$ 66.76	$ 54.62	$ 121.38
sub-grade fill & preparation	6	cu.m.	18.67	3.30	2.70	$ 61.61	$ 50.41	$ 112.02
sub-base gravel	10.5	tonne	23.00	5.80	4.70	$ 133.40	$ 108.10	$ 241.50
base gravel	4.2	tonne	28.50	2.30	1.90	$ 65.55	$ 54.15	$ 119.70
asphalt	3.5	tonne	112.00	1.90	1.60	$ 212.80	$ 179.20	$ 392.00
median	0	l.m.	60.00			$ -	$ -	$ -
new curb	2	l.m.	53.27	1.00	1.00	$ 53.27	$ 53.27	$ 106.54
new sidewalk	1	l.m.	87.83	1.00	0.00	$ 87.83	$ -	$ 87.83
shoulder	1	l.m.	11.00	0.00	0.00	$ -	$ -	$ 11.00
restoration	10	sq.m.	12.00	5.50	4.50	$ 66.00	$ 54.00	$ 120.00
drainage allowance	1	l.m.	600.00	1.00	0.00	$ 600.00	$ -	$ 600.00
noise fence	1	l.m.	800.00	0.00	1.00	$ -	$ 800.00	$ 800.00
lighting allowance	1	l.m.	122.05	0.50	0.50	$ 61.03	$ 61.03	$ 122.05
pavement markings	6	l.m.	2.80	3.00	3.00	$ 8.40	$ 8.40	$ 16.80
Total for 14 m Collector Road Section GG		l.m.				$ 1,455.65	$ 1,459.18	$ 2,922.82
					use:	**$ 1,460.00**	**$ 1,460.00**	

Section HH - Divided Arterial Road

16.2 total metre pavement, 30 metre R/W, 1 sidewalk, multi-use path, ped lights

	Qty	unit	unit cost	Qty to Dev	Qty to DCC	cost to dev	cost to DCC	Total
clear & grub	32	sq.m.	3.00		32	$ -	$ 96.00	$ 96.00
excavation	8	cu.m.	20.23		8	$ -	$ 161.84	$ 161.84
sub-grade fill & preparation	8	cu.m.	18.67		8	$ -	$ 149.36	$ 149.36
sub-base gravel	12.2	tonne	23.00		12.2	$ -	$ 280.60	$ 280.60
base gravel	5	tonne	28.50		5	$ -	$ 142.50	$ 142.50
asphalt	6.3	tonne	112.00		6.3	$ -	$ 705.60	$ 705.60
median	1	l.m.	434.15		1	$ -	$ 434.15	$ 434.15
new curb	4	l.m.	53.27		4	$ -	$ 213.08	$ 213.08
new sidewalk	1	l.m.	87.83		1	$ -	$ 87.83	$ 87.83
multi-use path	1		195.17		1	$ -	$ 195.17	$ 195.17
restoration	10	sq.m.	12.00		10	$ -	$ 120.00	$ 120.00
drainage allowance	1	l.m.	600.00		1	$ -	$ 600.00	$ 600.00
lighting allowance	1	l.m.	122.05		1	$ -	$ 122.05	$ 122.05
Ped light allowance	1	l.m.	61.03		1	$ -	$ 61.03	$ 61.03
pavement markings	6	l.m.	2.80		6	$ -	$ 16.80	$ 16.80

								$ -
Total for 16.2 m Divided Collector Road Section HH		l.m.				$ -	$ 3,386.01	$ 3,386.01
					use:	**$ -**	**$ 3,400.00**	

Section II - Divided Arterial Road
16.2 total metre pavement, 30 metre R/W, 2 sidewalks

	Qty	unit	unit cost	Qty to Dev	Qty to DCC	cost to dev	cost to DCC	Total
clear & grub	32	sq.m.	3.00		32	$ -	$ 96.00	$ 96.00
excavation	8	cu.m.	20.23		8	$ -	$ 161.84	$ 161.84
sub-grade fill & preparation	8	cu.m.	18.67		8	$ -	$ 149.36	$ 149.36
sub-base gravel	12.2	tonne	23.00		12.2	$ -	$ 280.60	$ 280.60
base gravel	5	tonne	28.50		5	$ -	$ 142.50	$ 142.50
asphalt	6.3	tonne	112.00		6.3	$ -	$ 705.60	$ 705.60
median	1	l.m.	434.15		1	$ -	$ 434.15	$ 434.15
new curb	4	l.m.	53.27		4	$ -	$ 213.08	$ 213.08
new sidewalk	2	l.m.	87.83		2	$ -	$ 175.66	$ 175.66
multi-use path	0		195.17		0	$ -	$ -	$ -
restoration	10	sq.m.	12.00		10	$ -	$ 120.00	$ 120.00
drainage allowance	1	l.m.	600.00		1	$ -	$ 600.00	$ 600.00
lighting allowance	1	l.m.	122.05		1	$ -	$ 122.05	$ 122.05
Ped light allowance	0	l.m.	61.03		0	$ -	$ -	$ -
pavement markings	6	l.m.	2.80		6	$ -	$ 16.80	$ 16.80
								$ -
Total for 16.2 m Divided Collector Road Section II		l.m.				$ -	$ 3,217.64	$ 3,217.64
					use:	**$ -**	**$ 3,300.00**	

Section JJ - Local Road at future redevelopment
8.5 metre pavement, 13.5 metre R/W, 1 sidewalk — all to developer

	Qty	unit	unit cost	Qty to Dev	Qty to DCC	cost to dev	cost to DCC	Total
clear & grub	16	sq.m.	3.00	16		$ 48.00	$ -	$ 48.00
excavation	4.5	cu.m.	20.23	4.5		$ 91.04	$ -	$ 91.04
sub-grade fill & preparation	4.5	cu.m.	18.67	4.5		$ 84.02	$ -	$ 84.02
sub-base gravel	7.1	tonne	23.00	7.1		$ 163.30	$ -	$ 163.30
base gravel	3.6	tonne	28.50	3.6		$ 102.60	$ -	$ 102.60
asphalt	2.2	tonne	112.00	2.2		$ 246.40	$ -	$ 246.40
median	0	l.m.	60.00	0		$ -	$ -	$ -
new curb	2	l.m.	53.27	2		$ 106.54	$ -	$ 106.54
new sidewalk	1	l.m.	87.83	1		$ 87.83	$ -	$ 87.83
multi-use trail	0	l.m.	107.35	0		$ -		$ -
shoulder	0	l.m.	11.00	0		$ -	$ -	$ -
restoration	10	sq.m.	12.00	10		$ 120.00	$ -	$ 120.00
drainage allowance	1	l.m.	600.00	1		$ 600.00	$ -	$ 600.00
enhanced ditch	1	l.m.	100.00	1		$ 100.00	$ -	$ 100.00
lighting allowance	1	l.m.	122.05	1		$ 122.05	$ -	$ 122.05
pavement markings	1	l.m.	2.80	1		$ 2.80	$ -	$ 2.80
Total for 8.5 m Local Road Section JJ		l.m.				$ 1,874.57	$ -	$ 1,874.57
					use:	**$ 1,850.00**	**$ -**	

Section KK - Collector Road
12 metre pavement, 24 metre R/W, 1 sidewalk, 1 path, ditch on north

12m r/w to developer; 12m r/w to DCC
6.0m pvmt to dev; 6.0 m pvmt to DCC

	Qty	unit	unit cost	Qty to Dev	Qty to DCC	cost to dev	cost to DCC	Total
clear & grub	26	sq.m.	3.00	13	13.00	$ 39.00	$ 39.00	$ 78.00
excavation	5	cu.m.	20.23	2.5	2.50	$ 50.58	$ 50.58	$ 101.15
sub-grade fill & preparation	5	sq.m.	18.67	2.5	2.50	$ 46.68	$ 46.68	$ 93.35
sub-base gravel	9.5	tonne	23.00	4.75	4.75	$ 109.25	$ 109.25	$ 218.50
base gravel	3.9	tonne	28.50	1.95	1.95	$ 55.58	$ 55.58	$ 111.15
asphalt	3.1	tonne	112.00	1.55	1.55	$ 173.60	$ 173.60	$ 347.20
median	0	l.m.	60.00			$ -	$ -	$ -
new curb	2	l.m.	53.27	1		$ 53.27	$ -	$ 106.54
new sidewalk	2	l.m.	87.83	1		$ 87.83	$ -	$ 175.66
path	0	l.m.	50.00		1.00	$ -	$ 50.00	$ -
restoration	10	sq.m.	12.00	5	5.00	$ 60.00	$ 60.00	$ 120.00
drainage allowance	1	l.m.	600.00	1		$ 600.00	$ -	$ 600.00
enhanced ditch	1	l.m.	100.00		1.00	$ -	$ 100.00	$ 100.00
lighting allowance	1	l.m.	122.05	0.5	0.50	$ 61.03	$ 61.03	$ 122.05
pavement markings	6	l.m.	2.80	3	3.00	$ 8.40	$ 8.40	$ 16.80
Total for 12 m Collector Road Section KK		l.m.				$ 1,345.20	$ 754.10	$ 2,190.40
					use:	**$ 1,400.00**	**$ 700.00**	

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ROAD CONSTRUCTION COST ESTIMATES

Anniedale-Tynehead NCP
Class D Cost Estimate

Road Construction Cost Summary

Description		Section	Cost		
88th Avenue - 168th Street to 192nd Street			$	11,164,502.18	25% NCP
92nd Avenue - 180 Street to Harvie Road		II	$	16,861,631.54	All to DCC
96th Avenue - 168th Street to 176 Street (Highway 15)			$	-	Complete
168th Street - 88th Avenue to 96th Avenue			$	5,598,338.59	50% NCP
180th Street - 88th Ave. to 92nd Ave. & GEW to 96th Ave.			$	8,521,704.36	
180th Street - 92nd Ave. to GEW		HH	$	4,571,450.00	All to DCC
184th Street - 92th Avenue to 80th Avenue			$	12,750,000.00	50% NCP
192nd Street - 88th Avenue to 92nd Avenue			$	5,573,100.00	
Highway 1 at 192 Street			$	5,000,000.00	provided by Surrey April 21, 2010
Highway 15 at Golden Ears Way	$43 mill		$	10,750,000.00	25% Share to Arterial Rds
Total for Arterials			**$**	**80,790,726.67**	
90th Avenue - 184 Street to 187th Street		KK	$	600,600.00	DCC Component
92nd Avenue - Bothwell to 172 and 175 to Highway 15		BB	$	544,830.00	DCC Component
92nd Avenue - 176 Street to 180 Street			$	902,538.00	Upsizing ONLY
92nd Avenue - 172 Street to 175 Street		CC	$	613,470.00	DCC Component
Lakiotis Ridge Drive - 92 Avenue to 180 Street		FF	$	-	Local Road REMOVED - no estimate
93rd Avenue/94A Avenue - 169th Street to 184th Avenue			$	2,766,909.60	Upsizing ONLY
94A Avenue - 168th Street to 16900 Block		AA	$	199,368.00	DCC Component
95th Avenue - 174th Street to 175th Street			$	321,204.00	Upsizing ONLY
95th Avenue - 172nd Street to 174th Street		DD	$	54,600.00	DCC Component
96th Avenue - 177A Street to 181A Street			$	527,436.00	Upsizing ONLY
Industrial Rd - 181A Street to 188th Street		GG	$	3,188,640.00	DCC Component
97th Avenue - 177A Street to 180th Street			$	376,740.00	Upsizing ONLY
172 Street - 92nd Avenue to 96th Avenue			$	602,784.00	Upsizing ONLY
173A Street - 92nd Avenue to 96th Avenue			$	602,784.00	Upsizing ONLY
175th Street - 92nd Avenue to 92A Avenue			$	122,522.40	Upsizing ONLY
175th Street - 92A Avenue to 93A Avenue		EE	$	207,792.00	DCC Component
177 Street - 92 Avenue to 93A Avenue			$	210,974.40	Upsizing ONLY
177A Street - 96 Avenue to 97 Avenue			$	190,008.00	Upsizing ONLY
180 Street - 96 Avenue to 97 Avenue			$	113,022.00	Upsizing ONLY
184 Street - 92A Avenue to 94A Avenue			$	427,518.00	Upsizing ONLY
188 Street - 90A Avenue to 93 Avenue			$	742,014.00	Upsizing ONLY
Industrial Road overpass at GEW			$	3,360,000.00	
94th Avenue overpass at Highway 15			$	4,670,000.00	
Total for Collectors			**$**	**21,345,754.40**	

Notes:
Special section JJ is local and not included in program.
Special section LL is local and not included in program.

Anniedale-Tynehead NCP
Class D Cost Estimate

88th Avenue - 168th Street to 192nd Street

Arterial Road (19m) URBAN SECTION
Assume LT lanes at signalized intersections
Signals at 4 intersections

Cost summary	unit	qty	unit cost	Cost	
Arterial Road	m	4800	3,700.00	$ 17,760,000.00	
LT lanes and tapers	m	600	1,300.00	$ 780,000.00	
preload plus surcharge	m	3700	1,700.00	$ 6,290,000.00	
Signals	each	4	180,690.50	$ 722,762.00	
Culvert crossings	each	2	500,000.00	$ 1,000,000.00	
Roundabout	LS		2,000,000.00	$ -	
Sub-total estimated cost				**$26,552,762.00**	
Contingency at 30%				$ 7,965,828.60	
Sub-total estimated cost				**$34,518,590.60**	
Administration at 5%				$ 1,725,929.53	
Engineering at 15%				$ 5,177,788.59	
Total Estimated Cost				**$41,422,308.72**	
Property requirements					
Development land	0.77	hectares	2,470,000.00	$ 1,901,900.00	3600m @ 10m
ALR land	3.6	hectares	370,500.00	$ 1,333,800.00	1.1km @ 7 m
Sub-total Land				**$ 3,235,700.00**	
Total estimated cost with land				**$44,658,008.72**	
Total 25% MRN				**$11,164,502.18**	

Notes:
Additional cost for preload and surcharge included
No allowance for enviromnmental
Signals at 180, 184, 192
Property area and unit costs per City

Anniedale-Tynehead NCP
Class D Cost Estimate

92nd Avenue - 180 Street to Harvie Road

20m Arterial Road URBAN SECTION
Assume LT lanes at signalized intersections
Signals at 0 intersections

Cost summary	unit	qty	unit cost	Cost		
Arterial Road	m	2000	3300	$ 6,600,000.00		
LT lanes and tapers	m		1300	$ -	incl. in five lane section	
Culvert croissings	each	1	500000	$ 500,000.00		
Signals	each	3	180690.5	$ 542,071.50		
Sub-total estimated cost				**$ 7,642,071.50**		
Contingency at 30%				$ 2,292,621.45		
Sub-total estimated cost				**$ 9,934,692.95**		
Administration at 5%				$ 496,734.65		
Engineering at 15%				$ 1,490,203.94		
Total Estimated Cost				**$11,921,631.54**		
Property requirements						
Development land		2 hectares	2,470,000.00	$ 4,940,000.00		2000m @ 10m
ALR land		0 hectares	370,500.00	$ -		1.1km @ 7 m
Sub-total Land				**$ 4,940,000.00**		
Total estimated cost with land				**$16,861,631.54**		

Notes:
No allowance for enviromnmental or land acquisition
Signals at 180, 184, 192
Property area assumes 2 metre widening continuous

Anniedale-Tynehead NCP
Class D Cost Estimate

96th Avenue - 168th Street to 176 Street (Highway 15) **COMPLETED**
See Doug M email May 16, 2011

19 m Arterial Road URBAN SECTION
Assume LT lanes at signalized intersections
Signals at 3 intersections

Cost summary	unit	qty	unit cost		Cost	
Arterial Road	m	1500		$	-	
LT lanes and tapers	m	0		$	-	included in five lane section
Signals	each	4		$	-	
Sub-total estimated cost				**$**	**-**	
Contingency at 30%				$	-	
Sub-total estimated cost				**$**	**-**	
Administration at 5%				$	-	
Engineering at 15%				$	-	
Total Estimated Cost				**$**	**-**	
Property requirements						
Development land		1.01 hectares		$	-	1450m @ 7m
ALR land		0 hectares		$	-	
Sub-total Land				**$**	**-**	
Total estimated cost with land				**$**	**-**	

Notes:
Allowances added to unit costs for preload and signals
No allowance for enviromnmental
Signals at 168, 172, 173A, 175A
Property area assumes 7 metre widening continuous

Anniedale-Tynehead NCP
Class D Cost Estimate

168th Street - 88th Avenue to 96th Avenue

20m Arterial Road URBAN SECTION
Assume LT lanes at signalized intersections
Signals at 0 intersections

Cost summary	unit	qty	unit cost	Cost	
Arterial Road	m	1600	3700	$ 5,920,000.00	
LT lanes and tapers	m	0	1300	$ -	included in five lane section
Signals	each	1	180690.5	$ 180,690.50	
Sub-total estimated cost				**$ 6,100,690.50**	
Contingency at 30%				$ 1,830,207.15	
Sub-total estimated cost				**$ 7,930,897.65**	
Administration at 5%				$ 396,544.88	
Engineering at 15%				$ 1,189,634.65	
Total Estimated Cost				**$ 9,517,077.18**	

Property requirements					
Development land	0.56	hectares	2,470,000.00	$ 1,383,200.00	800m @ 7m
ALR land	0.8	hectares	370,500.00	$ 296,400.00	800m @ 10 m
Sub-total Land				**$ 1,679,600.00**	
Total estimated cost with land				**$11,196,677.18**	
Total 50% CoS				$ 5,598,338.59	

Notes:
Additional cost for preload and surcharge included
No allowance for enviromnmental
Signal at 94A
Property area and unit costs per City

Anniedale-Tynehead NCP
Class D Cost Estimate

180th Street - 88th Ave. to 92nd Ave. & GEW to 96th Ave.

20m Arterial Road URBAN SECTION - full width per Section HH
Assume LT lanes at signalized intersections
Signals at 2 intersections

Cost summary	unit	qty	unit cost	Cost		
Arterial Road	km	950	3700	$ 3,515,000.00		
LT lanes and tapers	m	0	1300	$ -	included in five lane section	
Preload	m	500	1700	$ 850,000.00		
Signals	each	2	180,690.50	$ 361,381.00		
Sub-total estimated cost				**$4,726,381.00**		
Contingency at 30%				$ 1,417,914.30		
Sub-total estimated cost				**$6,144,295.30**		
Administration at 5%				$ 307,214.77		
Engineering at 15%				$ 921,644.30		
Total Estimated Cost				**$7,373,154.36**		
Property requirements						
Development land		0.315 hectares	2,470,000.00	$ 778,050.00		450m @ 7m
ALR land		1 hectares	370,500.00	$ 370,500.00		500m @ 20 m
Sub-total Land				**$1,148,550.00**		
Total estimated cost with land				**$8,521,704.36**		

Notes:
Additional cost for preload and surcharge included
No allowance for enviromnmental
Property area and unit costs per City

Anniedale-Tynehead NCP
Class D Cost Estimate

180th Street - 92nd Ave. to GEW

30m Divided Arterial Road SPECIAL URBAN SECTION HH
Assume LT lanes at signalized intersections
Signals at 2 intersections

			Developer		DCC Cost		
Cost summary	unit	qty	unit cost	Cost			
Arterial Road	km	650	0	$ -	3400	$ 2,210,000.00	
LT lanes and tapers	m	0	1300	$ -	1300	$ -	included in five lane section
Preload	m	0	1700	$ -	1700	$ -	
Signals	each	0	180,690.50	$ -	180,690.50	$ -	
Sub-total estimated cost				**$-**		**$2,210,000.00**	
Contingency at 30%				$ -		$ 663,000.00	
Sub-total estimated cost				**$-**		**$2,873,000.00**	
Administration at 5%				$ -		$ 143,650.00	
Engineering at 15%				$ -		$ 430,950.00	
Total Estimated Cost				**$-**		**$3,447,600.00**	
Property requirements							
Development land		0.455 hectares		$ -	2470000	$ 1,123,850.00	650m @ 20 m
ALR land		0 hectares	370,500.00	$ -	370500	$ -	0m @ 20 m
Sub-total Land				**$-**		**$1,123,850.00**	
Total estimated cost with land				**$-**		**$4,571,450.00**	

Notes:
Additional cost for preload and surcharge included
No allowance for enviromnmental
Property area and unit costs per City

Anniedale-Tynehead NCP
Class D Cost Estimate

184th Street - 92th Avenue to 80th Avenue

20m Arterial Road URBAN SECTION
Assume LT lanes at signalized intersections
Signals at 1 intersections

Cost summary	unit	qty	unit cost	Cost		
Arterial Road	m	550	3700	$ 2,035,000.00		
LT lanes and tapers	m	0	1300	$ -	included in five lane section	
Preload	m	150	1700	$ 255,000.00		
Signals	each	0	180,690.50	$ -		
Sub-total estimated cost				**$2,290,000.00**		
Contingency at 30%				$ 687,000.00		
Sub-total estimated cost				**$2,977,000.00**		
Administration at 5%				$ 148,850.00		
Engineering at 15%				$ 446,550.00		
Total Estimated Cost				**$3,572,400.00**		
Property requirements						
Development land		0 hectares	2,470,000.00	$ -		1100m @ 7m
ALR land		1 hectares	370,500.00	$ 370,500.00		500m @ 20 m
Sub-total Land				**$ 370,500.00**		
Total estimated cost with land				**$3,942,900.00**		

Notes:
Additional cost for preload and surcharge included
No allowance for enviromnmental
Property area and unit costs per City

Anniedale-Tynehead NCP
Class D Cost Estimate

192nd Street - 88th Avenue to 92nd Avenue

19m Arterial Road URBAN SECTION
Assume LT lanes at signalized intersections
Signals at 0 intersections

Cost summary	unit	qty	unit cost	Cost		
Arterial Road	m	850	3700	$ 3,145,000.00		
LT lanes and tapers	m	0	1300	$ -	incl. In five lane section	
Signals	each	0	180690.5	$ -		
Sub-total estimated cost				**$3,145,000.00**		
Contingency at 30%				$ 943,500.00		
Sub-total estimated cost				**$4,088,500.00**		
Administration at 5%				$ 204,425.00		
Engineering at 15%				$ 613,275.00		
Total Estimated Cost				**$4,906,200.00**		
Property requirements						
Development land	0.21	hectares	2,470,000.00	$ 518,700.00		300m @ 7m
ALR land	0.4	hectares	370,500.00	$ 148,200.00		550m @ 20 m
Sub-total Land				**$ 666,900.00**		
Total estimated cost with land				**$5,573,100.00**		

Notes:
Additional cost for preload and surcharge included
No allowance for enviromnmental
Property area and unit costs per City

Anniedale-Tynehead NCP
Class D Cost Estimate

90th Avenue - 184 Street to 187th Street

12m Collector Road SPECIAL URBAN SECTION KK
Assume LT lanes at signalized intersections
Signals at 0 intersections

				Developer		
Cost summary	unit	qty	unit cost	Cost		**DCC Cost**
Collector Road	m	550	1400	$ 770,000.00	700	$ 385,000.00
LT lanes and tapers	m	0	1300	$ -		$ -
Culvert crossings	each	0	500000	$ -	0	$ -
Signals	each	0	180690.5	$ -		$ -
Sub-total estimated cost				**$ 770,000.00**		**$385,000.00**
Contingency at 30%				$ 231,000.00		$ 115,500.00
Sub-total estimated cost				**$1,001,000.00**		**$500,500.00**
Administration at 5%				$ 50,050.00		$ 25,025.00
Engineering at 15%				$ 150,150.00		$ 75,075.00
Total Estimated Cost				**$1,201,200.00**		**$600,600.00**

Property requirements developer provided widenings

Notes:
No allowance for envirommnental or land acquisition

Anniedale-Tynehead NCP
Class D Cost Estimate

92nd Avenue - 172 Street to 175 Street

14m Collector Road URBAN SECTION
Assume LT lanes at signalized intersections
Signals at 0 intersections
ONLY development on north side of road

			Developer		DCC Cost	
Cost summary	unit	qty	unit cost	Cost	unit cost	Cost
Collector Road	m	650	1470	$ 955,500.00	605	$ 393,250.00
LT lanes and tapers	m		1300	$ -		$ -
Culvert croissings	each	1	500000	$ 500,000.00	0	$ -
Signals	each	0	180690.5	$ -		$ -
Sub-total estimated cost				**$1,455,500.00**		**$393,250.00**
Contingency at 30%				$ 436,650.00		$ 117,975.00
Sub-total estimated cost				**$1,892,150.00**		**$511,225.00**
Administration at 5%				$ 94,607.50		$ 25,561.25
Engineering at 15%				$ 283,822.50		$ 76,683.75
Total Estimated Cost				**$2,270,580.00**		**$613,470.00**

Notes:
No allowance for enviromnmental or land acquisition

Anniedale-Tynehead NCP
Class D Cost Estimate

92nd Avenue - 176 Street to 180 Street

14m Collector Road URBAN SECTION
Assume LT lanes at signalized intersections
Signals at 0 intersections

Cost summary	unit	qty	unit cost	Cost	
Collector Road	m	650	2300	$ 1,495,000.00	
Collector Road (10m)	m	0	2000	$ -	see special section BB
LT lanes and tapers	m		1300	$ -	
Culvert croissings	each	1	500000	$ 500,000.00	
Signals	each	0	180690.5	$ -	
Sub-total estimated cost				**$1,995,000.00**	
Contingency at 30%				$ 598,500.00	
Sub-total estimated cost				**$2,593,500.00**	
Administration at 5%				$ 129,675.00	
Engineering at 15%				$ 389,025.00	
Total Estimated Cost				**$3,112,200.00**	
Developer responible for 8.5m (71%) of 12m, 3m (29%) from upsizing				$ 902,538.00	
Property requirements	developer provided widenings				

Notes:
No allowance for enviromnmental or land acquisition

Anniedale-Tynehead NCP
Class D Cost Estimate

92nd Avenue - Bothwell to 172 and 175 to Highway 15

10m Collector Road SPECIAL URBAN SECTION BB
Assume LT lanes at signalized intersections
Signals at 0 intersections

			Developer		DCC Cost		
Cost summary	unit	qty	unit cost	Cost	unit cost	Cost	
Collector Road	m	350	1380	$ 483,000.00	635	$ 222,250.00	Bothwell to 171
Collector Road	m	200	1380	$ 276,000.00	635	$ 127,000.00	175 to Hwy 15
LT lanes and tapers	m		1300	$ -	1300	$ -	
Culvert crossings	each	0	500000	$ -	500000	$ -	
Signals	each	0	180690.5	$ -	180690.5	$ -	
Sub-total estimated cost				**$ 759,000.00**		**$349,250.00**	
Contingency at 30%				$ 227,700.00		$ 104,775.00	
Sub-total estimated cost				**$ 986,700.00**		**$454,025.00**	
Administration at 5%				$ 49,335.00		$ 22,701.25	
Engineering at 15%				$ 148,005.00		$ 68,103.75	
Total Estimated Cost				**$1,184,040.00**		**$544,830.00**	
Property requirements	developer provided widenings						

Notes:
No allowance for enviromnmental or land acquisition

Anniedale-Tynehead NCP
Class D Cost Estimate

Lakiotis Ridge Drive - 92 Avenue to 180 Street

14m Collector Road URBAN SECTION
Signals at 0 intersections

Cost summary	unit	qty	unit cost	Cost
Collector Road	m	900		$ -
LT lanes and tapers	m			$ -
Culvert croissings	each	1		$ -
Signals	each	0		$ -
Sub-total estimated cost				**$-**
Contingency at 30%				$ -
Sub-total estimated cost				**$-**
Administration at 5%				$ -
Engineering at 15%				$ -
Total Estimated Cost				**$-**

Property requirements developer provided widenings

Notes:
No allowance for enviromnmental or land acquisition

Anniedale-Tynehead NCP
Class D Cost Estimate

93rd Avenue/94A Avenue - 169th Street to 184th Avenue

Collector Road URBAN SECTION
Assume LT lanes at signalized intersections
Signals at 0 intersections

Cost summary	unit	qty	unit cost	Cost
Collector Road	m	3020	2300	$ 6,946,000.00
LT lanes and tapers	m	0	1300	$ -
Culverty crossings	each	3	500000	$ 1,500,000.00
Signals	each	0	180690.5	$ -
Sub-total estimated cost				**$ 8,446,000.00**
Contingency at 30%				$ 2,533,800.00
Sub-total estimated cost				**$10,979,800.00**
Administration at 5%				$ 548,990.00
Engineering at 15%				$ 1,646,970.00
Total Estimated Cost				**$13,175,760.00**
Developer responible for 11m (79%) of 14m, 3m (21%) from upsizing				$ 2,766,909.60
Property requirements	developer provided widenings			

Notes:
Allowances added to unit costs for preload and signals
No allowance for enviromnmental or land acquisition

Anniedale-Tynehead NCP
Class D Cost Estimate

94A Avenue - 168th Street to 16900 Block

Collector Road SPECIAL URBAN SECTION AA
Assume LT lanes at signalized intersections
Signals at 0 intersections

			Developer		DCC	
Cost summary	unit	qty	unit cost	Cost	unit cost	Cost
Collector Road	m	180	1420	$ 255,600.00	710	$ 127,800.00
LT lanes and tapers	m	0	1300	$ -	1300	$ -
Culverty crossings	each	0	500000	$ -	500000	$ -
Signals	each	0	180690.5	$ -	180690.5	$ -
Sub-total estimated cost				**$255,600.00**		**$127,800.00**
Contingency at 30%				$ 76,680.00		$ 38,340.00
Sub-total estimated cost				**$332,280.00**		**$166,140.00**
Administration at 5%				$ 16,614.00		$ 8,307.00
Engineering at 15%				$ 49,842.00		$ 24,921.00
Total Estimated Cost				**$398,736.00**		**$199,368.00**

Property requirements developer provided widenings

Notes:
Allowances added to unit costs for preload and signals
No allowance for enviromnmental or land acquisition

Anniedale-Tynehead NCP
Class D Cost Estimate

95th Avenue - 174th Street to 175th Street

12 Collector Road URBAN SECTION
Assume LT lanes at signalized intersections
Signals at 0 intersections

Cost summary	unit	qty	unit cost	Cost
Collector Road	m	100	2100	$ 210,000.00
LT lanes and tapers	m	0	1300	$ -
Culverty crossings	each	1	500000	$ 500,000.00
Signals	each	0	180690.5	$ -
Sub-total estimated cost				**$ 710,000.00**
Contingency at 30%				$ 213,000.00
Sub-total estimated cost				**$ 923,000.00**
Administration at 5%				$ 46,150.00
Engineering at 15%				$ 138,450.00
Total Estimated Cost				**$1,107,600.00**
Developer responible for 8.5m (71%) of 12m, 3m (29%) from upsizing				$ 321,204.00
Property requirements	developer provided widenings			

Notes:
Allowances added to unit costs for preload and signals
No allowance for enviromnmental or land acquisition

Anniedale-Tynehead NCP
Class D Cost Estimate

95th Avenue - 172nd Street to 174th Street

12 Collector Road SPECIAL URBAN SECTION DD
Assume LT lanes at signalized intersections
Signals at 0 intersections

			Developer		DCC	
Cost summary	unit	qty	unit cost	Cost	unit cost	Cost
Collector Road	m	500	2100	$ 1,050,000.00	70	$ 35,000.00
LT lanes and tapers	m	0	1300	$ -	1300	$ -
Culverty crossings	each	0	500000	$ -		$ -
Signals	each	0	180690.5	$ -	180690.5	$ -
Sub-total estimated cost				**$1,050,000.00**		**$35,000.00**
Contingency at 30%				$ 315,000.00		$ 10,500.00
Sub-total estimated cost				**$1,365,000.00**		**$45,500.00**
Administration at 5%				$ 68,250.00		$ 2,275.00
Engineering at 15%				$ 204,750.00		$ 6,825.00
Total Estimated Cost				**$1,638,000.00**		**$54,600.00**

Notes:
Allowances added to unit costs for preload and signals
No allowance for enviromnmental or land acquisition

Anniedale-Tynehead NCP
Class D Cost Estimate

96th Avenue - 177A Street to 181A Street

14m Collector Road URBAN SECTION
Assume LT lanes at signalized intersections
Signals at 0 intersections

Cost summary	unit	qty	unit cost	Cost
Collector Road	m	700	2300	$ 1,610,000.00
LT lanes and tapers	m	0	1300	$ -
Signals	each	0	180690.5	$ -
Sub-total estimated cost				**$1,610,000.00**
Contingency at 30%				$ 483,000.00
Sub-total estimated cost				**$2,093,000.00**
Administration at 5%				$ 104,650.00
Engineering at 15%				$ 313,950.00
Total Estimated Cost				**$2,511,600.00**
Developer responible for 11m (79%) of 14m, 3m (21%) from upsizing				$ 527,436.00
Property requirements	developer provided widenings			

Notes:
No allowance for enviromnmental or land acquisition

Anniedale-Tynehead NCP
Class D Cost Estimate

Industrial Rd - 181A Street to 188th Street

14m Service Collector Road SPECIAL URBAN SECTION GG
Assume LT lanes at signalized intersections
Signals at 0 intersections
ONLY development on one side of road

			Developer		DCC	
Cost summary	unit	qty	unit cost	Cost	unit cost	Cost
Collector Road	m	1400	1455	$ 2,037,000.00	1460	$ 2,044,000.00
LT lanes and tapers	m	0	1300	$ -	1300	$ -
Signals	each	0	180690.5	$ -		$ -
Sub-total estimated cost				**$2,037,000.00**		**$2,044,000.00**
Contingency at 30%				$ 611,100.00		$ 613,200.00
Sub-total estimated cost				**$2,648,100.00**		**$2,657,200.00**
Administration at 5%				$ 132,405.00		$ 132,860.00
Engineering at 15%				$ 397,215.00		$ 398,580.00
Total Estimated Cost				**$3,177,720.00**		**$3,188,640.00**

Notes:
No allowance for enviromnmental or land acquisition

Anniedale-Tynehead NCP
Class D Cost Estimate

97th Avenue - 177A Street to 180th Street

14m Collector Road URBAN SECTION
Assume LT lanes at signalized intersections
Signals at 0 intersections

Cost summary	unit	qty	unit cost	Cost
Collector Road	m	500	2300	$ 1,150,000.00
LT lanes and tapers	m	0	1300	$ -
Signals	each	0	180690.5	$ -
Sub-total estimated cost				**$1,150,000.00**
Contingency at 30%				$ 345,000.00
Sub-total estimated cost				**$1,495,000.00**
Administration at 5%				$ 74,750.00
Engineering at 15%				$ 224,250.00
Total Estimated Cost				**$1,794,000.00**
Developer responible for 11m (79%) of 14m, 3m (21%) from upsizing				$ 376,740.00
Property requirements	developer provided widenings			

Notes:
No allowance for enviromnmental or land acquisition

Anniedale-Tynehead NCP
Class D Cost Estimate

172 Street - 92nd Avenue to 96th Avenue

14m Collector Road URBAN SECTION
Assume LT lanes at signalized intersections
Signals at 0 intersections

Cost summary	unit	qty	unit cost	Cost	
Collector Road	m	800	2300	$ 1,840,000.00	
LT lanes and tapers	m	0	1300	$ -	
Signals	each	0	180,690.50	$ -	on intersecting streets
Sub-total estimated cost				**$1,840,000.00**	
Contingency at 30%				$ 552,000.00	
Sub-total estimated cost				**$2,392,000.00**	
Administration at 5%				$ 119,600.00	
Engineering at 15%				$ 358,800.00	
Total Estimated Cost				**$2,870,400.00**	
Developer responible for 11m (79%) of 14m, 3m (21%) from upsizing				$ 602,784.00	

Notes:
No allowance for enviromnmental
No land costs-developer dedication

Anniedale-Tynehead NCP
Class D Cost Estimate

173A Street - 92nd Avenue to 96th Avenue

14m Collector Road URBAN SECTION
Assume LT lanes at signalized intersections
Signals at 0 intersections

Cost summary	unit	qty	unit cost	Cost	
Collector Road	m	800	2300	$ 1,840,000.00	
LT lanes and tapers	m	0	1300	$ -	
Signals	each	0	180,690.50	$ -	on intersecting streets
Sub-total estimated cost				**$1,840,000.00**	
Contingency at 30%				$ 552,000.00	
Sub-total estimated cost				**$2,392,000.00**	
Administration at 5%				$ 119,600.00	
Engineering at 15%				$ 358,800.00	
Total Estimated Cost				**$2,870,400.00**	
Developer responible for 11m (79%) of 14m, 3m (21%) from upsizing				$ 602,784.00	

Notes:
No allowance for enviromnmental
No land costs-developer dedication

Anniedale-Tynehead NCP
Class D Cost Estimate

175th Street - 92nd Avenue to 92A Avenue

14m Collector Road URBAN SECTION
Assume no LT lanes at signalized intersections
Signals at 0 intersections

Cost summary	unit	qty	unit cost	Cost	
Collector Road	m	170	2200	$ 374,000.00	one sidewalk
LT lanes and tapers	m	0	1300	$ -	
Signals	each	0	180690.5	$ -	
Sub-total estimated cost				**$374,000.00**	
Contingency at 30%				$ 112,200.00	
Sub-total estimated cost				**$486,200.00**	
Administration at 5%				$ 24,310.00	
Engineering at 15%				$ 72,930.00	
Total Estimated Cost				**$583,440.00**	
Developer responible for 11m (79%) of 14m, 3m (21%) from upsizing				$ 122,522.40	

Notes:
No allowance for enviromnmental
No land costs-developer dedication

Anniedale-Tynehead NCP
Class D Cost Estimate

175th Street - 92A Avenue to 93A Avenue

12m Collector Road SPECIAL URBAN SECTION EE
Assume no LT lanes at signalized intersections
Signals at 0 intersections

			Developer		Parks + DCC	
Cost summary	unit	qty	unit cost	Cost	unit cost	Cost
Collector Road	m	180	1340	$ 241,200.00	740	$ 133,200.00
LT lanes and tapers	m	0	1300	$ -	1300	$ -
Signals	each	0	180690.5	$ -		$ -
Sub-total estimated cost				**$241,200.00**		**$133,200.00**
Contingency at 30%				$ 72,360.00		$ 39,960.00
Sub-total estimated cost				**$313,560.00**		**$173,160.00**
Administration at 5%				$ 15,678.00		$ 8,658.00
Engineering at 15%				$ 47,034.00		$ 25,974.00
Total Estimated Cost				**$376,272.00**		**$207,792.00**

Notes:
No allowance for enviromnmental
No land costs-developer dedication

Anniedale-Tynehead NCP
Class D Cost Estimate

177 Street - 92 Avenue to 93A Avenue

14m Collector Road URBAN SECTION
Assume LT lanes at signalized intersections
Signals at 0 intersections

Cost summary	unit	qty	unit cost	Cost
Collector Road	m	280	2300	$ 644,000.00
LT lanes and tapers	m	0	1300	$ -
Signals	each	0	180690.5	$ -
Sub-total estimated cost				**$ 644,000.00**
Contingency at 30%				$ 193,200.00
Sub-total estimated cost				**$ 837,200.00**
Administration at 5%				$ 41,860.00
Engineering at 15%				$ 125,580.00
Total Estimated Cost				**$1,004,640.00**
Developer responible for 11m (79%) of 14m, 3m (21%) from upsizing				$ 210,974.40

Notes:
No allowance for enviromnmental
No land costs-developer dedication

Anniedale-Tynehead NCP
Class D Cost Estimate

177A Street - 96 Avenue to 97 Avenue

Collector Road URBAN SECTION
Assume LT lanes at signalized intersections
Signals at 0 intersections

Cost summary	unit	qty	unit cost	Cost
Collector Road	m	200	2100	$ 420,000.00
LT lanes and tapers	m	0	1300	$ -
Signals	each	0	180690.5	$ -
Sub-total estimated cost				**$420,000.00**
Contingency at 30%				$ 126,000.00
Sub-total estimated cost				**$546,000.00**
Administration at 5%				$ 27,300.00
Engineering at 15%				$ 81,900.00
Total Estimated Cost				**$655,200.00**
Developer responible for 8.5m (71%) of 12m, 3m (29%) from upsizing				$ 190,008.00

Notes:
No allowance for enviromnmental
No land costs-developer dedication

Anniedale-Tynehead NCP
Class D Cost Estimate

180 Street - 96 Avenue to 97 Avenue

14m Collector Road URBAN SECTION
Assume LT lanes at signalized intersections
Signals at 0 intersections

Cost summary	unit	qty	unit cost	Cost
Collector Road	m	150	2300	$ 345,000.00
LT lanes and tapers	m	0	1300	$ -
Signals	each	0	180690.5	$ -
Sub-total estimated cost				**$345,000.00**
Contingency at 30%				$ 103,500.00
Sub-total estimated cost				**$448,500.00**
Administration at 5%				$ 22,425.00
Engineering at 15%				$ 67,275.00
Total Estimated Cost				**$538,200.00**
Developer responible for 11m (79%) of 14m, 3m (21%) from upsizing				$ 113,022.00

Notes:
No allowance for enviromnmental
No land costs-developer dedication

Anniedale-Tynehead NCP
Class D Cost Estimate

184 Street - 92A Avenue to 94A Avenue

Collector Road URBAN SECTION
Assume LT lanes at signalized intersections
Signals at 0 intersections

Cost summary	unit	qty	unit cost	Cost
Collector Road	m	450	2100	$ 945,000.00
LT lanes and tapers	m	0	1300	$ -
Signals	each	0	180690.5	$ -
Sub-total estimated cost				**$ 945,000.00**
Contingency at 30%				$ 283,500.00
Sub-total estimated cost				**$1,228,500.00**
Administration at 5%				$ 61,425.00
Engineering at 15%				$ 184,275.00
Total Estimated Cost				**$1,474,200.00**
Developer responible for 8.5m (71%) of 12m, 3m (29%) from upsizing				$ 427,518.00
Property requirements		0.28 hectares		

Notes:
No allowance for enviromnmental
No land costs-developer dedication

Anniedale-Tynehead NCP
Class D Cost Estimate

188 Street - 90A Avenue to 93 Avenue

14m Collector Road URBAN SECTION
Assume LT lanes at signalized intersections
Signals at 0 intersections

Cost summary	unit	qty	unit cost	Cost
Collector Road	m	550	2300	$ 1,265,000.00
LT lanes and tapers	m	0	1300	$ -
Culvert crossings	each	1	1000000	$ 1,000,000.00
Signals	each	0	180690.5	$ -
Sub-total estimated cost				**$2,265,000.00**
Contingency at 30%				$ 679,500.00
Sub-total estimated cost				**$2,944,500.00**
Administration at 5%				$ 147,225.00
Engineering at 15%				$ 441,675.00
Total Estimated Cost				**$3,533,400.00**
Developer responible for 11m (79%) of 14m, 3m (21%) from upsizing				$ 742,014.00
Property requirements		0.16 hectares		

Notes:
No allowance for enviromnmental
No land costs-developer dedication

APPENDIX B: SANITARY SEWER

- ☐ Tables 3.4-3 to 3.4.7
- ☐ Critical Section Profiles
- ☐ Sanitary Sewer Cost Estimates

APPENDIX B - SANITARY SEWER

TABLES 3.4.3 TO 3.4.7

Table 3.4-3

Phase	Description	Note	Ref No.	DR-Class	Service Catchment	Area (ha)	Population	ADWF (L/s)	PDWF (L/s)	PWWF (L/s)	Equiv. Pipe Dia. (mm)	Initial Main Dia. (actual) (mm)	Initial Main Dia. (nominal) (mm)	Twinned Main Dia. (actual) (mm)	Twinned Main Dia. (nominal) (mm)	Pipe Length (m)	Force Main Velocity (m/s)	Head Loss Gradient	Friction Loss (m)	PS Elevation (m)	Static Head (m)	TDH (m)	TDH (psi)	Estimated Pump Hydraulic Power (kW)	Estimated Pump Brake Power (hp)	Estimated Pump Brake Power (kW)
Phase 1	Tynehead Trunk		1-1		T(p)	54.5	3307	11.8	49.3	54.4	375	375	375			355										
	Tynehead FM		1-2	13.5	T	121.0	6661	25.4	88.6	102.3	343	343	400			835	1.1	0.4%	3.4							
	Tynehead - Anniedale FM	Interim	1-3	13.5	T	121.0	6661	25.4	88.6	102.3	343	343	400			980	1.1	0.4%	4.0							
	South Port Kells FM	Interim	1-4	13.5	T	121.0	6661	25.4	88.6	102.3	343	343	400			1150	1.1	0.4%	4.7							
	Tynehead Pump Station (172 St.)		-		T	121.0	6661	25.4	88.6	102.3									12.2	1.2	61.3	73.5	104.4	73.8	202.0	105.4
	South Port Kells Trunk		1-5		T	121.0	6661	25.4	88.6	102.3	528	528	600			800										
Phase 2	Anniedale A Trunk		2-1		A1+A3+B1(p)	88.2	6629	26.9	84.1	95.5	375	375	375			1000										
	Anniedale A FM		2-2	17	A1+A3+B1	105.1	8082	32.7	99.7	113.3	356	356	400			2140	1.1	0.4%	8.9							
	Anniedale B4 Trunk - 1		2-3		A2(p)+B4	35.3	3351	13.6	46.2	50.8	375	375	375			265										
	Anniedale B4 Trunk - 2		2-4		A2(p)+B4	56.3	5319	21.5	69.4	76.7	375	375	375			390										
	Anniedale B3 Trunk - 2		2-5		B3(p)	19.6	1864	7.6	19.6	24.7	300	300	300			690										
	Anniedale B3 Trunk - 3		2-6		B4(p)	22.7	2131	8.6	22.7	28.1	375	375	375			135										
	Anniedale B4 FM		2-7	13.5	A2+B4	79.0	7450.0	30.1	92.1	104.8	343	343	400			200	1.1	0.4%	0.9							
	Tynehead - Anniedale FM	Twin	2-8	13.5	A2+B4+T	200.0	14111	55.5	180.7	207.1	548	343	400	428	500	980	**0.9**	0.2%	1.5							
	South Port Kells FM	Twin	2-9	13.5	A+B1+B4+T	305.1	22193	88.2	280.4	320.4	654	343	400	557	650	1150	1.0	0.1%	1.7							
	Anniedale Pump Station (187 St.)		-		A1+A3+B1	105.1	8082	32.7	99.7	113.3									10.6	18.2	44.3	54.9	77.9	61.0	166.9	87.1
	Anniedale B4 Pump Station (176 St.)		-		A2+B4	79.0	7450	30.1	92.1	104.8									4.1	1.7	60.8	64.9	92.1	66.7	182.5	95.3
	Tynehead Pump Station (172 St.)		-		T	121.0	6661	25.4	88.6	102.3									6.6	1.2	61.3	67.9	96.5	68.2	186.6	97.4
Phase 3	Anniedale B3 Trunk - 1		3-1		B3	46.1	3224	13.1	44.6	50.6	300	300	300			220										
	Anniedale B3 Trunk - 2		-		B3 + B4(p)	65.8	5088	20.6	66.7	75.3	300	300	300			690										
	Anniedale B3 Trunk - 3		-		B3 + B4(p)	68.8	5355	21.7	69.8	78.7	375	375	375			135										
	Anniedale B4 FM		-	13.5	A2+B3+B4	125.1	10674	43.2	126.6	142.8	343	343	400			200	1.5	0.8%	1.5							
	Tynehead - Anniedale FM		-	13.5	A2+B3+B4+T	246.1	17335	68.6	215.2	245.1	548	343	400	428	500	980	1.0	0.2%	2.1							
	South Port Kells FM		-	13.5	A+B1+B3+B4+T	351.2	25417	101.3	314.9	358.4	654	343	400	557	650	1150	1.1	0.2%	2.1							
	Anniedale Pump Station (187 St.)		-		A1+A3+B1	105.1	8082	32.7	99.7	113.3									11.0	18.2	44.3	55.3	78.5	61.4	168.1	87.7
	Anniedale B4 Pump Station (176 St.)		-		A2+B3+B4	125.1	10674	43.2	126.6	142.8									5.7	1.7	60.8	66.5	94.4	93.1	254.8	133.0
	Tynehead Pump Station (172 St.)		-		T	121.0	6661	25.4	88.6	102.3									7.6	1.2	61.3	68.9	97.8	69.1	189.2	98.8
Phase 4	Anniedale B2 Trunk -1		4-1		B2(p)	39.0	2616	8.7	39.7	43.6	525	525	525			890										
	Anniedale B2 Trunk -2		4-2		B2(p)	49.3	3433	12.2	50.8	56.1	600	600	600			190										
	Anniedale B2 FM	Interim	4-3	15.5	B2	54.5	3621	12.8	52.4	58.4	236	236	250			1320	1.3	0.9%	11.9							
	Anniedale B FM	Interim	4-4	15.5	B2	54.5	3621	12.8	52.4	58.4	236	236	250			850	1.3	0.9%	7.7							
	Tynehead - Anniedale FM		-	13.5	A2+B2+B3+B4+T	300.6	20956	81.4	267.6	303.5	548	343	400	428	500	980	1.3	0.3%	3.1							
	South Port Kells FM		-	13.5	A+B+T	405.7	29038	114.1	367.3	416.8	654	343	400	557	650	1150	1.2	0.2%	2.7							
	Anniedale Pump Station (187 St.)		-		A1+A3+B1	105.1	8082	32.7	99.7	113.3									11.6	18.2	44.3	55.9	79.4	62.2	170.1	88.8
	Anniedale B2 Pump Station (184 St.)		-		B2	54.5	3621	12.8	52.4	58.4									25.4	12.0	50.5	75.9	107.8	43.5	119.0	62.1
	Anniedale B4 Pump Station (176 St.)		-		A2+B3+B4	125.1	10674	43.2	126.6	142.8									7.3	1.7	60.8	68.1	96.8	95.4	261.2	136.3
	Tynehead Pump Station (172 St.)		-		T	121.0	6661	25.4	88.6	102.3									9.2	1.2	61.3	70.5	100.2	70.8	193.8	101.1
Phase 5	Anniedale B2 Trunk		-		B2(p) +P	210.0	11216	8.7	153.8	155.9	525	525	525			890										
	Anniedale B2 Trunk		-		B2(p) +P	220.3	12033	11.8	176.9	182.0	600	600	600			190										
	Port Kells FM		5-1	32.5	P	171.0	8600	34.8	105.2	127.4	380	380	400			530	1.1	0.4%	2.0							
	Anniedale B2 FM	Twin	5-2	15.5	B2+P	225.5	12221	12.8	179.8	185.8	460	236	250	395	450	1320	1.1	0.3%	3.9							
	Anniedale B FM	Twin	5-3	15.5	B2+P	225.5	12221	12.8	179.8	185.8	460	236	250	395	450	850	1.1	0.3%	2.5							
	Tynehead - Anniedale FM		-	13.5	A2+B2+B3+B4+P+T	471.6	29556	81.4	395.0	430.9	548	343	400	428	500	980	**1.8**	0.6%	5.8							
	South Port Kells FM		-	13.5	A+B+P+T	576.7	37638	114.1	494.7	544.2	654	343	400	557	650	1150	**1.6**	0.4%	4.5							
	South Port Kells Trunk				A+B+P+T	576.7	37638	114.1	494.7	544.2	600	600	600			800										
	Anniedale Pump Station (187 St.)		-		A1+A3+B1	105.1	8082	32.7	99.7	113.3									13.4	18.2	44.3	57.7	81.9	64.1	175.5	91.6
	Anniedale B2 Pump Station (184 St.)		-		B2+P	225.5	12221	12.8	179.8	185.8									16.8	12.0	50.5	67.3	95.6	122.7	335.7	175.2
	Anniedale B4 Pump Station (176 St.)		-		A2+B3+B4	125.1	10674	43.2	126.6	142.8									11.9	1.7	60.8	72.7	103.2	101.8	278.6	145.4
	Port Kells Pump Station (189 St.)		-		P	171.0	8600	34.8	105.2	127.4									2.0		13.4	15.4	21.8	19.2	52.6	27.5
	Tynehead Pump Station (172 St.)		-		T	121.0	6661	25.4	88.6	102.3									13.8	1.2	61.3	75.1	106.6	75.4	206.2	107.7

Notes:
- Pipe Flows & Friction losses estimated using PWWF
- Pump Hydraulic Power Requirement estimated using PWWF and TDH
- Pump Brake Horse Power Requirements estimated using pump efficiency of 70%
- Pipe Design Capacity Based on Pipe Flow Depth at 70% of pipe diameter (83.2% of Pipe Full Capacity) for trunks
- Population and Areas calculated from information provided by the City of Surrey
- Per capita demand of 350 L/cap/day used
- Peaking Factor determined by Harmons Equation
- I&I flows based on 11,200 L/ha/day
- Bold red text indicates FM velocities < 1.0 m/s or > 1.6 m/s
- As the landuse of the Port Kells area has not been finalized at this time, any infrastructure affected by flow from the Port Kells area should be reviewed at the detailed design stage
- 'Tynehead - Anniedale B' and 'South Port Kells' forcemains may require upgrades with additional forcemains or alternate sizes in Phase 5 to minimize power requirements at 184 St Pump Station.

Service Catchment Abbreviations

A1	Anniedale A - West 1
A2	Anniedale A - West 2
A3	Anniedale A - East 1
A	Anniedale A - Total
B1	Anniedale B1
B2	Anniedale B2
B3	Anniedale B3
B4	Anniedale B4
B	Anniedale B - Total
T	Tynehead
P	Port Kells
(p)	partial from catchment

Table 3.4-4

Unit Demand 350 L/person/day
Infiltration *0.130* L/s/ha *11200 L/ha/day*
Manning's Coefficient (n) *0.013*

Project: Anniedale Tynehead NCP
Scenario: NCP - December 2010 Landuse
Client: City of Surrey
USL Job: 1072.0173.01

172nd Street Pump Station Catchment

Development Area: Tynehead

Sub Catchment	US Node	DS Node	Catchment Details					Flow Details									Pipe Design																
								Point Loads		Average Dry Weather Flow		Peak Dry Weather Flow		Infiltration Flow		PWWF	Pipe Design							US Node Elevation			DS Node Elevation			Depth to pipe invert (m)			
			Area (ha)	Zoning	Population Density (ppha) [1]	Parcel Population	Total Population	(L/s)	Accum. (L/s)	Acc. Popl'n	Flow (L/s)	Peak Factor	Flow (L/s)	Accum. Area (ha)	Flow (L/s)	(L/s)	Length (m)	Assumed Grade [2]	Size (mm)	Design Guideline Capacity [3] (L/s)	Qdes / Qcap [3] (%)	Ddes / Dcap [3] (%)	Velocity [4] (m/s)	Est. Rim	Con. [5] Rim	Est. Invert	Est. Rim	Con. [5] Rim	Est. Invert	US	Con. [5] US	DS	Con. [5] DS
South-East			0.65	*NA*	*0*	*0*																											
South-East			1.05	*RM-10*	*114*	*120*																											
South-East	**105**	104	1.7				*120*	0.0	0.0	120	0.5	4.22	2.0	1.7	0.2	2.3	114	6.10%	200	40.5	6%	22%	1.0	53.0		51.0	46.0		44.0	2.00		2.00	
South-East			0.51	*NA*	*0*	*0*																											
South-East			1.08	*RM-10*	*114*	*123*																											
South-East	**104**	103	1.59				*123*	0.0	0.0	243	1.0	4.12	4.0	3.3	0.4	4.5	72	7.60%	200	45.2	10%	30%	1.3	46.0		44.0	40.5		38.5	2.02		2.00	
South-East	**103**	102					0	0.0	0.0	243	1.0	4.12	4.0	3.3	0.4	4.5	72	12.30%	200	57.5	8%	26%	1.5	40.5		38.5	31.6		29.6	2.02		2.00	
South-East			1.87	*NA*	*0*	*0*																											
South-East	**102**	101	1.87				0	0.0	0.0	243	1.0	4.12	4.0	5.2	0.7	4.7	79	15.90%	200	65.4	7%	24%	1.7	31.6		29.6	19.0		17.0	2.02		2.00	
South-East			0.86	*NA*	*0*	*0*																											
South-East			0.12	*RF*	*66*	*8*																											
South-East			0.24	*RM-10*	*114*	*27*																											
South-East	**101**	100	1.22				*35*	0.0	0.0	278	1.1	4.09	4.6	6.4	0.8	5.4	115	3.00%	200	28.4	19%	40%	1.0	19.0		17.0	15.6		13.6	2.02		2.00	
South-East			1.04	*NA*	*0*	*0*																											
South-East			0.38	*RF*	*66*	*25*																											
South-East	**107**	106	1.42				*25*	0.0	0.0	25	0.1	4.37	0.4	1.4	0.2	0.6	94	8.60%	200	48.1	1%	10%	0.7	39.0		37.0	31.0		29.0	2.00		2.00	
South-East			0.2	*NA*	*0*	*0*																											
South-East			0.34	*PI*	*50*	*17*																											
South-East			0.31	*RF*	*66*	*20*																											
South-East	**106**	100	0.85				*37*	0.0	0.0	63	0.3	4.30	1.1	2.3	0.3	1.4	148	10.40%	200	52.9	3%	16%	1.0	31.0		29.0	15.6		13.6	2.02		2.00	
South-East			0.47	*NA*	*0*	*0*																											
South-East			0.44	*PI*	*50*	*22*																											
South-East	**100**	099	0.91				*22*	0.0	0.0	363	1.5	4.04	5.9	9.6	1.2	7.2	92	7.60%	200	45.2	16%	38%	1.5	15.6		13.5	8.6		6.6	2.02		2.00	
South-East			0.55	*NA*	*0*	*0*																											
South-East	**099**	077	0.55				0	0.0	0.0	363	1.5	4.04	5.9	10.1	1.3	7.2	103	2.00%	200	23.2	31%	52%	0.9	8.6		6.5	6.5		4.5	2.02		2.00	
East			1.1	*NA*	*0*	*0*																											
East			0.45	*RM-45*	*266*	*120*																											
East	**098**	097	1.55				*120*	0.0	0.0	120	0.5	4.22	2.0	1.6	0.2	2.2	91	1.50%	200	20.1	11%	32%	0.6	53.7		51.7	53.0		50.4	2.00		2.63	
East			1	*NA*	*0*	*0*																											
East			0.44	*RM-45*	*266*	*117*																											
East	**097**	096	1.44				*117*	0.0	0.0	237	1.0	4.12	4.0	3.0	0.4	4.3	86	6.20%	200	40.8	11%	30%	1.2	53.0		50.4	47.0		45.0	2.65		2.00	
East			0.22	*NA*	*0*	*0*																											
East			0.08	*C-15*	*90*	*7*																											
East	**096**	089	0.3				*7*	0.0	0.0	244	1.0	4.12	4.1	3.3	0.4	4.5	90	6.70%	200	42.4	11%	30%	1.2	47.0		45.0	41.0		39.0	2.02		2.00	
East			1.06	*NA*	*0*	*0*																											
East			0.45	*C-15*	*90*	*41*																											
East	**095**	093	1.51				*41*	0.0	0.0	41	0.2	4.33	0.7	1.5	0.2	0.9	56	3.70%	200	31.5	3%	16%	0.6	53.8		51.8	51.7		49.7	2.00		2.00	
East			2.98	*NA*	*0*	*0*																											
East			0.41	*C-15*	*90*	*37*																											
East	**094**	093	3.39				*37*	0.0	0.0	37	0.1	4.34	0.6	3.4	0.4	1.1	98	1.20%	200	18.0	6%	22%	*0.4*	52.3		50.3	51.7		49.1	2.00		2.60	
East	**093**	091					0	0.0	0.0	77	0.3	4.27	1.3	4.9	0.6	2.0	43	2.50%	200	25.9	8%	26%	0.6	51.7		49.1	50.0		48.0	2.62		2.00	
East			3.83	*NA*	*0*	*0*																											
East			0.64	*C-15*	*90*	*58*																											
East	**092**	091	4.47				*58*	0.0	0.0	58	0.2	4.30	1.0	4.5	0.6	1.6	100	1.00%	200	16.4	10%	28%	*0.4*	49.4		47.4	50.0		46.4	2.00		**3.58**	
East			0.2	*NA*	*0*	*0*																											
East			0.42	*C-15*	*90*	*38*																											
East	**091**	090	0.62				*38*	0.0	0.0	173	0.7	4.17	2.9	10.0	1.3	4.2	108	1.00%	200	16.4	26%	48%	*0.6*	50.0		46.4	47.3		45.3	**3.60**		2.00	
East			0.17	*NA*	*0*	*0*																											
East			0.49	*C-15*	*90*	*44*																											
East	**090**	089	0.66				*44*	0.0	0.0	217	0.9	4.14	3.6	10.7	1.4	5.0	97	6.50%	200	41.8	12%	32%	1.2	47.3		45.3	41.0		39.0	2.02		2.00	

Unit Demand 350 L/person/day
Infiltration 0.130 L/s/ha 11200 L/ha/day
Manning's Coefficient (n) 0.013

Project Anniedale Tynehead NCP
Scenario NCP - December 2010 Landuse
Client City of Surrey
USL Job 1072.0173.01

172nd Street Pump Station Catchment

Development Area: Tynehead

Sub Catchment	US Node	DS Node	Catchment Details: Area (ha)	Zoning	Population Density (ppha)[1]	Parcel Population	Total Population	Flow Details: Point Loads (L/s)	Point Loads Accum. (L/s)	Average Dry Weather Flow: Acc. Popl'n	Average Dry Weather Flow: Flow (L/s)	Peak Dry Weather Flow: Peak Factor	Peak Dry Weather Flow: Flow (L/s)	Infiltration Flow: Accum. Area (ha)	Infiltration Flow: Flow (L/s)	PWWF (L/s)	Pipe Design: Length (m)	Assumed Grade[2]	Size (mm)	Design Guideline Capacity[3] (L/s)	Qdes / Qcap[3] (%)	Ddes / Dcap[3] (%)	Velocity[4] (m/s)	US Node Elevation: Est. Rim	Con.[5] Rim	Est. Invert	DS Node Elevation: Est. Rim	Con.[5] Rim	Est. Invert	Depth to pipe invert (m): US	Con.[5] US	DS	Con.[5] DS
East			0.42	NA	0	0																											
East			0.51	C-15	90	46																											
East	089	088	0.93				46	0.0	0.0	507	2.1	3.97	8.2	14.9	1.9	10.1	85	2.80%	200	27.4	37%	58%	1.1	41.0		39.0	38.6		36.6	2.02		2.00	
East	088	081					0	0.0	0.0	507	2.1	3.97	8.2	14.9	1.9	10.1	92	3.40%	200	30.2	33%	54%	1.2	38.6		36.6	35.4		33.4	2.02		2.00	
East			0.69	NA	0	0																											
East			1.35	C-8	60	81																											
East	087	086	2.04				81	0.0	0.0	81	0.3	4.27	1.4	2.0	0.3	1.7	95	3.10%	200	28.9	6%	22%	0.7	50.2		48.2	47.2		45.2	2.00		2.00	
East	086	083					0	0.0	0.0	81	0.3	4.27	1.4	2.0	0.3	1.7	42	4.40%	200	34.4	5%	20%	0.8	47.2		45.2	45.4		43.4	2.02		2.00	
East			0.45	NA	0	0																											
East			0.72	C-15	90	65																											
East	085	084	1.17				65	0.0	0.0	65	0.3	4.29	1.1	1.2	0.2	1.3	52	4.20%	200	33.6	4%	18%	0.7	49.4		47.4	47.2		45.2	2.00		2.00	
East			0.48	NA	0	0																											
East			0.83	C-15	90	75																											
East	084	083	1.31				75	0.0	0.0	140	0.6	4.20	2.4	2.5	0.3	2.7	86	2.10%	200	23.8	11%	32%	0.7	47.2		45.2	45.4		43.4	2.02		2.00	
East			0.31	NA	0	0																											
East			0.99	C-8	60	59																											
East	083	082	1.3				59	0.0	0.0	280	1.1	4.09	4.6	5.8	0.8	5.4	98	3.70%	200	31.5	17%	38%	1.1	45.4		43.3	41.7		39.7	2.02		2.00	
East			0.4	NA	0	0																											
East			1.03	C-8	60	62																											
East	082	081	1.43				62	0.0	0.0	342	1.4	4.05	5.6	7.3	0.9	6.6	104	6.00%	200	40.2	16%	38%	1.3	41.7		39.7	35.4		33.4	2.02		2.00	
East			1.62	NA	0	0																											
East			0.77	RM-30	206	159																											
East	081	080	2.39				159	0.0	0.0	1007	4.1	3.80	15.5	24.5	3.2	18.7	142	5.90%	200	39.8	47%	64%	1.8	35.4		33.4	27.0		25.0	2.02		2.00	
East			4.95	NA	0	0																											
East	080	078	4.95				0	0.0	0.0	1007	4.1	3.80	15.5	29.5	3.8	19.3	103	6.80%	200	42.8	45%	64%	1.9	27.0		25.0	20.0		18.0	2.02		2.00	
East			0.33	NA	0	0																											
East			0.59	RF-9	128	76																											
East	079	078	0.92				76	0.0	0.0	76	0.3	4.28	1.3	0.9	0.1	1.4	76	1.00%	200	16.4	9%	28%	0.5	18.0	18.0	16.0	20.0	19.5	15.2	2.00	2.00	4.76	4.26
East			0.41	NA	0	0																											
East			0.75	PI	50	38																											
East	078	077	1.16				38	0.0	0.0	1120	4.5	3.77	17.1	31.5	4.1	21.2	135	7.90%	200	46.1	46%	64%	2.0	20.0	19.5	15.2	6.5	6.5	4.5	4.78	4.28	2.00	2.00
East			0.88	NA	0	0																											
East			0.77	RF	66	51																											
East	077	076	1.65				51	0.0	0.0	1534	6.2	3.67	22.8	43.3	5.6	28.4	86	1.00%	250	29.7	96%	96%	1.0	6.5		4.5	6.0		3.7	2.02		2.36	
East	076	062					0	0.0	0.0	1534	6.2	3.67	22.8	43.3	5.6	28.4	78	1.00%	250	29.7	96%	96%	1.0	6.0		3.7	5.0		2.9	2.38		2.09	
Center-East			0.24	NA	0	0																											
Center-East			0.22	C-15	90	20																											
Center-East	075	073	0.46				20	0.0	0.0	20	0.1	4.38	0.4	0.5	0.1	0.4	82	3.50%	200	30.7	1%	10%	0.5	50.2		48.2	47.3		45.3	2.00		2.00	
Center-East			0.08	NA	0	0																											
Center-East			0.63	C-15	90	57																											
Center-East	074	073	0.71				57	0.0	0.0	57	0.2	4.30	1.0	0.7	0.1	1.1	95	1.50%	200	20.1	5%	22%	0.5	47.7		45.7	47.3		44.3	2.00		3.04	
Center-East	073	071					0	0.0	0.0	77	0.3	4.27	1.3	1.2	0.2	1.5	57	2.20%	200	24.3	6%	22%	0.6	47.3		44.3	45.0		43.0	3.06		2.00	
Center-East			0.8	NA	0	0																											
Center-East			0.75	C-15	90	68																											
Center-East	072	071	1.55				68	0.0	0.0	68	0.3	4.29	1.2	1.6	0.2	1.4	97	1.60%	200	20.7	7%	24%	0.5	45.1		43.1	45.0		41.6	2.00		3.44	
Center-East			0.17	NA	0	0																											
Center-East			0.33	C-15	90	30																											
Center-East	071	070	0.5				30	0.0	0.0	174	0.7	4.17	2.9	3.2	0.4	3.4	94	3.90%	200	32.4	10%	30%	0.9	45.0		41.5	39.9		37.9	3.46		2.00	
Center-East			0.21	NA	0	0																											
Center-East			0.6	C-15	90	54																											
Center-East	070	067	0.81				54	0.0	0.0	228	0.9	4.13	3.8	4.0	0.5	4.3	105	6.30%	200	41.2	11%	30%	1.2	39.9		37.8	33.3		31.3	2.02		2.00	
Center-East			0.32	NA	0	0																											
Center-East			0.96	C-15	90	86																											

Unit Demand					350 L/person/day									Project		Anniedale Tynehead NCP							**172nd Street Pump Station Catchment**										
Infiltration					0.130 L/s/ha		11200 L/ha/day							Scenario		NCP - December 2010 Landuse																	
Manning's Coefficient (n)					0.013									Client		City of Surrey																	
														USL Job		1072.0173.01							Development Area: Tynehead										

Sub Catchment	US Node	DS Node	Catchment Details: Area (ha)	Zoning	Population Density (ppha) [1]	Parcel Population	Total Population	Flow Details: Point Loads (L/s)	Point Loads Accum. (L/s)	Average Dry Weather Flow: Acc. Popl'n	Average Dry Weather Flow: Flow (L/s)	Peak Dry Weather Flow: Peak Factor	Peak Dry Weather Flow: Flow (L/s)	Infiltration Flow: Accum. Area (ha)	Infiltration Flow: Flow (L/s)	PWWF (L/s)	Pipe Design: Length (m)	Assumed Grade [2]	Size (mm)	Design Guideline Capacity [3] (L/s)	Qdes / Qcap [3] (%)	Ddes / Dcap [3] (%)	Velocity [4] (m/s)	US Node Elevation: Est. Rim	US Con. [5] Rim	US Est. Invert	DS Node Elevation: Est. Rim	DS Con. [5] Rim	DS Est. Invert	Depth to pipe invert (m): US	Con. [5] US	DS	Con. [5] DS
Center-East	**069**	068	1.28				86	0.0	0.0	86	0.4	4.26	1.5	1.3	0.2	1.7	126	3.90%	200	32.4	5%	22%	0.8	37.4		35.4	32.5		30.5	2.00		2.00	
Center-East	**068**	067					0	0.0	0.0	86	0.4	4.26	1.5	1.3	0.2	1.7	37	0.60%	200	12.7	13%	34%	0.4	32.5		30.5	33.3		30.3	2.02		2.95	
Center-East			0.45	NA	0	0																											
Center-East			0.39	RM-30	206	80																											
Center-East	**067**	065	0.84				80	0.0	0.0	394	1.6	4.03	6.4	6.2	0.8	7.2	146	4.90%	200	36.3	20%	42%	1.3	33.3		30.3	25.1		23.1	2.97		2.00	
Center-East			0.19	NA	0	0																											
Center-East			0.53	RM-30	206	109																											
Center-East	**066**	065	0.72				109	0.0	0.0	109	0.4	4.23	1.9	0.7	0.1	2.0	68	1.00%	200	16.4	12%	32%	0.5	23.5	23.5	21.5	25.1	24.5	20.8	2.00	2.00	**4.36**	**3.72**
Center-East			0.19	NA	0	0																											
Center-East			0.19	RF-9	128	24																											
Center-East	**065**	063	0.38				24	0.0	0.0	528	2.1	3.96	8.5	7.3	0.9	9.4	105	5.50%	200	38.5	24%	46%	1.4	25.1	24.5	20.8	17.0	17.0	15.0	**4.38**	**3.74**	2.00	2.00
Center-East			0.17	NA	0	0																											
Center-East			0.31	RF-9	128	40																											
Center-East	**064**	063	0.48				40	0.0	0.0	40	0.2	4.33	0.7	0.5	0.1	0.8	45	3.00%	200	28.4	3%	16%	0.6	18.0		16.0	17.0		14.7	2.00		2.33	
Center-East			0.27	NA	0	0																											
Center-East			0.64	RF	66	42																											
Center-East	**063**	062	0.91				42	0.0	0.0	610	2.5	3.93	9.7	8.6	1.1	10.8	132	8.80%	200	48.6	22%	44%	1.8	17.0		14.6	5.0		3.0	2.35		2.00	
Center-East			0.35	NA	0	0																											
Center-East	**062**	061	0.35				0	0.0	0.0	2143	8.7	3.56	30.9	52.3	6.8	37.7	66	0.30%	375	48.0	79%	86%	0.7	5.0		2.9	6.2		2.7	2.09		**3.53**	
Center-East			0.48	NA	0	0																											
Center-East	**061**	000	0.48				0	0.0	0.0	2143	8.7	3.56	30.9	52.8	6.8	37.8	86	0.30%	375	48.0	79%	86%	0.7	6.2		2.7	5.7		2.4	**3.55**		3.25	
Center			0.05	NA	0	0																											
Center			0.21	C-15	90	19																											
Center	**060**	059	0.26				19	0.0	0.0	19	0.1	4.38	0.3	0.3	0.0	0.4	142	2.40%	200	25.4	1%	12%	0.4	46.7		44.7	44.6		41.2	2.00		3.38	
Center			0.52	NA	0	0																											
Center			1.11	C-15	90	100																											
Center	**059**	057	1.63				100	0.0	0.0	119	0.5	4.22	2.0	1.9	0.2	2.3	58	2.70%	200	26.9	8%	28%	0.7	44.6		41.2	41.6		39.6	3.40		2.00	
Center			1.07	NA	0	0																											
Center			0.38	C-15	90	34																											
Center	**058**	057	1.45				34	0.0	0.0	34	0.1	4.35	0.6	1.5	0.2	0.8	134	2.00%	200	23.2	3%	18%	0.5	43.7		41.7	41.6		39.0	2.00		2.60	
Center			0.45	NA	0	0																											
Center			0.37	RM-30	206	76																											
Center	**057**	056	0.82				76	0.0	0.0	229	0.9	4.13	3.8	4.2	0.5	4.4	140	4.60%	200	35.2	12%	32%	1.1	41.6		39.0	34.5		32.5	2.62		2.00	
Center			0.45	NA	0	0																											
Center			2.13	RM-30	206	439																											
Center	**056**	055	2.58				439	0.0	0.0	668	2.7	3.91	10.6	6.7	0.9	11.4	119	5.50%	200	38.5	30%	52%	1.5	34.5		32.5	27.9		25.9	2.02		2.00	
Center			0.29	NA	0	0																											
Center			1.25	RM-30	206	258																											
Center	**055**	053	1.54				258	0.0	0.0	926	3.7	3.82	14.3	8.3	1.1	15.4	85	8.20%	200	47.0	33%	54%	2.0	27.9		25.9	21.0		19.0	2.02		2.00	
Center			0.27	NA	0	0																											
Center			0.28	RM-30	206	58																											
Center	**054**	053	0.55				58	0.0	0.0	58	0.2	4.30	1.0	0.6	0.1	1.1	128	2.50%	200	25.9	4%	18%	0.6	23.6		21.6	21.0		18.4	2.00		2.60	
Center			0.56	NA	0	0																											
Center			1.14	RF-12	89	101																											
Center	**053**	051	1.7				101	0.0	0.0	1085	4.4	3.78	16.6	10.5	1.4	18.0	108	5.40%	200	38.1	47%	66%	1.7	21.0		18.4	14.6		12.6	2.62		2.00	
Center			0.34	NA	0	0																											
Center			0.46	RF-12	89	41																											
Center	**052**	051	0.8				41	0.0	0.0	41	0.2	4.33	0.7	0.8	0.1	0.8	129	3.00%	200	28.4	3%	16%	0.6	17.0		15.0	14.6		11.1	2.00		3.46	
Center			0.25	NA	0	0																											
Center			0.51	RF	66	34																											
Center	**051**	000	0.76				34	0.0	0.0	1159	4.7	3.76	17.6	12.1	1.6	19.2	128	5.80%	200	39.5	49%	66%	1.8	14.6		11.1	5.7		3.7	3.48		2.00	

Unit Demand	350 L/person/day		Project	Anniedale Tynehead NCP
Infiltration	0.130 L/s/ha	11200 L/ha/day	Scenario	NCP - December 2010 Landuse
Manning's Coefficient (n)	0.013		Client	City of Surrey
			USL Job	1072.0173.01

172nd Street Pump Station Catchment

Development Area: Tynehead

Sub Catchment	US Node	DS Node	Catchment Details: Area (ha)	Zoning	Population Density (ppha) [1]	Parcel Population	Total Population	Flow Details: Point Loads (L/s)	Point Loads Accum. (L/s)	Average Dry Weather Flow: Acc. Popl'n	Average Dry Weather Flow: Flow (L/s)	Peak Dry Weather Flow: Peak Factor	Peak Dry Weather Flow: Flow (L/s)	Infiltration Flow: Accum. Area (ha)	Infiltration Flow: Flow (L/s)	PWWF (L/s)	Pipe Design: Length (m)	Assumed Grade [2]	Size (mm)	Design Guideline Capacity [3] (L/s)	Qdes / Qcap [3] (%)	Ddes / Dcap [3] (%)	Velocity [4] (m/s)	US Node Elevation: Est. Rim	US Con. [5] Rim	US Est. Invert	DS Node Elevation: Est. Rim	DS Con. [5] Rim	DS Est. Invert	Depth to pipe invert (m): US	Con. [5] US	DS	Con. [5] DS
LPS-North			2.55	*NA*	*0*	*0*																											
LPS-North			0.3	*PI*	*50*	*15*																											
LPS-North			0.69	*C-8*	*60*	*41*																											
LPS-North			1.08	*RF-9*	*128*	*138*																											
LPS-North			0.62	*RM-30*	*206*	*128*																											
LPS-North	**LPS-N**	LPS-N	5.24				322	0.0	0.0	322	1.3	4.07	5.3	5.2	0.7	6.0																	
West			0.46	*NA*	*0*	*0*																											
West			0.77	*RF-9*	*128*	*99*																											
West	**022**	021	1.23				*99*	0.0	0.0	99	0.4	4.25	1.7	1.2	0.2	1.9	122	6.50%	200	41.8	4%	20%	1.0	18.0		16.0	10.0		8.0	2.00		2.00	
West			0.93	*NA*	*0*	*0*																											
West			1.47	*RF*	*66*	*97*																											
West			0.4	*RF-9*	*128*	*51*																											
West	**021**	020	2.8				*148*	6.0	6.0	247	1.0	4.11	10.1	4.0	0.5	10.6	75	2.60%	200	26.4	40%	60%	1.2	10.0		8.0	8.0		6.0	2.02		2.00	
West			0.24	*NA*	*0*	*0*																											
West			0.6	*RF-9*	*128*	*77*																											
West	**020**	011	0.84				*77*	0.0	6.0	324	1.3	4.07	11.3	4.9	0.6	11.9	104	0.40%	250	18.8	64%	76%	0.6	8.0	8.0	6.0	8.0	8.0	5.6	2.02	2.02	2.44	2.44
West			0.43	*NA*	*0*	*0*																											
West			0.82	*RM-30*	*206*	*169*																											
West	**019**	018	1.25				*169*	0.0	0.0	169	0.7	4.17	2.9	1.3	0.2	3.0	141	5.10%	200	37.0	8%	26%	1.0	34.5		32.5	27.3		25.3	2.00		2.00	
West	**018**	016					0	0.0	0.0	169	0.7	4.17	2.9	1.3	0.2	3.0	66	6.00%	200	40.2	8%	26%	1.1	27.3		25.3	23.4		21.4	2.02		2.00	
West			0.68	*NA*	*0*	*0*																											
West			0.8	*RM-30*	*206*	*165*																											
West	**017**	016	1.48				*165*	0.0	0.0	165	0.7	4.18	2.8	1.5	0.2	3.0	145	5.70%	200	39.2	8%	26%	1.1	31.6		29.6	23.4		21.4	2.00		2.00	
West			1.16	*NA*	*0*	*0*																											
West			0.86	*RM-30*	*206*	*177*																											
West	**016**	013	2.02				*177*	0.0	0.0	511	2.1	3.97	8.2	4.8	0.6	8.8	88	3.80%	200	32.0	28%	50%	1.3	23.4		21.4	20.0		18.0	2.02		2.00	
West			2.83	*NA*	*0*	*0*																											
West			1.89	*RF-9*	*128*	*242*																											
West	**015**	014	4.72				*242*	0.0	0.0	242	1.0	4.12	4.0	4.7	0.6	4.6	133	3.40%	200	30.2	15%	36%	1.0	30.0		27.0	25.5		22.5	3.00		3.00	
West	**014**	013					0	0.0	0.0	242	1.0	4.12	4.0	4.7	0.6	4.6	121	3.70%	200	31.5	15%	36%	1.0	25.5		22.5	20.0		18.0	3.02		2.00	
West	**013**	012					0	0.0	0.0	753	3.0	3.88	11.8	9.5	1.2	13.1	110	6.30%	200	41.2	32%	52%	1.7	20.0		18.0	13.0		11.0	2.02		2.00	
West			0.53	*NA*	*0*	*0*																											
West			0.69	*RF-9*	*128*	*88*																											
West	**012**	011	1.22				*88*	0.0	0.0	841	3.4	3.85	13.1	10.7	1.4	14.5	86	5.80%	200	39.5	37%	58%	1.7	13.0		11.0	8.0	8.0	6.0	2.02		2.00	2.00
West			2	*NA*	*0*	*0*																											
West			1.19	*RF*	*66*	*79*																											
West	**011**	010	3.19				*79*	0.0	6.0	1243	5.0	3.74	24.8	18.8	2.4	27.2	67	0.40%	300	30.6	89%	92%	0.7	8.0	8.0	5.6	8.2	8.0	5.3	2.44	2.44	2.90	2.67
West	**010**	007					0	0.0	6.0	1243	5.0	3.74	24.8	18.8	2.4	27.2	89	0.40%	300	30.6	89%	92%	0.7	8.2	8.0	5.3	8.9	8.1	5.0	2.92	2.69	**3.89**	3.10
West			0.71	*NA*	*0*	*0*																											
West			2.63	*RF-9*	*128*	*337*																											
West	**009**	008	3.34				*337*	0.0	0.0	337	1.4	4.06	5.5	3.3	0.4	6.0	104	8.00%	200	46.4	13%	34%	1.4	23.9		21.9	15.5		13.5	2.00		2.00	

Unit Demand	350 L/person/day	
Infiltration	0.130 L/s/ha	11200 L/ha/day
Manning's Coefficient (n)	0.013	

Project	Anniedale Tynehead NCP
Scenario	NCP - December 2010 Landuse
Client	City of Surrey
USL Job	1072.0173.01

172nd Street Pump Station Catchment

Development Area: Tynehead

Sub Catchment	US Node	DS Node	Catchment Details					Flow Details									Pipe Design																
								Point Loads		Average Dry Weather Flow		Peak Dry Weather Flow		Infiltration Flow		PWWF	Pipe Design							US Node Elevation			DS Node Elevation			Depth to pipe invert (m)			
			Area (ha)	Zoning	Population Density (ppha) [1]	Parcel Population	Total Population	(L/s)	Accum. (L/s)	Acc. Popl'n	Flow (L/s)	Peak Factor	Flow (L/s)	Accum. Area (ha)	Flow (L/s)	(L/s)	Length (m)	Assumed Grade [2]	Size (mm)	Design Guideline Capacity [3] (L/s)	Qdes / Qcap [3] (%)	Ddes / Dcap [3] (%)	Velocity [4] (m/s)	Est. Rim	Con. [5] Rim	Est. Invert	Est. Rim	Con. [5] Rim	Est. Invert	US	Con. [5] US	DS	Con. [5] DS
West	**008**	007					0	0.0	0.0	337	1.4	4.06	5.5	3.3	0.4	6.0	121	5.40%	200	38.1	16%	36%	1.3	15.5		13.5	8.9	8.1	6.9	2.02		2.00	
West			0.86	*NA*	*0*	*0*																											
West			1.06	*RF*	*66*	*70*																											
West			0.4	*RF-9*	*128*	*51*																											
West	**007**	006	2.32				*121*	0.0	6.0	1701	6.9	3.64	31.1	24.4	3.2	34.2	74	0.30%	375	48.0	71%	82%	0.7	8.9	8.1	5.0	9.8	8.5	4.8	**3.89**	3.10	**5.05**	**3.73**
West			0.87	*NA*	*0*	*0*																											
West			1.42	*RF*	*66*	*94*																											
West	**006**	004	2.29				*94*	0.0	6.0	1795	7.3	3.62	32.3	26.7	3.5	35.8	93	0.30%	375	48.0	75%	84%	0.7	9.8	8.5	4.8	7.8	8.0	4.5	**5.07**	**3.75**	3.34	**3.52**
West			0.27	*NA*	*0*	*0*																											
West			1.06	*RF-9*	*128*	*136*																											
West	**005**	004	1.33				*136*	0.0	0.0	136	0.5	4.21	2.3	1.3	0.2	2.5	129	8.80%	200	48.6	5%	22%	1.1	19.2		17.2	7.8	8.0	5.8	2.00		2.00	2.19
West			0.14	*NA*	*0*	*0*																											
West			0.66	*RF*	*66*	*44*																											
West	**004**	003	0.8				*44*	0.0	6.0	1974	8.0	3.59	34.7	28.8	3.7	38.4	115	1.00%	375	87.7	44%	62%	1.1	7.8	8.0	4.5	5.3	5.3	3.3	3.34	**3.52**	2.00	2.00
LPS-South			7.55	*NA*	*0*	*0*																											
LPS-South			3	*RH,RH-g*	*22*	*66*																											
LPS-South	**LPS-S**	LPS-S	10.55				66	0.0	0.0	66	0.3	4.29	1.1	10.6	1.4	2.5																	
West	**003**	002					0	2.5	8.5	1974	8.0	3.59	37.2	28.8	3.7	41.0	117	0.30%	375	79.9	51%	64%	0.7	5.3	5.3	3.3	7.2	6.0	2.9	2.00	2.00	**4.21**	3.06
West	**002**	001					0	0.0	8.5	1974	8.0	3.59	37.2	28.8	3.7	41.0	87	0.30%	375	79.9	51%	64%	0.7	7.2	6.0	2.9	5.0	5.0	2.7	**4.23**	3.08	2.34	2.34
Center-West			0.19	*NA*	*0*	*0*																											
Center-West			0.66	*RM-45*	*266*	*176*																											
Center-West	**050**	049	0.85				*176*	0.0	0.0	176	0.7	4.17	3.0	0.9	0.1	3.1	118	6.70%	200	42.4	7%	26%	1.1	48.3		46.3	40.4		38.4	2.00		2.00	
Center-West			0.34	*NA*	*0*	*0*																											
Center-West			0.19	*RM-45*	*266*	*51*																											
Center-West	**049**	048	0.53				*51*	0.0	0.0	226	0.9	4.13	3.8	1.4	0.2	4.0	63	4.00%	200	32.8	12%	32%	1.0	40.4		38.4	37.8		35.8	2.02		2.00	
Center-West			0.28	*NA*	*0*	*0*																											
Center-West			0.14	*RM-45*	*266*	*37*																											
Center-West	**048**	046	0.42				*37*	0.0	0.0	263	1.1	4.10	4.4	1.8	0.2	4.6	52	5.10%	200	37.0	12%	32%	1.2	37.8		35.8	35.1		33.1	2.02		2.00	
Center-West			0.13	*NA*	*0*	*0*																											
Center-West			0.55	*RM-45*	*266*	*146*																											
Center-West	**047**	046	0.68				*146*	0.0	0.0	146	0.6	4.20	2.5	0.7	0.1	2.6	126	6.90%	200	43.1	6%	22%	1.1	43.8		41.8	35.1		33.1	2.00		2.00	
Center-West			1.08	*NA*	*0*	*0*																											
Center-West	**046**	045	1.08				0	0.0	0.0	410	1.7	4.02	6.7	3.6	0.5	7.1	53	2.00%	200	23.2	31%	52%	1.0	35.1		33.1	34.0		32.0	2.02		2.00	
Center-West			0.32	*NA*	*0*	*0*																											
Center-West			0.53	*RM-30*	*206*	*109*																											
Center-West	**045**	043	0.85				*109*	0.0	0.0	519	2.1	3.97	8.3	4.4	0.6	8.9	111	2.70%	200	26.9	33%	54%	1.1	34.0		32.0	31.0		29.0	2.02		2.00	
Center-West			0.1	*NA*	*0*	*0*																											
Center-West			0.31	*RM-30*	*206*	*64*																											
Center-West	**044**	043	0.41				*64*	0.0	0.0	64	0.3	4.29	1.1	0.4	0.1	1.2	125	4.50%	200	34.8	3%	16%	0.7	36.6		34.6	31.0		29.0	2.00		2.00	
Center-West			0.33	*NA*	*0*	*0*																											
Center-West			0.6	*RM-30*	*206*	*124*																											
Center-West	**043**	042	0.93				*124*	0.0	0.0	706	2.9	3.89	11.1	5.8	0.7	11.9	135	4.30%	200	34.0	35%	56%	1.4	31.0		29.0	25.2		23.2	2.02		2.00	
Center-West			0.19	*NA*	*0*	*0*																											
Center-West			0.51	*RM-30*	*206*	*105*																											
Center-West	**042**	041	0.7				*105*	0.0	0.0	811	3.3	3.86	12.7	6.5	0.8	13.5	97	1.30%	200	18.7	72%	82%	1.0	25.2		23.2	23.9		21.9	2.02		2.00	

Unit Demand	350	L/person/day		
Infiltration	0.130	L/s/ha	11200	L/ha/day
Manning's Coefficient (n)	0.013			

Project	Anniedale Tynehead NCP
Scenario	NCP - December 2010 Landuse
Client	City of Surrey
USL Job	1072.0173.01

172nd Street Pump Station Catchment

Development Area: Tynehead

Sub Catchment	US Node	DS Node	Catchment Details: Area (ha)	Zoning	Population Density (ppha) [1]	Parcel Population	Total Population	Flow Details: Point Loads (L/s)	Point Loads Accum. (L/s)	Average Dry Weather Flow: Acc. Popl'n	Average Dry Weather Flow: Flow (L/s)	Peak Dry Weather Flow: Peak Factor	Peak Dry Weather Flow: Flow (L/s)	Infiltration Flow: Accum. Area (ha)	Infiltration Flow: Flow (L/s)	PWWF (L/s)	Pipe Design: Length (m)	Assumed Grade [2]	Size (mm)	Design Guideline Capacity [3] (L/s)	Qdes / Qcap [3] (%)	Ddes / Dcap [3] (%)	Velocity [4] (m/s)	US Node Elevation: Est. Rim	Con. [5] Rim	Est. Invert	DS Node Elevation: Est. Rim	Con. [5] Rim	Est. Invert	Depth to pipe invert (m): US	Con. [5] US	DS	Con. [5] DS
Center-West			0.35	*NA*	*0*	*0*																											
Center-West			0.44	*RF-9*	*128*	*56*																											
Center-West	**041**	039	0.79				*56*	0.0	0.0	868	3.5	3.84	13.5	7.2	0.9	14.4	115	6.90%	200	43.1	34%	54%	1.8	23.9		21.9	16.0		14.0	2.02		2.00	
Center-West			0.21	*NA*	*0*	*0*																											
Center-West			0.59	*RF-12*	*89*	*53*																											
Center-West	**040**	039	0.8				*53*	0.0	0.0	53	0.2	4.31	0.9	0.8	0.1	1.0	85	1.00%	200	16.4	6%	24%	*0.4*	13.0	13.0	11.0	16.0	15.5	10.1	2.00	2.00	**5.85**	**5.35**
Center-West			0.19	*NA*	*0*	*0*																											
Center-West			0.38	*RF*	*66*	*25*																											
Center-West	**039**	001	0.57				*25*	0.0	0.0	945	3.8	3.82	14.6	8.6	1.1	15.7	126	5.60%	200	38.8	41%	60%	1.7	16.0	15.5	10.1	5.0	5.0	3.0	**5.87**	**5.37**	2.00	2.00
Center-West			1.28	*NA*	*0*	*0*																											
Center-West	**001**	000	1.28				0	0.0	8.5	2919	11.8	3.45	49.3	38.7	5.0	54.4	149	0.30%	375	79.9	68%	76%	0.8	5.0		2.7	5.7		2.2	2.34		3.47	
Center			0.86	*NA*	*0*	*0*																											
Center			0.77	*RF*	*66*	*51*																											
Center	**000**	PS	1.63				*51*	0.0	8.5	6273	25.4	3.15	88.6	105.2	13.6	102.3								5.7		2.2				3.47			
Pump Station	**PS**									6661	25.4		88.6	121.0		102.3																	

1- ppha from Table 2.6 of surrey Design Criteria
2- Assumed grade based on existing ground elevations. To be confirmed with road profile design.
3- Q Capacity and D Capacity based on 50% of pipes when flows are less then 40 L/s, and 83.2% of pipe full capacity (equivalent to flow with normal depth of 70% of pipe diameter) when flows are greater than 40 L/s.
4- Velocity based on normal depth flow at 70% of PDWF.
5- Conceptual Rim and Depth based on conceptual finished ground. Does not take into account any review of road profile or geometry.

Q > 40 L/s
Size > 200mm
3.6 Pipe depth > 3.5m
0.5 Pipe Velocity < 0.6 m/s

Land Use	Assumed Zoning	Abbr.
Road	NA	NA
Buffer	NA	NA
Trail	NA	NA
Riparian	NA	NA
Park Acquisition	NA	NA
Potential Park	NA	NA
School	Institutional	PI
Community Centre	Commercial Recreation	CPR
Institutional	Institutional	PI
Commercial	CD (based on C-15)	C-15
Village Commercial	Community Commercial	C-8
Industrial Low Impact	Light Impact Industrial	IL
Industrial Business Park	Business Park	IB
Suburban Cluster	Half-Acre Residential (Gross Density)	RH, RH-G
Low Density Urban 6-10	Single Family Residential - 12m Frontage	RF-12
Cluster Residential 4-6	CD (based on RF)	RF
Cluster Residential 6-10	CD (based on RF-9)	RF-9
Cluster Residential 10-15	CD (based on RM-10)	RM-10
Medium Density 10-15	Single Family Residential - 9m Frontage	RF-9
Medium High Density 15-25	Multiple Residential Development	RM-30
High Density Residential 25-45	CD (based on RM-30)	RM-30
High Density Residential 30-45	CD (based on RM-45)	RM-45
Special Residential 15-25	CD (based on RM-30)	RM-30

Table 3.4-5

Unit Demand	350 L/person/day		
Infiltration	0.130 L/s/ha	11200 L/ha/day	
Manning's Coefficient (n)	0.013		

Project	Anniedale Tynehead NCP
Scenario	NCP - December 2010 Landuse
Client	City of Surrey
USL Job	1072.0173.01

Anniedale Pump Station Catchment (187 St.)

Development Areas: Anniedale A - West 1, Anniedale A - East 1 & Anniedale B1

Sub Catchment	US Node	DS Node	Catchment Details: Area (ha)	Zoning	Population Density (ppha) [1]	Parcel Population	Total Population	Flow Details: Point Loads (L/s)	Point Loads Accum. (L/s)	Average Dry Weather Flow: Acc. Popl'n	Average Dry Weather Flow: Flow (L/s)	Peak Dry Weather Flow: Peak Factor	Peak Dry Weather Flow: Flow (L/s)	Infiltration Flow: Accum. Area (ha)	Infiltration Flow: Flow (L/s)	PWWF (L/s)	Pipe Design: Length (m)	Assumed Grade [2]	Size (mm)	Design Guideline Capacity [3] (L/s)	Qdes / Qcap [3] (%)	Ddes / Dcap [3] (%)	Velocity [4] (m/s)	US Node Elevation: Est. Rim	Con. [5] Rim	Est. Invert	DS Node Elevation: Est. Rim	Con. [5] Rim	Est. Invert	Depth to pipe invert (m): US	Con. [5] US	DS	Con. [5] DS
LPS			0.32	NA	0	0																											
LPS			2.61	IB	90	235																											
East	099	098	2.93				235	0.0	0.0	235	1.0	4.12	3.9	2.9	0.4	4.3	95	1.00%	200	16.4	26%	48%	0.6	27.9		25.9	28.7		25.0	2.00		3.71	
East			0.06	NA	0	0																											
East			0.53	IB	90	48																											
East	098	097	0.59				48	0.0	0.0	283	1.1	4.09	4.7	3.5	0.5	5.1	118	0.60%	200	12.7	41%	60%	0.6	28.7		24.9	26.7		24.2	3.73		2.43	
East	097	091					0	0.0	0.0	283	1.1	4.09	4.7	3.5	0.5	5.1	11	0.50%	200	11.6	44%	64%	0.5	26.7		24.2	28.0		24.2	2.45		3.84	
East			0.36	NA	0	0																											
East			0.89	IB	90	80																											
East	096	093	1.25				80	0.0	0.0	80	0.3	4.27	1.4	1.3	0.2	1.5	142	1.70%	200	21.4	7%	26%	0.6	37.4		35.4	35.0		33.0	2.00		2.00	
East			0.59	NA	0	0																											
East			1.7	IB	90	153																											
East	095	094	2.29				153	0.0	0.0	153	0.6	4.19	2.6	2.3	0.3	2.9	135	1.90%	200	22.6	13%	34%	0.7	38.8		36.8	36.2		34.2	2.00		2.00	
East	094	093	0				0	0.0	0.0	153	0.6	4.19	2.6	2.3	0.3	2.9	41	3.00%	200	28.4	10%	30%	0.8	36.2		34.2	35.0		33.0	2.02		2.00	
East			0.21	NA	0	0																											
East			0.77	IB	90	69																											
East	093	092	0.98				69	0.0	0.0	302	1.2	4.08	5.0	4.5	0.6	5.6	86	3.30%	200	29.8	19%	40%	1.0	35.0		33.0	32.1		30.1	2.02		2.00	
East			0.26	NA	0	0																											
East			0.71	IB	90	64																											
East	092	091	0.97				64	0.0	0.0	366	1.5	4.04	6.0	5.5	0.7	6.7	73	5.60%	200	38.8	17%	38%	1.3	32.1		30.1	28.0		26.0	2.02		2.00	
East	091	090					0	0.0	0.0	649	2.6	3.91	10.3	9.0	1.2	11.5	139	1.40%	200	19.4	59%	74%	0.9	28.0		24.2	24.3		22.3	3.84		2.00	
Center-East			0.16	NA	0	0																											
Center-East			0.85	IB	90	77																											
Center-East	090	085	1.01				77	0.0	0.0	726	2.9	3.89	11.4	10.0	1.3	12.7	96	3.00%	200	28.4	45%	64%	1.3	24.3		22.3	21.4		19.4	2.02		2.00	
Center-East			0.37	NA	0	0																											
Center-East			0.27	IB	90	24																											
Center-East			0.35	RM-30	206	72																											
Center-East	089	087	0.99				96	0.0	0.0	96	0.4	4.25	1.7	1.0	0.1	1.8	102	6.20%	200	40.8	4%	20%	0.9	41.6		39.6	35.3		33.3	2.00		2.00	
Center-East			0.44	NA	0	0																											
Center-East			0.94	RM-30	206	194																											
Center-East	088	087	1.38				194	0.0	0.0	194	0.8	4.15	3.3	1.4	0.2	3.4	61	1.50%	200	20.1	17%	38%	0.7	36.2		34.2	35.3		33.3	2.00		2.00	
Center-East			0.27	NA	0	0																											
Center-East			1.08	IB	90	97																											
Center-East	087	086	1.35				97	0.0	0.0	387	1.6	4.03	6.3	3.7	0.5	6.8	96	5.80%	200	39.5	17%	38%	1.3	35.3		33.3	29.7		27.7	2.02		2.00	
Center-East			0.41	NA	0	0																											
Center-East			0.92	IB	90	83																											
Center-East	086	085	1.33				83	0.0	0.0	470	1.9	3.99	7.6	5.1	0.7	8.2	126	6.60%	200	42.1	20%	42%	1.5	29.7		27.7	21.4		19.4	2.02		2.00	
Center-East	085	084					0	0.0	0.0	1196	4.8	3.75	18.2	15.1	2.0	20.1	58	0.50%	250	21.0	96%	96%	0.7	21.4		19.3	21.0		19.0	2.02		2.00	
Center-East	084	000					0	0.0	0.0	1196	4.8	3.75	18.2	15.1	2.0	20.1	42	0.50%	250	21.0	96%	96%	0.7	21.0		19.0	21.2		18.8	2.02		2.36	
Center			1.37	NA	0	0																											
Center			1.75	RM-30	206	361																											
Center	001	000	3.12				361	0.0	0.0	361	1.5	4.04	5.9	3.1	0.4	6.3	83	2.70%	200	26.9	23%	46%	1.0	23.4		21.4	21.2		19.2	2.00		2.00	
North			0.02	NA	0	0																											
North			0.16	IL	90	14																											
North	100	083	0.18				14	0.0	0.0	14	0.1	4.40	0.2	0.2	0.0	0.3	58	1.30%	200	18.7	1%	12%	0.3	66.8		64.8	66.0		64.0	2.00		2.00	
North			0.34	NA	0	0																											
North			1.12	IL	90	101																											

Unit Demand	350 L/person/day		Project	Anniedale Tynehead NCP
Infiltration	0.130 L/s/ha	11200 L/ha/day	Scenario	NCP - December 2010 Landuse
Manning's Coefficient (n)	0.013		Client	City of Surrey
			USL Job	1072.0173.01

Anniedale Pump Station Catchment (187 St.)

Development Areas: Anniedale A - West 1, Anniedale A - East 1 & Anniedale B1

Sub Catchment	US Node	DS Node	Catchment Details: Area (ha)	Zoning	Population Density (ppha)[1]	Parcel Population	Total Population	Flow Details: Point Loads (L/s)	Point Loads Accum. (L/s)	Average Dry Weather Flow: Acc. Popl'n	Average Dry Weather Flow: Flow (L/s)	Peak Dry Weather Flow: Peak Factor	Peak Dry Weather Flow: Flow (L/s)	Infiltration Flow: Accum. Area (ha)	Infiltration Flow: Flow (L/s)	PWWF (L/s)	Pipe Design: Length (m)	Assumed Grade[2]	Size (mm)	Design Guideline Capacity[3] (L/s)	Qdes / Qcap[3] (%)	Ddes / Dcap[3] (%)	Velocity[4] (m/s)	US Node Elevation: Est. Rim	US Con. Rim[5]	US Est. Invert	DS Node Elevation: Est. Rim	DS Con. Rim[5]	DS Est. Invert	Depth to pipe invert (m): US	Con. US[5]	DS	Con. DS[5]
North	**083**	082	1.46				101	0.0	0.0	115	0.5	4.23	2.0	1.6	0.2	2.2	123	1.60%	200	20.7	11%	30%	0.6	66.0		64.0	64.0		62.0	2.02		2.00	
North			0.26	*NA*	*0*	*0*																											
North			1.02	*IL*	*90*	*92*																											
North	**082**	080	1.28				92	0.0	0.0	207	0.8	4.14	3.5	2.9	0.4	3.9	133	2.30%	200	24.9	15%	36%	0.8	64.0		62.0	60.9		58.9	2.02		2.00	
North			0.3	*NA*	*0*	*0*																											
North			4.09	*IL*	*90*	*368*																											
North	**081**	080	4.39				368	0.0	0.0	368	1.5	4.04	6.0	4.4	0.6	6.6	111	0.50%	200	11.6	57%	72%	*0.6*	60.0		58.0	60.9		57.4	2.00		3.48	
North			0.2	*NA*	*0*	*0*																											
North			1.02	*IL*	*90*	*92*																											
North	**080**	079	1.22				92	0.0	0.0	667	2.7	3.91	10.6	8.5	1.1	11.7	89	1.30%	200	18.7	62%	76%	0.9	60.9		57.4	58.3		56.3	3.50		2.00	
North			0.46	*NA*	*0*	*0*																											
North			1.29	*IL*	*90*	*116*																											
North	**079**	078	1.75				116	0.0	0.0	783	3.2	3.87	12.3	10.3	1.3	13.6	97	2.80%	200	27.4	50%	66%	1.3	58.3		56.3	55.6		53.6	2.02		2.00	
North			0.19	*NA*	*0*	*0*																											
North			0.77	*IL*	*90*	*69*																											
North	**078**	077	0.96				69	0.0	0.0	852	3.5	3.84	13.3	11.2	1.5	14.7	87	4.80%	200	35.9	41%	60%	1.6	55.6		53.6	51.4		49.4	2.02		2.00	
North			0.3	*NA*	*0*	*0*																											
North			0.29	*IL*	*90*	*26*																											
North	**077**	076	0.59				26	0.0	0.0	878	3.6	3.84	13.6	11.8	1.5	15.2	85	3.20%	200	29.3	52%	68%	1.4	51.4		49.4	48.7		46.7	2.02		2.00	
North			0.17	*NA*	*0*	*0*																											
North			0.41	*IL*	*90*	*37*																											
North	**076**	075	0.58				37	0.0	0.0	915	3.7	3.83	14.2	12.4	1.6	15.8	90	1.10%	200	17.2	92%	94%	1.0	48.7		46.7	47.7		45.7	2.02		2.00	
North	**075**	067					0	0.0	0.0	915	3.7	3.83	14.2	12.4	1.6	15.8	83	0.80%	250	26.6	59%	74%	0.8	47.7		45.7	47.0		45.0	2.02		2.00	
North			0.34	*NA*	*0*	*0*																											
North			2.23	*IL*	*90*	*201*																											
North	**074**	073	2.57				201	0.0	0.0	201	0.8	4.15	3.4	2.6	0.3	3.7	124	2.40%	200	25.4	15%	36%	0.8	64.6		62.6	61.7		59.7	2.00		2.00	
North			0.24	*NA*	*0*	*0*																											
North			1.71	*IL*	*90*	*154*																											
North	**073**	071	1.95				154	0.0	0.0	355	1.4	4.05	5.8	4.5	0.6	6.4	127	1.30%	200	18.7	34%	56%	0.8	61.7		59.7	60.0		58.0	2.02		2.00	
North			0.35	*NA*	*0*	*0*																											
North			0.69	*IL*	*90*	*62*																											
North	**072**	071	1.04				62	0.0	0.0	62	0.3	4.30	1.1	1.0	0.1	1.2	76	2.00%	200	23.2	5%	22%	*0.6*	60.5		58.5	60.0		57.0	2.00		3.05	
North			0.16	*NA*	*0*	*0*																											
North			0.5	*IL*	*90*	*45*																											
North	**071**	070	0.66				45	0.0	0.0	462	1.9	3.99	7.5	6.2	0.8	8.3	87	1.00%	200	16.4	50%	68%	0.8	60.0		56.9	58.0		56.0	3.07		2.00	
North			0.44	*NA*	*0*	*0*																											
North			0.83	*IL*	*90*	*75*																											
North	**070**	069	1.27				75	0.0	0.0	537	2.2	3.96	8.6	7.5	1.0	9.6	102	3.50%	200	30.7	31%	52%	1.2	58.0		56.0	54.5		52.5	2.02		2.00	
North			0.19	*NA*	*0*	*0*																											
North			0.95	*IL*	*90*	*86*																											
North	**069**	068	1.14				86	0.0	0.0	623	2.5	3.92	9.9	8.6	1.1	11.0	87	4.80%	200	35.9	31%	52%	1.4	54.5		52.5	50.3		48.3	2.02		2.00	
North			0.32	*NA*	*0*	*0*																											
North			0.63	*IL*	*90*	*57*																											
North	**068**	067	0.95				57	0.0	0.0	680	2.8	3.90	10.7	9.6	1.2	12.0	82	4.00%	200	32.8	37%	56%	1.4	50.3		48.3	47.0		45.0	2.02		2.00	
North			0.49	*NA*	*0*	*0*																											
North			1.73	*IL*	*90*	*156*																											
North	**067**	065	2.22				156	0.0	0.0	1751	7.1	3.63	25.7	24.2	3.1	28.9	144	2.60%	250	47.9	60%	74%	1.5	47.0		45.0	43.3		41.3	2.02		2.00	
North			0.5	*NA*	*0*	*0*																											
North			0.34	*IL*	*90*	*31*																											
North	**066**	065	0.84				31	0.0	0.0	31	0.1	4.35	0.5	0.8	0.1	0.7	132	1.00%	200	16.4	4%	18%	*0.4*	44.7		42.7	43.3		41.3	2.00		2.00	
North			0.24	*NA*	*0*	*0*																											
North			1.1	*IL*	*90*	*99*																											
North	**065**	064	1.34				99	0.0	0.0	1881	7.6	3.61	27.5	26.4	3.4	30.9	113	1.10%	250	31.2	**99%**	98%	1.1	43.3		41.3	42.1		40.0	2.02		2.07	

Unit Demand	350 L/person/day		Project	Anniedale Tynehead NCP
Infiltration	0.130 L/s/ha	11200 L/ha/day	Scenario	NCP - December 2010 Landuse
Manning's Coefficient (n)	0.013		Client	City of Surrey
			USL Job	1072.0173.01

Anniedale Pump Station Catchment (187 St.)

Development Areas: Anniedale A - West 1, Anniedale A - East 1 & Anniedale B1

			Catchment Details					Flow Details									Pipe Design																
								Point Loads		Average Dry Weather Flow		Peak Dry Weather Flow		Infiltration Flow		PWWF	Pipe Design							US Node Elevation			DS Node Elevation			Depth to pipe invert (m)			
Sub Catchment	US Node	DS Node	Area (ha)	Zoning	Population Density (ppha) [1]	Parcel Population	Total Population	(L/s)	Accum. (L/s)	Acc. Popl'n	Flow (L/s)	Peak Factor	Flow (L/s)	Accum. Area (ha)	Flow (L/s)	(L/s)	Length (m)	Assumed Grade [2]	Size (mm)	Design Guideline Capacity [3] (L/s)	Qdes / Qcap [3] (%)	Ddes / Dcap [3] (%)	Velocity [4] (m/s)	Est. Rim	Con. [5] Rim	Est. Invert	Est. Rim	Con. [5] Rim	Est. Invert	US	Con. [5] US	DS	Con. [5] DS
North			0.46	*NA*	*0*	*0*																											
North			0.66	*IL*	*90*	*59*																											
North	**064**	063	1.12				59	0.0	0.0	1940	7.9	3.60	28.3	27.5	3.6	31.8	104	1.80%	250	39.9	80%	86%	1.3	42.1		40.0	40.1		38.1	2.09		2.00	
North	**063**	062					0	0.0	0.0	1940	7.9	3.60	28.3	27.5	3.6	31.8	107	0.50%	300	34.2	93%	94%	0.8	40.1	40.1	38.1	40.7	40.0	37.6	2.02	2.02	3.11	2.43
North			0.34	*NA*	*0*	*0*																											
North			0.6	*IL*	*90*	*54*																											
North	**062**	050	0.94				54	0.0	0.0	1994	8.1	3.59	29.0	28.5	3.7	32.7	95	0.50%	300	34.2	96%	96%	0.8	40.7	40.0	37.6	41.1	40.5	37.1	3.13	2.45	**4.01**	3.42
North-West			0.12	*NA*	*0*	*0*																											
North-West			0.81	*IL*	*90*	*73*																											
North-West	**061**	060	0.93				73	0.0	0.0	73	0.3	4.28	1.3	0.9	0.1	1.4	68	1.70%	200	21.4	6%	24%	*0.5*	63.0		61.0	61.9		59.9	2.00		2.00	
North-West			0.74	*NA*	*0*	*0*																											
North-West			0.71	*IL*	*90*	*64*																											
North-West	**060**	059	1.45				64	0.0	0.0	137	0.6	4.20	2.3	2.4	0.3	2.6	150	1.70%	200	21.4	12%	32%	0.6	61.9		59.8	59.3		57.3	2.02		2.00	
North-West			0.39	*NA*	*0*	*0*																											
North-West			0.71	*IL*	*90*	*64*																											
North-West	**059**	058	1.1				64	0.0	0.0	201	0.8	4.15	3.4	3.5	0.5	3.8	96	2.60%	200	26.4	14%	36%	0.9	59.3		57.2	56.7		54.7	2.02		2.00	
North-West			0.62	*NA*	*0*	*0*																											
North-West			1.06	*IL*	*90*	*95*																											
North-West	**058**	057	1.68				95	0.0	0.0	296	1.2	4.08	4.9	5.2	0.7	5.6	90	3.70%	200	31.5	18%	40%	1.1	56.7		54.7	53.3		51.3	2.02		2.00	
North-West			0.36	*NA*	*0*	*0*																											
North-West			0.96	*IL*	*90*	*86*																											
North-West	**057**	056	1.32				86	0.0	0.0	382	1.5	4.03	6.2	6.5	0.8	7.1	83	3.10%	200	28.9	25%	46%	1.1	53.3		51.3	50.7		48.7	2.02		2.00	
North-West			0.64	*NA*	*0*	*0*																											
North-West			0.87	*IL*	*90*	*78*																											
North-West	**056**	055	1.51				78	0.0	0.0	460	1.9	3.99	7.4	8.0	1.0	8.5	84	2.30%	200	24.9	34%	54%	1.0	50.7		48.7	48.8		46.8	2.02		2.00	
North-West			0.7	*NA*	*0*	*0*																											
North-West			1.23	*IL*	*90*	*111*																											
North-West	**055**	054	1.93				111	0.0	0.0	571	2.3	3.94	9.1	9.9	1.3	10.4	149	2.60%	200	26.4	39%	60%	1.1	48.8		46.8	44.9		42.9	2.02		2.00	
North-West			1.42	*NA*	*0*	*0*																											
North-West			0.72	*IL*	*90*	*65*																											
North-West	**054**	053	2.14				65	0.0	0.0	636	2.6	3.92	10.1	12.1	1.6	11.7	144	0.50%	250	21.0	55%	72%	0.6	44.9		42.8	44.2		42.1	2.02		2.07	
North-West			1.31	*NA*	*0*	*0*																											
North-West			0.81	*IL*	*90*	*73*																											
North-West	**053**	052	2.12				73	0.0	0.0	709	2.9	3.89	11.2	14.2	1.8	13.0	116	0.80%	250	26.6	49%	66%	0.8	44.2		42.1	43.2		41.2	2.09		2.00	
North-West			0.4	*NA*	*0*	*0*																											
North-West			0.7	*IL*	*90*	*63*																											
North-West	**052**	051	1.1				63	0.0	0.0	772	3.1	3.87	12.1	15.3	2.0	14.1	142	2.90%	250	50.6	28%	50%	1.3	43.2		41.1	38.3	38.4	37.0	2.02		**1.25**	**1.30**
North			0.38	*NA*	*0*	*0*																											
North			0.53	*IL*	*90*	*48*																											
North	**049**	050	0.91				48	0.0	0.0	48	0.2	4.32	0.8	0.9	0.1	1.0	113	1.00%	200	16.4	6%	22%	*0.4*	41.8		39.8	41.1		38.7	2.00		2.36	
North	**050**	051					0	0.0	0.0	2042	8.3	3.58	29.6	29.4	3.8	33.4	102	0.20%	375	39.2	85%	90%	0.6	41.1	40.5	37.1	38.3	38.4	36.9	**4.01**	3.42	**1.42**	**1.48**
North	**051**	042					0	0.0	0.0	2814	11.4	3.47	39.5	44.6	5.8	45.3	30	0.20%	375	65.2	69%	77%	0.7	38.3	38.4	36.9	39.3	38.4	36.8	**1.44**	**1.50**	2.47	**1.56**
Center-North			1.37	*NA*	*0*	*0*																											
Center-North			0.51	*IB*	*90*	*46*																											
Center-North	**048**	047	1.88				46	0.0	0.0	46	0.2	4.32	0.8	1.9	0.2	1.0	106	1.00%	200	16.4	6%	24%	*0.4*	37.5		35.5	37.0		34.4	2.00		2.56	
Center-North	**047**	016	0				0	0.0	0.0	46	0.2	4.32	0.8	1.9	0.2	1.0	134	0.60%	200	12.7	8%	26%	*0.3*	37.0		34.4	36.3		33.6	2.58		2.70	
Center-North			1.39	*NA*	*0*	*0*																											
Center-North			1.38	*RM-10*	*114*	*157*																											
Center-North	**046**	045	2.77				157	0.0	0.0	157	0.6	4.19	2.7	2.8	0.4	3.0	106	1.00%	200	16.4	18%	40%	*0.6*	43.5		41.5	44.3		40.5	2.00		**3.82**	
Center-North			0.68	*NA*	*0*	*0*																											

Unit Demand 350 L/person/day
Infiltration 0.130 L/s/ha 11200 L/ha/day
Manning's Coefficient (n) 0.013

Project Anniedale Tynehead NCP
Scenario NCP - December 2010 Landuse
Client City of Surrey
USL Job 1072.0173.01

Anniedale Pump Station Catchment (187 St.)

Development Areas: Anniedale A - West 1, Anniedale A - East 1 & Anniedale B1

			Catchment Details					Flow Details									Pipe Design																
								Point Loads		Average Dry Weather Flow		Peak Dry Weather Flow		Infiltration Flow		PWWF	Pipe Design							US Node Elevation			DS Node Elevation			Depth to pipe invert (m)			
Sub Catchment	US Node	DS Node	Area (ha)	Zoning	Population Density (ppha) [1]	Parcel Population	Total Population	(L/s)	Accum. (L/s)	Acc. Popl'n	Flow (L/s)	Peak Factor	Flow (L/s)	Accum. Area (ha)	Flow (L/s)	(L/s)	Length (m)	Assumed Grade [2]	Size (mm)	Design Guideline Capacity [3] (L/s)	Qdes / Qcap [3] (%)	Ddes / Dcap [3] (%)	Velocity [4] (m/s)	Est. Rim	Con. [5] Rim	Est. Invert	Est. Rim	Con. [5] Rim	Est. Invert	US	Con. [5] US	DS	Con. [5] DS
Center-North			1.1	RM-30	206	227																											
Center-North	045	044	1.78				227	0.0	0.0	384	1.6	4.03	6.3	4.6	0.6	6.9	104	0.60%	200	12.7	54%	70%	0.6	44.3		40.5	42.8		39.8	3.84		2.96	
Center-North			0.77	NA	0	0																											
Center-North			0.25	RM-30	206	52																											
Center-North	044	042	1.02				52	0.0	0.0	436	1.8	4.01	7.1	5.6	0.7	7.8	106	3.90%	200	32.4	24%	46%	1.2	42.8		39.8	39.3	38.4	35.7	2.98		3.56	2.65
Center-North			0.22	NA	0	0																											
Center-North			0.96	RM-30	206	198																											
Center-North	043	042	1.18				198	0.0	0.0	198	0.8	4.15	3.3	1.2	0.2	3.5	133	5.10%	200	37.0	9%	28%	1.1	46.9		44.9	39.3	38.4	38.1	2.00		1.20	0.29
Center-North			0.52	NA	0	0																											
Center-North			0.01	RM-10	114	1																											
Center-North			1.14	RM-30	206	235																											
Center-North	042	041	1.67				236	0.0	0.0	3684	14.9	3.37	50.2	53.1	6.9	57.1	127	0.20%	375	65.2	88%	90%	0.7	39.3	38.4	36.8	41.6	40.5	36.5	2.47	1.56	5.06	3.96
Center-North			0.48	NA	0	0																											
Center-North			1.7	RM-10	114	194																											
Center-North			0	RM-30	206	0																											
Center-North	041	040	2.18				194	0.0	0.0	3878	15.7	3.35	52.6	55.2	7.2	59.7	117	0.20%	375	65.2	92%	93%	0.7	41.6	40.5	36.5	38.8	38.8	36.3	5.08	3.98	2.46	2.46
Center-North			0.5	NA	0	0																											
Center-North			1.49	RM-10	114	170																											
Center-North	040	039	1.99				170	0.0	0.0	4048	16.4	3.33	54.6	57.2	7.4	62.0	82	1.40%	375	172.6	36%	53%	1.4	38.8	38.8	36.3	36.5	36.5	35.1	2.48	2.48	1.38	1.38
Center-North			0.37	NA	0	0																											
Center-North			0.77	RM-10	114	88																											
Center-North	039	016	1.14				88	0.0	0.0	4136	16.8	3.32	55.6	58.4	7.6	63.2	101	0.20%	375	65.2	97%	97%	0.7	36.5	36.5	35.1	36.3	36.8	34.9	1.38	1.38	1.38	1.83
South-West			0.27	NA	0	0																											
South-West			0.61	RM-10	114	70																											
South-West	038	037	0.88				70	0.0	0.0	70	0.3	4.28	1.2	0.9	0.1	1.3	94	1.00%	200	16.4	8%	26%	0.4	46.7	46.7	44.7	46.0	46.0	43.8	2.00	2.00	2.24	2.24
South-West			0.22	NA	0	0																											
South-West			0.36	RF-9	128	46																											
South-West			0.01	RM-30	206	2																											
South-West	037	036	0.59				48	0.0	0.0	118	0.5	4.22	2.0	1.5	0.2	2.2	95	0.60%	200	12.7	17%	38%	0.4	46.0	46.0	43.7	46.8	46.3	43.2	2.26	2.26	3.62	3.08
South-West			0.34	NA	0	0																											
South-West			0.38	RF-9	128	49																											
South-West	036	035	0.72				49	0.0	0.0	167	0.7	4.18	2.8	2.2	0.3	3.1	106	0.50%	200	11.6	27%	48%	0.4	46.8	46.3	43.1	47.3	46.5	42.6	3.64	3.10	4.70	3.88
South-West			0.23	NA	0	0																											
South-West			0.39	RF-9	128	50																											
South-West	035	034	0.62				50	0.0	0.0	217	0.9	4.14	3.6	2.8	0.4	4.0	99	0.50%	200	11.6	34%	56%	0.5	47.3	46.5	42.6	45.4	45.8	42.1	4.72	3.90	3.33	3.65
South-West			0.32	NA	0	0																											
South-West			0.45	RF-9	128	58																											
South-West	034	026	0.77				58	0.0	0.0	275	1.1	4.10	4.6	3.6	0.5	5.0	100	0.50%	200	11.6	43%	62%	0.5	45.4	45.8	42.1	44.9	44.9	41.6	3.35	3.67	3.27	3.27
South-West			0.24	NA	0	0																											
South-West			0.29	RF-9	128	37																											
South-West	033	031	0.53				37	0.0	0.0	37	0.1	4.34	0.7	0.5	0.1	0.7	89	1.00%	200	16.4	4%	20%	0.4	48.4		46.4	48.5		45.5	2.00		2.98	
South-West			0.23	NA	0	0																											
South-West			0.26	RF-9	128	33																											
South-West	032	031	0.49				33	0.0	0.0	33	0.1	4.35	0.6	0.5	0.1	0.6	85	1.00%	200	16.4	4%	18%	0.4	48.8		46.8	48.5		45.9	2.00		2.55	
South-West	031	029					0	0.0	0.0	70	0.3	4.28	1.2	1.0	0.1	1.3	93	0.60%	200	12.7	11%	30%	0.4	48.5		45.5	47.4		44.9	2.98		2.48	
South-West			0.7	NA	0	0																											
South-West			1.15	RF-9	128	147																											
South-West	030	029	1.85				147	0.0	0.0	147	0.6	4.19	2.5	1.9	0.2	2.7	147	1.00%	200	16.4	17%	38%	0.6	47.6		45.6	47.4		44.1	2.00		3.29	
South-West	029	027					0	0.0	0.0	217	0.9	4.14	3.6	2.9	0.4	4.0	87	0.60%	200	12.7	32%	52%	0.5	47.4		44.1	46.5		43.6	3.31		2.87	
South-West			0.73	NA	0	0																											
South-West			1.19	RF-9	128	152																											
South-West	028	027	1.92				152	0.0	0.0	152	0.6	4.19	2.6	1.9	0.2	2.8	105	1.00%	200	16.4	17%	38%	0.6	46.6		44.6	46.5		43.5	2.00		2.94	

Unit Demand 350 L/person/day
Infiltration 0.130 L/s/ha 11200 L/ha/day
Manning's Coefficient (n) 0.013

Project Anniedale Tynehead NCP
Scenario NCP - December 2010 Landuse
Client City of Surrey
USL Job 1072.0173.01

Anniedale Pump Station Catchment (187 St.)

Development Areas: Anniedale A - West 1, Anniedale A - East 1 & Anniedale B1

Sub Catchment	US Node	DS Node	Catchment Details: Area (ha)	Zoning	Population Density (ppha) [1]	Parcel Population	Total Population	Flow Details: Point Loads (L/s)	Point Loads Accum. (L/s)	Average Dry Weather Flow: Acc. Popl'n	Average Dry Weather Flow: Flow (L/s)	Peak Dry Weather Flow: Peak Factor	Peak Dry Weather Flow: Flow (L/s)	Infiltration Flow: Accum. Area (ha)	Infiltration Flow: Flow (L/s)	PWWF (L/s)	Pipe Design: Length (m)	Assumed Grade [2]	Size (mm)	Design Guideline Capacity [3] (L/s)	Qdes / Qcap [3] (%)	Ddes / Dcap [3] (%)	Velocity [4] (m/s)	US Node Elevation: Est. Rim	US Con. [5] Rim	US Est. Invert	DS Node Elevation: Est. Rim	DS Con. [5] Rim	DS Est. Invert	Depth to pipe invert (m): US	Con. [5] US	DS	Con. [5] DS
South-West	**027**	026					0	0.0	0.0	369	1.5	4.04	6.0	4.8	0.6	6.7	106	0.60%	200	12.7	52%	68%	0.6	46.5		43.5	44.9	44.9	42.9	2.96		2.00	2.00
South-West			0.2	*NA*	*0*	*0*																											
South-West			0.39	*RF-9*	*128*	*50*																											
South-West	**026**	025	0.59				50	0.0	0.0	694	2.8	3.90	11.0	9.0	1.2	12.1	98	0.60%	200	12.7	95%	96%	0.7	44.9	44.9	41.6	44.1	44.1	41.0	3.27	3.27	3.10	3.10
South-West			0.23	*NA*	*0*	*0*																											
South-West			0.42	*RF-9*	*128*	*54*																											
South-West	**025**	018	0.65				54	0.0	0.0	748	3.0	3.88	11.8	9.6	1.2	13.0	107	0.70%	200	13.7	95%	96%	0.8	44.1	44.1	41.0	43.5		40.2	3.12	3.12	3.30	
South-West			0.28	*NA*	*0*	*0*																											
South-West			0.57	*RF-9*	*128*	*73*																											
South-West	**024**	023	0.85				73	0.0	0.0	73	0.3	4.28	1.3	0.9	0.1	1.4	62	1.20%	200	18.0	8%	26%	0.5	47.5		45.5	46.7		44.7	2.00		2.00	
South-West			0.39	*NA*	*0*	*0*																											
South-West			0.46	*RF-9*	*128*	*59*																											
South-West	**023**	022	0.85				59	0.0	0.0	132	0.5	4.21	2.3	1.7	0.2	2.5	88	0.60%	200	12.7	19%	42%	0.4	46.7		44.7	47.0		44.2	2.02		2.81	
South-West	**022**	019					0	0.0	0.0	132	0.5	4.21	2.3	1.7	0.2	2.5	85	1.40%	200	19.4	13%	34%	0.6	47.0		44.2	45.0		43.0	2.83		2.00	
South-West			0.23	*NA*	*0*	*0*																											
South-West			0.36	*RM-30*	*206*	*74*																											
South-West	**019**	018	0.59				74	0.0	0.0	206	0.8	4.14	3.5	2.3	0.3	3.8	106	1.40%	200	19.4	19%	42%	0.7	45.0		43.0	43.5		41.5	2.02		2.00	
South-West	**018**	017					0	0.0	0.0	954	3.9	3.81	14.7	11.9	1.5	16.3	72	1.90%	200	22.6	72%	82%	1.2	43.5		40.2	40.8		38.8	3.30		2.00	
South-West	**017**	016					0	0.0	0.0	954	3.9	3.81	14.7	11.9	1.5	16.3	91	4.10%	200	33.2	49%	66%	1.5	40.8		38.8	36.3		35.1	2.02		**1.20**	
South-West			0.99	*NA*	*0*	*0*																											
South-West			0.81	*IB*	*90*	*73*																											
South-West	**016**	015	1.8				73	0.0	0.0	5209	21.1	3.23	68.1	74.0	9.6	77.7	145	0.30%	375	79.9	97%	97%	0.9	36.3	36.8	33.6	40.2	38.0	33.2	2.70	3.15	**7.06**	**4.83**
Center			0.84	*NA*	*0*	*0*																											
Center			0.58	*IB*	*90*	*52*																											
Center	**015**	014	1.42				52	0.0	0.0	5261	21.3	3.23	68.7	75.4	9.8	78.5	131	2.50%	375	230.6	34%	51%	1.9	40.2	38.0	33.2	31.9	31.9	29.9	**7.08**	**4.85**	2.00	2.00
Center	**014**	002					0	0.0	0.0	5261	21.3	3.23	68.7	75.4	9.8	78.5	131	6.90%	375	383.2	20%	39%	2.7	31.9	31.9	29.9	22.8		20.8	2.02	2.02	2.00	
Center			0.34	*NA*	*0*	*0*																											
Center			1.56	*RM-10*	*114*	*178*																											
Center	**003**	002	1.9				178	0.0	0.0	178	0.7	4.17	3.0	1.9	0.2	3.3	107	9.20%	200	49.7	7%	24%	1.3	32.6		30.6	22.8		20.8	2.00		2.00	
Center			0.47	*NA*	*0*	*0*																											
Center			0.01	*RM-10*	*114*	*1*																											
Center			2.36	*RM-30*	*206*	*486*																											
Center	**013**	009	2.84				487	0.0	0.0	487	2.0	3.98	7.9	2.8	0.4	8.2	90	0.50%	200	11.6	71%	82%	0.6	44.3		42.3	44.2		41.9	2.00		2.35	
Center			0.28	*NA*	*0*	*0*																											
Center			0.49	*RM-30*	*206*	*101*																											
Center	**012**	010	0.77				101	0.0	0.0	101	0.4	4.24	1.7	0.8	0.1	1.8	85	1.00%	200	16.4	11%	32%	0.5	46.7		44.7	46.1		43.8	2.00		2.22	
Center			0.54	*NA*	*0*	*0*																											
Center			0.41	*RM-30*	*206*	*84*																											
Center	**011**	010	0.95				84	0.0	0.0	84	0.3	4.26	1.5	1.0	0.1	1.6	76	3.40%	200	30.2	5%	22%	0.7	48.7		46.7	46.1		44.1	2.00		2.00	
Center	**010**	009					0	0.0	0.0	185	0.7	4.16	3.1	1.7	0.2	3.3	94	1.70%	200	21.4	16%	36%	0.7	46.1		43.8	44.2		42.2	2.22		2.00	
Center			0.25	*NA*	*0*	*0*																											
Center			1.42	*RM-10*	*114*	*162*																											
Center	**009**	008	1.67				162	0.0	0.0	834	3.4	3.85	13.0	6.2	0.8	13.8	101	4.30%	200	34.0	41%	60%	1.5	44.2		41.9	39.5		37.5	2.35		2.00	
Center			0.18	*NA*	*0*	*0*																											
Center			0.79	*RM-10*	*114*	*90*																											
Center	**008**	004	0.97				90	0.0	0.0	924	3.7	3.82	14.3	7.2	0.9	15.2	102	9.40%	200	50.3	30%	52%	2.0	39.5		37.5	29.9		27.9	2.02		2.00	
Center			0.36	*NA*	*0*	*0*																											
Center			0.42	*RM-10*	*114*	*48*																											
Center	**007**	006	0.78				48	0.0	0.0	48	0.2	4.32	0.8	0.8	0.1	0.9	108	4.90%	200	36.3	3%	14%	0.7	47.3		45.3	42.0		40.0	2.00		2.00	
Center			0.34	*NA*	*0*	*0*																											
Center			0.64	*RM-10*	*114*	*73*																											
Center			0.01	*RM-30*	*206*	*2*																											

Unit Demand	350	L/person/day	
Infiltration	0.130	L/s/ha	11200 L/ha/day
Manning's Coefficient (n)	0.013		

Project	Anniedale Tynehead NCP
Scenario	NCP - December 2010 Landuse
Client	City of Surrey
USL Job	1072.0173.01

Anniedale Pump Station Catchment (187 St.)

Development Areas: Anniedale A - West 1, Anniedale A - East 1 & Anniedale B1

Sub Catchment	US Node	DS Node	Catchment Details					Flow Details									Pipe Design																
								Point Loads		Average Dry Weather Flow		Peak Dry Weather Flow		Infiltration Flow		PWWF	Pipe Design							US Node Elevation			DS Node Elevation			Depth to pipe invert (m)			
			Area (ha)	Zoning	Population Density (ppha) [1]	Parcel Population	Total Population	(L/s)	Accum. (L/s)	Acc. Popl'n	Flow (L/s)	Peak Factor	Flow (L/s)	Accum. Area (ha)	Flow (L/s)	(L/s)	Length (m)	Assumed Grade [2]	Size (mm)	Design Guideline Capacity [3] (L/s)	Qdes / Qcap [3] (%)	Ddes / Dcap [3] (%)	Velocity [4] (m/s)	Est. Rim	Con. [5] Rim	Est. Invert	Est. Rim	Con. [5] Rim	Est. Invert	US	Con. [5] US	DS	Con. [5] DS
Center	**006**	005	0.99				75	0.0	0.0	123	0.5	4.22	2.1	1.8	0.2	2.3	81	5.60%	200	38.8	6%	22%	1.0	42.0		40.0	37.4		35.4	2.02		2.00	
Center	**005**	004					0	0.0	0.0	123	0.5	4.22	2.1	1.8	0.2	2.3	90	8.30%	200	47.2	5%	20%	1.1	37.4		35.4	29.9		27.9	2.02		2.00	
Center			0.33	*NA*	*0*	*0*																											
Center			0.34	*RM-10*	*114*	*39*																											
Center	**004**	002	0.67				39	0.0	0.0	1086	4.4	3.78	16.6	9.6	1.2	17.9	116	6.10%	200	40.5	44%	62%	1.8	29.9		27.9	22.8		20.8	2.02		2.00	
Center	**002**	000					0	0.0	0.0	6525	26.4	3.14	82.9	86.9	11.3	94.2	123	1.30%	375	166.3	57%	69%	1.6	22.8		20.8	21.2		19.2	2.02		2.00	
Pump Station	**000**						0	0.0	0.0	8082	32.7	3.05	99.7	105.1	13.6	113.3								21.2		18.8	21.2			2.36			
Pump Station	**PS**									8082	32.7		99.7	105.1		113.3																	

1- ppha from Table 2.6 of surrey Design Criteria
2- Assumed grade based on existing ground elevations. To be confirmed with road profile design.
3- Q Capacity and D Capacity based on 50% of pipes when flows are less then 40 L/s, and 83.2% of pipe full capacity (equivalent to flow with normal depth of 70% of pipe diameter) when flows are greater than 40 L/s.
4- Velocity based on normal depth flow at 70% of PDWF.
5- Conceptual Rim and Depth based on conceptual finished ground. Does not take into account any review of road profile or geometry.

Q > 40 L/s
Size > 200mm
3.6 Pipe depth > 3.5m
0.5 Pipe Velocity < 0.6 m/s

Land Use	Assumed Zoning	Abbr.
Road	NA	NA
Buffer	NA	NA
Trail	NA	NA
Riparian	NA	NA
Park Acquisition	NA	NA
Potential Park	NA	NA
School	Institutional	PI
Community Centre	Commercial Recreation	CPR
Institutional	Institutional	PI
Commercial	CD (based on C-15)	C-15
Village Commercial	Community Commercial	C-8
Industrial Low Impact	Light Impact Industrial	IL
Industrial Business Park	Business Park	IB
Suburban Cluster	Half-Acre Residential (Gross Density)	RH, RH-G
Low Density Urban 6-10	Single Family Residential - 12m Frontage	RF-12
Cluster Residential 4-6	CD (based on RF)	RF
Cluster Residential 6-10	CD (based on RF-9)	RF-9
Cluster Residential 10-15	CD (based on RM-10)	RM-10
Medium Density 10-15	Single Family Residential - 9m Frontage	RF-9
Medium High Density 15-25	Multiple Residential Development	RM-30
High Density Residential 25-45	CD (based on RM-30)	RM-30
High Density Residential 30-45	CD (based on RM-45)	RM-45
Special Residential 15-25	CD (based on RM-30)	RM-30

Table 3.4-6

Unit Demand	350 L/person/day		Project	Anniedale Tynehead NCP
Infiltration	0.130 L/s/ha	11200 L/ha/day	Scenario	NCP - December 2010 Landuse
Manning's Coefficient (n)	0.013		Client	City of Surrey
			USL Job	1072.0173.01

176th Street Pump Station Catchment

Development Areas: Anniedale A - West 2, Anniedale B3 & Anniedale B4

Sub Catchment	US Node	DS Node	Catchment Details: Area (ha)	Zoning	Population Density (ppha) [1]	Parcel Population	Total Population	Flow Details: Point Loads (L/s)	Point Loads Accum. (L/s)	Average Dry Weather Flow Acc. Popl'n	Average Dry Weather Flow Flow (L/s)	Peak Dry Weather Flow Peak Factor	Peak Dry Weather Flow Flow (L/s)	Infiltration Flow Accum. Area (ha)	Infiltration Flow Flow (L/s)	PWWF (L/s)	Pipe Design: Length (m)	Assumed Grade [2]	Size (mm)	Design Guideline Capacity [3] (L/s)	Qdes / Qcap [3] (%)	Ddes / Dcap [3] (%)	Velocity [4] (m/s)	US Node Elevation Est. Rim	US Node Elevation Con. [5] Rim	US Node Elevation Est. Invert	DS Node Elevation Est. Rim	DS Node Elevation Con. [5] Rim	DS Node Elevation Est. Invert	Depth to pipe invert (m) US	Con. [5] US	DS	Con. [5] DS
East			0.53	NA	0	0																											
East			0.84	C-8	60	50																											
East			0.78	RM-30	206	161																											
East	**083**	082	2.15				211	0.0	0.0	211	0.9	4.14	3.5	2.2	0.3	3.8	104	1.00%	200	16.4	23%	46%	0.6	47.7		45.7	48.0		44.6	2.00		3.38	
East			0.42	NA	0	0																											
East			0.81	RM-30	206	167																											
East	**082**	081	1.23				167	0.0	0.0	378	1.5	4.03	6.2	3.4	0.4	6.6	98	0.60%	200	12.7	52%	68%	0.6	48.0		44.6	46.6		44.0	3.40		2.57	
East			0.45	NA	0	0																											
East			0.83	RM-30	206	171																											
East	**081**	080	1.28				171	0.0	0.0	549	2.2	3.95	8.8	4.7	0.6	9.4	100	1.50%	200	20.1	47%	64%	0.9	46.6		44.0	44.5		42.5	2.59		2.00	
East			0.28	NA	0	0																											
East			0.29	RF-9	128	37																											
East	**085**	084	0.57				37	0.0	0.0	37	0.1	4.34	0.7	0.6	0.1	0.7	92	2.50%	200	25.9	3%	16%	0.5	48.7		46.7	47.4		44.4	2.00		2.98	
East	**084**	080					0	0.0	0.0	37	0.1	4.34	0.7	0.6	0.1	0.7	110	2.50%	200	25.9	3%	16%	0.5	47.4		44.4	44.5		41.7	3.00		2.86	
East			0.28	NA	0	0																											
East			0.86	RM-30	206	177																											
East	**080**	079	1.14				177	0.0	0.0	763	3.1	3.87	12.0	6.4	0.8	12.8	108	2.00%	200	23.2	55%	70%	1.1	44.5		41.7	41.5		39.5	2.88		2.00	
East			0.28	NA	0	0																											
East			0.83	RM-30	206	171																											
East	**079**	068	1.11				171	0.0	0.0	934	3.8	3.82	14.4	7.5	1.0	15.4	100	1.00%	200	16.4	94%	96%	0.9	41.5		39.4	40.6		38.4	2.02		2.15	
East			0.65	NA	0	0																											
East			1.18	RF-9	128	151																											
East	**078**	076	1.83				151	0.0	0.0	151	0.6	4.19	2.6	1.8	0.2	2.8	150	1.00%	200	16.4	17%	38%	0.6	46.2		44.2	45.5		42.7	2.00		2.85	
East			1.11	NA	0	0																											
East			0.66	RM-10	114	75																											
East	**077**	076	1.77				75	0.0	0.0	75	0.3	4.28	1.3	1.8	0.2	1.5	44	1.00%	200	16.4	9%	28%	0.5	45.4		43.4	45.5		43.0	2.00		2.53	
East	**076**	073					0	0.0	0.0	226	0.9	4.13	3.8	3.6	0.5	4.2	106	1.00%	200	16.4	26%	48%	0.6	45.5		42.7	44.8		41.6	2.85		3.20	
East			0.4	NA	0	0																											
East			0.84	RF-9	128	108																											
East	**075**	074	1.24				108	0.0	0.0	108	0.4	4.24	1.9	1.2	0.2	2.0	73	1.00%	200	16.4	12%	32%	0.5	45.6		42.9	45.0		42.2	2.68		2.83	
East	**074**	073					0	0.0	0.0	108	0.4	4.24	1.9	1.2	0.2	2.0	81	0.60%	200	12.7	16%	38%	0.4	45.0		42.1	44.8		41.7	2.85		3.16	
East			1.17	NA	0	0																											
East			0.51	RF-9	128	65																											
East	**073**	070	1.68				65	0.0	0.0	399	1.6	4.02	6.5	6.5	0.8	7.3	90	0.70%	200	13.7	54%	70%	0.6	44.8		41.6	44.4		41.0	3.20		3.45	
East			0.24	NA	0	0																											
East			0.36	RF-9	128	46																											
East	**072**	071	0.6				46	0.0	0.0	46	0.2	4.32	0.8	0.6	0.1	0.9	77	1.70%	200	21.4	4%	18%	0.5	45.7		43.0	44.4		41.7	2.67		2.67	
East			0.24	NA	0	0																											
East			0.22	RF-9	128	28																											
East	**071**	070	0.46				28	0.0	0.0	74	0.3	4.28	1.3	1.1	0.1	1.4	83	0.60%	200	12.7	11%	32%	0.4	44.4		41.7	44.4		41.2	2.69		3.24	
East	**070**	068	0				0	0.0	0.0	473	1.9	3.99	7.6	7.6	1.0	8.6	118	2.00%	200	23.2	37%	58%	1.0	44.4		41.0	40.6		38.6	3.45		2.00	
East			1.38	NA	0	0																											
East			1.5	RM-30	206	309																											
East	**069**	068	2.88				309	0.0	0.0	309	1.3	4.07	5.1	2.9	0.4	5.5	97	1.00%	200	16.4	33%	54%	0.7	40.4		38.4	40.6		37.4	2.00		3.20	
East	**068**	067					0	0.0	0.0	1716	7.0	3.64	25.3	17.9	2.3	27.6	103	3.00%	200	28.4	97%	98%	1.6	40.6		37.4	36.8		34.3	3.22		2.48	
East	**067**	064					0	0.0	0.0	1716	7.0	3.64	25.3	17.9	2.3	27.6	108	3.00%	200	28.4	97%	98%	1.6	36.8		34.3	33.0		31.0	2.50		2.00	
East			12.9	NA	0	0																											
East			3.45	RM-10	114	393																											
East	**066**	065	16.35				393	0.0	0.0	393	1.6	4.03	6.4	16.4	2.1	8.5	107	1.10%	200	17.2	50%	66%	0.8	33.0		31.0	31.8		29.8	2.00		2.00	
East			0.73	NA	0	0																											
East			3.53	RM-10	114	402																											
East	**065**	064	4.26				402	0.0	0.0	795	3.2	3.86	12.4	20.6	2.7	15.1	103	0.30%	250	16.3	93%	94%	0.6	31.8		29.8	33.0		29.5	2.02		3.50	

Unit Demand	350 L/person/day		Project	Anniedale Tynehead NCP		**176th Street Pump Station Catchment**	
Infiltration	0.130 L/s/ha	11200 L/ha/day	Scenario	NCP - December 2010 Landuse			
Manning's Coefficient (n)	0.013		Client	City of Surrey			
			USL Job	1072.0173.01		Development Areas: Anniedale A - West 2, Anniedale B3 & Anniedale B4	

Sub Catchment	US Node	DS Node	Catchment Details: Area (ha)	Zoning	Population Density (ppha) [1]	Parcel Population	Total Population	Flow Details: Point Loads (L/s)	Point Loads Accum. (L/s)	Average Dry Weather Flow: Acc. Popl'n	Average Dry Weather Flow: Flow (L/s)	Peak Dry Weather Flow: Peak Factor	Peak Dry Weather Flow: Flow (L/s)	Infiltration Flow: Accum. Area (ha)	Infiltration Flow: Flow (L/s)	PWWF (L/s)	Pipe Design: Length (m)	Assumed Grade [2]	Size (mm)	Design Guideline Capacity [3] (L/s)	Qdes / Qcap [3] (%)	Ddes / Dcap [3] (%)	Velocity [4] (m/s)	US Node Elevation: Est. Rim	Con. [5] Rim	Est. Invert	DS Node Elevation: Est. Rim	Con. [5] Rim	Est. Invert	Depth to pipe invert (m): US	Con. [5] US	DS	Con. [5] DS
South			0.2	NA	0	0																											
South			2.02	RM-10	114	230																											
South	**064**	063	2.22				230	0.0	0.0	2741	11.1	3.48	38.6	40.8	5.3	43.9	72	0.50%	300	56.9	77%	83%	0.9	33.0		29.5	32.3		29.1	**3.52**		3.22	
South			0.35	NA	0	0																											
South			3.81	RM-10	114	434																											
South	**063**	062	4.16				434	0.0	0.0	3175	12.9	3.42	44.0	44.9	5.8	49.8	104	0.50%	300	56.9	88%	90%	0.9	32.3		29.1	31.3		28.6	3.24		2.70	
South			0.77	NA	0	0																											
South			0.43	RM-10	114	49																											
South	**062**	061	1.2				49	0.0	0.0	3224	13.1	3.42	44.6	46.1	6.0	50.6	43	1.10%	300	84.4	60%	70%	1.3	31.3		28.6	30.1		28.1	2.72		2.00	
South			0.43	NA	0	0																											
South			2.42	RM-10	114	276																											
South	**061**	060	2.85				276	0.0	0.0	3500	14.2	3.39	48.0	49.0	6.3	54.3	82	1.30%	300	91.7	59%	70%	1.4	30.1		28.1	29.0		27.0	2.02		2.00	
South			0.17	NA	0	0																											
South			0.85	RM-10	114	97																											
South	**060**	059	1.02				97	0.0	0.0	3597	14.6	3.38	49.2	50.0	6.5	55.7	69	2.40%	300	124.6	45%	60%	1.7	29.0		27.0	27.4		25.4	2.02		2.00	
South			0.34	NA	0	0																											
South			1.83	RM-10	114	209																											
South	**059**	058	2.17				209	0.0	0.0	3806	15.4	3.35	51.7	52.2	6.8	58.5	40	1.20%	300	88.1	66%	76%	1.3	27.4		25.3	26.9		24.9	2.02		2.00	
South			0.6	NA	0	0																											
South			3.13	RM-10	114	357																											
South	**058**	057	3.73				357	0.0	0.0	4163	16.9	3.32	56.0	55.9	7.2	63.2	98	5.90%	300	195.4	32%	50%	2.5	26.9		24.8	21.1		19.1	2.02		2.00	
South			0.39	NA	0	0																											
South			0.62	RM-10	114	71																											
South	**057**	056	1.01				71	0.0	0.0	4234	17.2	3.31	56.8	56.9	7.4	64.2	106	10.30%	300	258.2	25%	43%	3.0	21.1		19.1	10.2		8.2	2.02		2.00	
South			0.28	NA	0	0																											
South			2.56	RM-10	114	292																											
South	**056**	055	2.84				292	0.0	0.0	4526	18.3	3.29	60.2	59.8	7.7	68.0	84	0.80%	300	72.0	94%	94%	1.2	10.2		8.2	10.8		7.5	2.02		3.32	
South			0.54	NA	0	0																											
South			3.45	RM-10	114	393																											
South	**055**	054	3.99				393	0.0	0.0	4919	19.9	3.25	64.8	63.7	8.3	73.1	99	1.70%	300	104.9	70%	77%	1.6	10.8		7.5	7.8		5.8	3.34		2.00	
South			0.55	NA	0	0																											
South			1.48	RM-10	114	169																											
South	**054**	053	2.03				169	0.0	0.0	5088	20.6	3.24	66.7	65.8	8.5	75.3	113	3.40%	300	148.4	51%	64%	2.1	7.8		5.8	4.0		2.0	2.02		2.00	
South			0.2	NA	0	0																											
South			0.3	RM-10	114	34																											
South	**088**	087	0.5				34	0.0	0.0	34	0.1	4.35	0.6	0.5	0.1	0.7	60	12.60%	200	58.2	1%	10%	0.9	27.2		25.2	19.6		17.6	2.00		2.00	
South	**087**	086					0	0.0	0.0	34	0.1	4.35	0.6	0.5	0.1	0.7	47	15.00%	200	63.5	1%	10%	0.9	19.6		17.6	12.5		10.5	2.02		2.00	
South	**086**	053					0	0.0	0.0	34	0.1	4.35	0.6	0.5	0.1	0.7	93	9.20%	200	49.7	1%	10%	0.8	12.5		10.5	4.0		2.0	2.02		2.00	
South			0.47	NA	0	0																											
South			2.04	RM-10	114	233																											
South	**053**	000	2.51				233	0.0	0.0	5355	21.7	3.22	69.8	68.8	8.9	78.7	134	0.30%	375	79.9	99%	97%	0.9	4.0		1.9	4.7		1.5	2.02		3.17	
North-East			1.52	NA	0	0																											
North-East			0.42	C-8	60	25																											
North-East			1.11	RM-30	206	229																											
North-East	**052**	051	3.05				254	0.0	0.0	254	1.0	4.11	4.2	3.1	0.4	4.6	66	1.00%	200	16.4	28%	50%	0.6	47.0		45.0	46.7		44.3	2.00		2.34	
North-East	**051**	050					0	0.0	0.0	254	1.0	4.11	4.2	3.1	0.4	4.6	36	0.60%	200	12.7	36%	56%	0.5	46.7		44.3	46.6		44.1	2.36		2.46	
North-East	**050**	048					0	0.0	0.0	254	1.0	4.11	4.2	3.1	0.4	4.6	58	0.50%	200	11.6	40%	60%	0.5	46.6		44.1	47.0		43.8	2.48		3.21	
North-East			0.41	NA	0	0																											
North-East			0.88	RM-30	206	181																											
North-East	**049**	048	1.29				181	0.0	0.0	181	0.7	4.16	3.1	1.3	0.2	3.2	116	1.00%	200	16.4	20%	42%	0.6	48.0		46.0	47.0		44.8	2.00		2.17	
North-East			0.31	NA	0	0																											
North-East			0.28	RM-30	206	58																											
North-East	**048**	046	0.59				58	0.0	0.0	493	2.0	3.98	7.9	4.9	0.6	8.6	83	0.50%	200	11.6	74%	84%	0.6	47.0		43.8	45.9		43.4	3.21		2.48	

Unit Demand 350 L/person/day
Infiltration 0.130 L/s/ha 11200 L/ha/day
Manning's Coefficient (n) 0.013

Project: Anniedale Tynehead NCP
Scenario: NCP - December 2010 Landuse
Client: City of Surrey
USL Job: 1072.0173.01

176th Street Pump Station Catchment

Development Areas: Anniedale A - West 2, Anniedale B3 & Anniedale B4

Sub Catchment	US Node	DS Node	Catchment Details					Flow Details									Pipe Design																
								Point Loads		Average Dry Weather Flow		Peak Dry Weather Flow		Infiltration Flow		PWWF	Pipe Design							US Node Elevation			DS Node Elevation			Depth to pipe invert (m)			
			Area (ha)	Zoning	Population Density (ppha) [1]	Parcel Population	Total Population	(L/s)	Accum. (L/s)	Acc. Popl'n	Flow (L/s)	Peak Factor	Flow (L/s)	Accum. Area (ha)	Flow (L/s)	(L/s)	Length (m)	Assumed Grade [2]	Size (mm)	Design Guideline Capacity [3] (L/s)	Qdes / Qcap [3] (%)	Ddes / Dcap [3] (%)	Velocity [4] (m/s)	Est. Rim	Con. [5] Rim	Est. Invert	Est. Rim	Con. [5] Rim	Est. Invert	US	Con. [5] US	DS	Con. [5] DS
North-East			0.57	NA	0	0																											
North-East			0.72	RM-10	114	82																											
North-East	047	046	1.29				82	0.0	0.0	82	0.3	4.27	1.4	1.3	0.2	1.6	49	1.60%	200	20.7	8%	26%	0.6	45.6		43.6	45.9		42.8	2.00		3.02	
North-East			1.73	NA	0	0																											
North-East			0.61	C-8	60	37																											
North-East	046	045	2.34				37	0.0	0.0	612	2.5	3.93	9.7	8.6	1.1	10.8	116	0.70%	200	13.7	79%	86%	0.7	45.9		42.8	44.0		42.0	3.04		2.00	
North-East	045	037					0	0.0	0.0	612	2.5	3.93	9.7	8.6	1.1	10.8	136	0.60%	200	12.7	85%	90%	0.7	44.0		42.0	44.0		41.2	2.02		2.84	
North-East			1.25	NA	0	0																											
North-East			1.01	RM-30	206	208																											
North-East	044	043	2.26				208	0.0	0.0	208	0.8	4.14	3.5	2.3	0.3	3.8	110	1.00%	200	16.4	23%	44%	0.6	48.5		46.5	47.4		45.4	2.00		2.00	
North-East	043	041					0	0.0	0.0	208	0.8	4.14	3.5	2.3	0.3	3.8	87	0.60%	200	12.7	30%	52%	0.5	47.4		45.4	48.4		44.9	2.02		3.51	
North-East			0.17	NA	0	0																											
North-East			1.26	RM-30	206	260																											
North-East	042	041	1.43				260	0.0	0.0	260	1.1	4.11	4.3	1.4	0.2	4.5	101	0.80%	200	14.7	31%	52%	0.6	49.0		47.0	48.4		46.2	2.00		2.17	
North-East			0.29	NA	0	0																											
North-East			0.26	RM-30	206	54																											
North-East	041	039	0.55				54	0.0	0.0	522	2.1	3.97	8.4	4.2	0.5	8.9	91	0.70%	200	13.7	65%	78%	0.7	48.4		44.9	46.2		44.2	3.51		2.00	
North-East			0.38	NA	0	0																											
North-East			0.65	RM-30	206	134																											
North-East	040	039	1.03				134	0.0	0.0	134	0.5	4.21	2.3	1.0	0.1	2.4	101	1.00%	200	16.4	15%	36%	0.5	47.1		45.1	46.2		44.1	2.00		2.13	
North-East	039	037					0	0.0	0.0	656	2.7	3.91	10.4	5.3	0.7	11.1	107	1.90%	200	22.6	49%	66%	1.0	46.2		44.1	44.0		42.0	2.15		2.00	
North-East			0.29	NA	0	0																											
North-East			1.2	CPR	50	60																											
North-East	038	037	1.49				60	0.0	0.0	60	0.2	4.30	1.0	1.5	0.2	1.2	76	2.20%	200	24.3	5%	20%	0.6	44.7		42.7	44.0		41.1	2.00		2.93	
North-East			2.68	NA	0	0																											
North-East			0.02	PI	50	1																											
North-East	037	036	2.7				1	0.0	0.0	1329	5.4	3.72	20.0	18.0	2.3	22.3	89	1.90%	200	22.6	99%	98%	1.3	44.0		41.0	41.4		39.4	2.95		2.00	
North-East	036	035					0	0.0	0.0	1329	5.4	3.72	20.0	18.0	2.3	22.3	91	4.00%	200	32.8	68%	80%	1.7	41.4		39.4	37.7	37.7	35.7	2.02		2.00	2.00
North-East			0.17	NA	0	0																											
North-East			1.19	PI	50	60																											
North-East	035	034	1.36				60	0.0	0.0	1389	5.6	3.70	20.8	19.4	2.5	23.4	85	0.50%	300	34.2	68%	80%	0.8	37.7	37.7	35.7	37.8	37.8	35.3	2.02	2.02	2.54	2.54
North-Center			0.36	NA	0	0																											
North-Center			0.96	PI	50	48																											
North-Center	034	023	1.32				48	0.0	0.0	1437	5.8	3.69	21.5	20.7	2.7	24.2	73	0.50%	300	34.2	71%	82%	0.8	37.8	37.8	35.3	38.4	38.4	34.9	2.56	2.56	3.47	3.47
North-Center			0.54	NA	0	0																											
North-Center			0.28	RM-30	206	58																											
North-Center	033	031	0.82				58	0.0	0.0	58	0.2	4.30	1.0	0.8	0.1	1.1	81	1.20%	200	18.0	6%	24%	0.4	51.4		49.4	50.5		48.5	2.00		2.00	
North-Center			0.97	NA	0	0																											
North-Center			1	RM-30	206	206																											
North-Center	032	031	1.97				206	0.0	0.0	206	0.8	4.14	3.5	2.0	0.3	3.7	98	4.10%	200	33.2	11%	32%	1.0	54.5		52.5	50.5		48.5	2.00		2.00	
North-Center			0.16	NA	0	0																											
North-Center			0.26	RM-30	206	54																											
North-Center	031	029	0.42				54	0.0	0.0	318	1.3	4.07	5.2	3.2	0.4	5.7	85	0.60%	200	12.7	45%	64%	0.6	50.5		48.4	50.8		47.9	2.02		2.86	
North-Center			0.18	NA	0	0																											
North-Center			0.77	RM-30	206	159																											
North-Center	030	029	0.95				159	0.0	0.0	159	0.6	4.18	2.7	1.0	0.1	2.8	98	3.40%	200	30.2	9%	28%	0.9	54.1		52.1	50.8		48.8	2.00		2.00	
North-Center	029	027					0	0.0	0.0	477	1.9	3.99	7.7	4.2	0.5	8.2	89	1.60%	200	20.7	40%	60%	0.9	50.8		47.9	48.5		46.5	2.86		2.00	
North-Center			0.58	NA	0	0																											
North-Center			0.66	RM-30	206	136																											
North-Center	028	027	1.24				136	0.0	0.0	136	0.6	4.21	2.3	1.2	0.2	2.5	106	3.50%	200	30.7	8%	26%	0.8	52.2		50.2	48.5		46.5	2.00		2.00	
North-Center			0.19	NA	0	0																											
North-Center			0.58	RM-30	206	119																											
North-Center	027	025	0.77				119	0.0	0.0	732	3.0	3.88	11.5	6.2	0.8	12.3	110	1.90%	200	22.6	54%	70%	1.1	48.5		46.5	46.4		44.4	2.02		2.00	

Unit Demand	350 L/person/day		Project	Anniedale Tynehead NCP
Infiltration	0.130 L/s/ha	11200 L/ha/day	Scenario	NCP - December 2010 Landuse
Manning's Coefficient (n)	0.013		Client	City of Surrey
			USL Job	1072.0173.01

176th Street Pump Station Catchment

Development Areas: Anniedale A - West 2, Anniedale B3 & Anniedale B4

Sub Catchment	US Node	DS Node	Catchment Details					Flow Details									Pipe Design																	
								Point Loads		Average Dry Weather Flow		Peak Dry Weather Flow		Infiltration Flow		PWWF	Pipe Design							US Node Elevation			DS Node Elevation			Depth to pipe invert (m)			
			Area (ha)	Zoning	Population Density (ppha) [1]	Parcel Population	Total Population	(L/s)	Accum. (L/s)	Acc. Popl'n	Flow (L/s)	Peak Factor	Flow (L/s)	Accum. Area (ha)	Flow (L/s)	(L/s)	Length (m)	Assumed Grade [2]	Size (mm)	Design Guideline Capacity [3] (L/s)	Qdes / Qcap [3] (%)	Ddes / Dcap [3] (%)	Velocity [4] (m/s)	Est. Rim	Con. [5] Rim	Est. Invert	Est. Rim	Con. [5] Rim	Est. Invert	US	Con. [5] US	DS	Con. [5] DS
North-Center			0.3	NA	0	0																											
North-Center			0.29	RM-30	206	60																											
North-Center	**026**	025	0.59				60	0.0	0.0	60	0.2	4.30	1.0	0.6	0.1	1.1	139	2.40%	200	25.4	4%	20%	0.6	49.8		47.8	46.4		44.4	2.00		2.00	
North-Center			0.13	NA	0	0																											
North-Center			0.37	RM-30	206	76																											
North-Center	**025**	024	0.5				76	0.0	0.0	868	3.5	3.84	13.5	7.3	0.9	14.4	67	1.00%	200	16.4	88%	92%	0.9	46.4		44.4	45.8		43.8	2.02		2.00	
North-Center	**024**	023					0	0.0	0.0	868	3.5	3.84	13.5	7.3	0.9	14.4	113	6.50%	200	41.8	35%	56%	1.8	45.8		43.7	38.4	38.4	36.4	2.02		2.00	2.00
North-Center			0.16	NA	0	0																											
North-Center			0.64	RM-30	206	132																											
North-Center	**023**	022	0.8				132	0.0	0.0	2437	9.9	3.52	34.7	28.8	3.7	38.5	73	0.30%	375	48.0	80%	88%	0.7	38.4	38.4	34.9	38.7	38.0	34.7	3.47	3.47	4.05	3.33
North-Center			0.34	NA	0	0																											
North-Center			0.78	RM-30	206	161																											
North-Center	**022**	017	1.12				161	0.0	0.0	2598	10.5	3.50	36.8	29.9	3.9	40.7	82	0.30%	375	79.9	51%	64%	0.7	38.7	38.0	34.7	36.8	37.0	34.4	4.07	3.35	2.41	2.59
North-Center			0.37	NA	0	0																											
North-Center			0.79	RM-30	206	163																											
North-Center	**021**	019	1.16				163	0.0	0.0	163	0.7	4.18	2.8	1.2	0.2	2.9	54	4.40%	200	34.4	8%	28%	1.0	51.4		49.4	49.0		47.0	2.00		2.00	
North-Center			0.33	NA	0	0																											
North-Center			0.56	RM-30	206	115																											
North-Center	**020**	019	0.89				115	0.0	0.0	115	0.5	4.23	2.0	0.9	0.1	2.1	96	1.50%	200	20.1	10%	30%	0.6	49.5		47.5	49.0		46.0	2.00		2.95	
North-Center			0.23	NA	0	0																											
North-Center			1.19	RM-30	206	245																											
North-Center	**019**	018	1.42				245	0.0	0.0	523	2.1	3.97	8.4	3.5	0.4	8.9	98	5.10%	200	37.0	24%	46%	1.4	49.0		46.0	43.0		41.0	2.97		2.00	
North-Center	**018**	017					0	0.0	0.0	523	2.1	3.97	8.4	3.5	0.4	8.9	85	7.30%	200	44.3	20%	42%	1.6	43.0		41.0	36.8	37.0	34.8	2.02		2.00	2.19
North-Center			0.58	NA	0	0																											
North-Center			0.61	RM-30	206	126																											
North-Center	**017**	016	1.19				126	0.0	0.0	3247	13.2	3.41	44.9	34.5	4.5	49.4	99	0.30%	375	79.9	62%	71%	0.8	36.8	37.0	34.4	37.3	37.3	34.1	2.41	2.59	3.16	3.16
North-Center			0.16	NA	0	0																											
North-Center			0.24	RM-10	114	27																											
North-Center			0.37	RM-30	206	76																											
North-Center	**016**	004	0.77				104	0.0	0.0	3351	13.6	3.40	46.2	35.3	4.6	50.8	84	0.30%	375	79.9	64%	73%	0.8	37.3	37.3	34.1	36.0		33.8	3.18	3.18	2.16	
West			1.07	NA	0	0																											
West			0.91	RM-45	266	242																											
West	**015**	014	1.98				242	0.0	0.0	242	1.0	4.12	4.0	2.0	0.3	4.3	114	1.40%	200	19.4	22%	44%	0.7	56.4		54.4	54.8		52.8	2.00		2.00	
West			0.48	NA	0	0																											
West			1.92	RM-45	266	511																											
West	**014**	013	2.4				511	0.0	0.0	753	3.1	3.88	11.8	4.4	0.6	12.4	86	1.60%	200	20.7	60%	74%	1.0	54.8		52.8	53.5		51.5	2.02		2.00	
West	**013**	009					0	0.0	0.0	753	3.1	3.88	11.8	4.4	0.6	12.4	87	1.50%	200	20.1	62%	76%	1.0	53.5		51.4	52.1		50.1	2.02		2.00	
West			5.07	NA	0	0																											
West			0.27	RM-30	206	56																											
West			0.61	RM-45	266	162																											
West	**012**	011	5.95				218	0.0	0.0	218	0.9	4.14	3.7	6.0	0.8	4.4	52	1.00%	200	16.4	27%	48%	0.6	52.2		50.2	52.1		49.6	2.00		2.42	
West	**011**	010					0	0.0	0.0	218	0.9	4.14	3.7	6.0	0.8	4.4	69	0.60%	200	12.7	35%	56%	0.5	52.1		49.6	51.7		49.2	2.44		2.52	
West	**010**	009					0	0.0	0.0	218	0.9	4.14	3.7	6.0	0.8	4.4	33	0.50%	200	11.6	38%	58%	0.5	51.7		49.2	52.1		49.0	2.54		3.10	
West			0.99	NA	0	0																											
West			0.32	RM-30	206	66																											
West			0.92	RM-45	266	245																											
West	**009**	008	2.23				311	0.0	0.0	1282	5.2	3.73	19.4	12.6	1.6	21.0	112	2.70%	200	26.9	78%	86%	1.4	52.1		49.0	48.0		46.0	3.12		2.00	
West			0.44	NA	0	0																											
West			0.38	RM-30	206	78																											
West	**008**	005	0.82				78	0.0	0.0	1360	5.5	3.71	20.4	13.4	1.7	22.2	93	8.60%	200	48.1	46%	64%	2.2	48.0		46.0	41.9	41.3	38.0	2.02		3.91	3.28
West			0.59	NA	0	0																											
West			1.81	RM-30	206	373																											
West	**007**	006	2.4				373	0.0	0.0	373	1.5	4.04	6.1	2.4	0.3	6.4	106	7.10%	200	43.7	15%	36%	1.5	47.2	47.2	45.2	38.7	40.0	37.7	2.00	2.00	1.04	2.34
West	**006**	005					0	0.0	0.0	373	1.5	4.04	6.1	2.4	0.3	6.4	83	0.60%	200	12.7	50%	68%	0.6	38.7	40.0	37.5	41.9	41.3	37.0	1.20	2.50	4.88	4.25

Unit Demand	350 L/person/day		
Infiltration	0.130 L/s/ha	11200 L/ha/day	
Manning's Coefficient (n)	0.013		

Project	Anniedale Tynehead NCP
Scenario	NCP - December 2010 Landuse
Client	City of Surrey
USL Job	1072.0173.01

176th Street Pump Station Catchment

Development Areas: Anniedale A - West 2, Anniedale B3 & Anniedale B4

Sub Catchment	US Node	DS Node	Catchment Details: Area (ha)	Zoning	Population Density (ppha) [1]	Parcel Population	Total Population	Flow Details: Point Loads (L/s)	Point Loads Accum. (L/s)	Average Dry Weather Flow: Acc. Popl'n	Average Dry Weather Flow: Flow (L/s)	Peak Dry Weather Flow: Peak Factor	Peak Dry Weather Flow: Flow (L/s)	Infiltration Flow: Accum. Area (ha)	Infiltration Flow: Flow (L/s)	PWWF (L/s)	Pipe Design: Length (m)	Assumed Grade [2]	Size (mm)	Design Guideline Capacity [3] (L/s)	Qdes / Qcap [3] (%)	Ddes / Dcap [3] (%)	Velocity [4] (m/s)	US Node Elevation: Est. Rim	US Con. [5] Rim	US Est. Invert	DS Node Elevation: Est. Rim	DS Con. [5] Rim	DS Est. Invert	Depth to pipe invert (m): US	Con. [5] US	DS	Con. [5] DS
West			0.3	NA	0	0																											
West			0.35	RM-30	206	72																											
West	**005**	004	0.65				72	0.0	0.0	1805	7.3	3.62	26.5	16.4	2.1	28.6	85	3.50%	250	55.6	51%	68%	1.7	41.9	41.3	37.0	36.0	36.0	34.0	4.90	4.27	2.00	2.00
West			0.33	NA	0	0																											
West			0.3	RM-10	114	34																											
West			0.35	RM-30	206	72																											
West	**004**	003	0.98				106	0.0	0.0	5262	21.3	3.23	68.7	52.7	6.8	75.6	86	5.00%	375	326.2	23%	41%	2.4	36.0	36.0	33.8	31.6		29.6	2.16	2.16	2.00	
West			0.37	NA	0	0																											
West			0.23	RM-10	114	26																											
West			0.15	RM-30	206	31																											
West	**003**	002	0.75				57	0.0	0.0	5319	21.5	3.22	69.4	53.5	6.9	76.3	75	8.90%	375	435.2	18%	36%	3.0	31.6		29.5	24.9		22.9	2.02		2.00	
West			2.82	NA	0	0																											
West	**002**	001	2.82				0	0.0	0.0	5319	21.5	3.22	69.4	56.3	7.3	76.7	113	10.10%	375	463.6	17%	36%	3.1	24.9		22.9	13.4		11.4	2.02		2.00	
West	**001**	000					0	0.0	0.0	5319	21.5	3.22	69.4	56.3	7.3	76.7	111	7.80%	375	407.4	19%	37%	2.8	13.4		11.4	4.7		2.7	2.02		2.00	
Pump Station	**000**						0	0.0	0.0	10674	43.2	2.93	126.6	125.1	16.2	142.8								4.7		1.5				3.17			
Pump Station	**PS**									10674	43.2		126.6	125.1		142.8																	

1- ppha from Table 2.6 of surrey Design Criteria
2- Assumed grade based on existing ground elevations. To be confirmed with road profile design.
3- Q Capacity and D Capacity based on 50% of pipes when flows are less then 40 L/s, and 83.2% of pipe full capacity (equivalent to flow with normal depth of 70% of pipe diameter) when flows are greater than 40 L/s.
4- Velocity based on normal depth flow at 70% of PDWF.
5- Conceptual Rim and Depth based on conceptual finished ground. Does not take into account any review of road profile or geometry.

Q > 40 L/s
Size > 200mm
3.6 Pipe depth > 3.5m
0.5 Pipe Velocity < 0.6 m/s

Land Use	Assumed Zoning	Abbr.
Road	NA	NA
Buffer	NA	NA
Trail	NA	NA
Riparian	NA	NA
Park Acquisition	NA	NA
Potential Park	NA	NA
School	Institutional	PI
Community Centre	Commercial Recreation	CPR
Institutional	Institutional	PI
Commercial	CD (based on C-15)	C-15
Village Commercial	Community Commercial	C-8
Industrial Low Impact	Light Impact Industrial	IL
Industrial Business Park	Business Park	IB
Suburban Cluster	Half-Acre Residential (Gross Density)	RH, RH-G
Low Density Urban 6-10	Single Family Residential - 12m Frontage	RF-12
Cluster Residential 4-6	CD (based on RF)	RF
Cluster Residential 6-10	CD (based on RF-9)	RF-9
Cluster Residential 10-15	CD (based on RM-10)	RM-10
Medium Density 10-15	Single Family Residential - 9m Frontage	RF-9
Medium High Density 15-25	Multiple Residential Development	RM-30
High Density Residential 25-45	CD (based on RM-30)	RM-30
High Density Residential 30-45	CD (based on RM-45)	RM-45
Special Residential 15-25	CD (based on RM-30)	RM-30

Table 3.4-7

Unit Demand 350 L/person/day
Infiltration 0.130 L/s/ha 11200 L/ha/day
Manning's Coefficient (n) 0.013

Project: Anniedale Tynehead NCP
Scenario: NCP - December 2010 Landuse
Client: City of Surrey
USL Job: 1072.0173.01

184th Street Pump Station Catchment

Development Areas: Anniedale B2 & Port Kells

Sub Catchment	US Node	DS Node	Catchment Details: Area (ha)	Zoning	Population Density (ppha) [1]	Parcel Population	Total Population	Flow Details: Point Loads (L/s)	Point Loads Accum. (L/s)	Average Dry Weather Flow: Acc. Popl'n	Average Dry Weather Flow: Flow (L/s)	Peak Dry Weather Flow: Peak Factor	Peak Dry Weather Flow: Flow (L/s)	Infiltration Flow: Accum. Area (ha)	Infiltration Flow: Flow (L/s)	PWWF (L/s)	Pipe Design: Length (m)	Assumed Grade [2]	Size (mm)	Design Guideline Capacity [3] (L/s)	Qdes / Qcap [3] (%)	Ddes / Dcap [3] (%)	Velocity [4] (m/s)	US Node Elevation: Est. Rim	US Con. [5] Rim	US Est. Invert	DS Node Elevation: Est. Rim	DS Con. [5] Rim	DS Est. Invert	Depth to pipe invert (m): US	Con. [5] US	DS	Con. [5] DS
LPS			4.43	NA	0	0																											
LPS			1.44	IB	90	130																											
LPS			2.67	RF-9	128	342																											
LPS	**LPS**	LPS	8.54				471			471	1.9	3.99	7.6	8.5	1.1	8.7																	
East			0.17	NA	0	0																											
East			0.39	RF-9	128	50																											
East	**052**	046	0.56				50	8.7	8.7	50	0.2	4.32	9.6	0.6	0.1	9.7	91	1.83%	200	22.2	44%	62%	1.0	20.4		18.4	18.7		16.7	2.00		2.00	
East			1.14	NA	0	0																											
East			1.02	IB	90	92																											
East	**051**	050	2.16				92	0.0	0.0	92	0.4	4.25	1.6	2.2	0.3	1.9	99	1.00%	200	16.4	11%	32%	0.5	36.2	36.2	34.2	37.6	35.8	33.2	2.00	2.00	**4.42**	2.57
East			0.47	NA	0	0																											
East			0.46	IB	90	41																											
East	**050**	048	0.93				41	0.0	0.0	133	0.5	4.21	2.3	3.1	0.4	2.7	135	4.47%	200	34.7	8%	26%	0.9	37.6	35.8	33.2	29.2	29.2	27.2	**4.44**	2.59	2.00	2.00
East			0.18	NA	0	0																											
East			0.38	RF-9	128	49																											
East	**049**	048	0.56				49	0.0	0.0	49	0.2	4.32	0.9	0.6	0.1	0.9	75	1.29%	200	18.6	5%	20%	0.4	30.1		28.1	29.2	29.2	27.2	2.00		2.00	2.00
East			0.27	NA	0	0																											
East			0.78	RF-9	128	100																											
East	**048**	046	1.05				100	0.0	0.0	282	1.1	4.09	4.7	4.7	0.6	5.3	122	8.53%	200	47.9	11%	30%	1.4	29.2	29.2	27.1	18.7		16.7	2.02	2.02	2.00	
East			0.32	NA	0	0																											
East			0.65	RF-9	128	83																											
East	**047**	046	0.97				83	0.0	0.0	83	0.3	4.27	1.4	1.0	0.1	1.6	139	2.31%	200	24.9	6%	24%	0.6	21.9		19.9	18.7		16.7	2.00		2.00	
East	**046**	045					0	0.0	8.7	415	1.7	4.02	15.5	6.2	0.8	16.3	68	4.78%	200	35.9	45%	64%	1.7	18.7		16.7	15.5		13.5	2.02		2.00	
East	**045**	044					0	127.4	136.1	415	1.7	4.02	142.9	6.2	0.8	143.7	80	0.30%	525	196.0	73%	80%	1.0	15.5		13.4	15.2		13.2	2.03		2.00	
East	**044**	029					0	0.0	136.1	415	1.7	4.02	142.9	6.2	0.8	143.7	84	0.31%	525	199.6	72%	79%	1.1	15.2		13.2	14.9		12.9	2.03		2.00	

Unit Demand	350 L/person/day		
Infiltration	0.130 L/s/ha	11200 L/ha/day	
Manning's Coefficient (n)	0.013		

Project	Anniedale Tynehead NCP
Scenario	NCP - December 2010 Landuse
Client	City of Surrey
USL Job	1072.0173.01

184th Street Pump Station Catchment

Development Areas: Anniedale B2 & Port Kells

Sub Catchment	US Node	DS Node	Catchment Details					Flow Details									Pipe Design															
								Point Loads		Average Dry Weather Flow		Peak Dry Weather Flow		Infiltration Flow		PWWF	Pipe Design							US Node Elevation			DS Node Elevation			Depth to pipe invert (m)			
			Area (ha)	Zoning	Population Density (ppha) [1]	Parcel Population	Total Population	(L/s)	Accum. (L/s)	Acc. Popl'n	Flow (L/s)	Peak Factor	Flow (L/s)	Accum. Area (ha)	Flow (L/s)	(L/s)	Length (m)	Assumed Grade [2]	Size (mm)	Design Guideline Capacity [3] (L/s)	Qdes / Qcap [3] (%)	Ddes / Dcap [3] (%)	Velocity [4] (m/s)	Est. Rim	Con. [5] Rim	Est. Invert	Est. Rim	Con. [5] Rim	Est. Invert	US	Con. [5] US	DS	Con. [5] DS
Center-East			0.39	NA	0	0																											
Center-East			0.55	IB	90	50																											
Center-East	**043**	040	0.94				50	0.0	0.0	50	0.2	4.32	0.9	0.9	0.1	1.0	40	8.99%	200	49.2	2%	14%	0.9	37.5		35.5	33.9		31.9	2.00		2.00	
Center-East			0.41	NA	0	0																											
Center-East			0.8	IB	90	72																											
Center-East	**042**	041	1.21				72	0.0	0.0	72	0.3	4.28	1.2	1.2	0.2	1.4	102	2.30%	200	24.9	6%	22%	0.6	35.4		33.4	33.1		31.1	2.00		2.00	
Center-East	**041**	040					0	0.0	0.0	72	0.3	4.28	1.2	1.2	0.2	1.4	68	0.60%	200	12.7	11%	30%	0.4	33.1		31.1	33.9		30.6	2.02		3.29	
Center-East			0.15	NA	0	0																											
Center-East			0.18	RF-9	128	23																											
Center-East	**040**	036	0.33				23	0.0	0.0	145	0.6	4.20	2.5	2.5	0.3	2.8	79	6.70%	200	42.4	7%	24%	1.1	33.9		30.6	27.3		25.3	3.31		2.00	
Center-East			0.38	NA	0	0																											
Center-East			0.68	RF-9	128	87																											
Center-East	**039**	038	1.06				87	0.0	0.0	87	0.4	4.26	1.5	1.1	0.1	1.6	127	3.20%	200	29.3	6%	22%	0.7	34.2		32.2	30.2		28.2	2.00		2.00	
Center-East			0.23	NA	0	0																											
Center-East			0.34	RF-9	128	44																											
Center-East	**038**	036	0.57				44	0.0	0.0	131	0.5	4.21	2.2	1.6	0.2	2.4	123	2.30%	200	24.9	10%	30%	0.7	30.2		28.1	27.3		25.3	2.02		2.00	
Center-East			0.17	NA	0	0																											
Center-East			0.28	RF-9	128	36																											
Center-East	**037**	036	0.45				36	0.0	0.0	36	0.1	4.34	0.6	0.5	0.1	0.7	63	4.20%	200	33.6	2%	14%	0.6	30.0		28.0	27.3		25.3	2.00		2.00	
Center-East			0.18	NA	0	0																											
Center-East			0.26	RF-9	128	33																											
Center-East	**036**	034	0.44				33	0.0	0.0	344	1.4	4.05	5.7	5.0	0.6	6.3	58	3.70%	200	31.5	20%	42%	1.1	27.3		25.3	25.2		23.2	2.02		2.00	
Center-East			0.04	NA	0	0																											
Center-East			0.35	RF-9	128	45																											
Center-East	**035**	034	0.39				45	0.0	0.0	45	0.2	4.33	0.8	0.4	0.1	0.8	62	3.70%	200	31.5	3%	16%	0.6	27.5		25.5	25.2		23.2	2.00		2.00	
Center-East	**034**	030					0	0.0	0.0	389	1.6	4.03	6.3	5.4	0.7	7.0	64	6.50%	200	41.8	17%	38%	1.4	25.2		23.2	21.0		19.0	2.02		2.00	
Center-East			0.33	NA	0	0																											
Center-East			1.43	RF-9	128	183																											
Center-East	**033**	031	1.76				183	0.0	0.0	183	0.7	4.16	3.1	1.8	0.2	3.3	133	3.40%	200	30.2	11%	30%	0.9	26.9		24.9	22.4		20.4	2.00		2.00	
Center-East			0.25	NA	0	0																											
Center-East			0.32	RF-9	128	41																											
Center-East	**032**	031	0.57				41	0.0	0.0	41	0.2	4.33	0.7	0.6	0.1	0.8	62	7.40%	200	44.6	2%	12%	0.8	27.0		25.0	22.4		20.4	2.00		2.00	
Center-East			0.26	NA	0	0																											
Center-East			0.46	RF-9	128	59																											
Center-East	**031**	030	0.72				59	0.0	0.0	283	1.1	4.09	4.7	3.1	0.4	5.1	116	1.20%	200	18.0	28%	50%	0.7	22.4		20.4	21.0		19.0	2.02		2.00	
Center-East			0.16	NA	0	0																											
Center-East			0.61	RF-9	128	78																											
Center-East	**030**	029	0.77				78	0.0	0.0	750	3.0	3.88	11.8	9.2	1.2	13.0	65	9.40%	200	50.3	26%	48%	2.0	21.0		19.0	14.9	14.9	12.9	2.02		2.00	2.00
Center-East	**029**	028					0	0.0	136.1	1165	4.7	3.76	153.8	15.4	2.0	155.9	146	0.35%	525	211.7	74%	80%	1.1	14.9	14.9	12.9	14.2	14.2	12.4	2.03	2.03	**1.86**	**1.86**
Center-East	**028**	016					0	0.0	136.1	1165	4.7	3.76	153.8	15.4	2.0	155.9	136	0.35%	525	211.7	74%	80%	1.1	14.2	14.2	12.2	14.0	14.0	11.7	2.03	2.03	2.29	2.29
Center			0.85	NA	0	0																											
Center			2.32	RM-10	114	264																											
Center	**027**	026	3.17				264	0.0	0.0	264	1.1	4.10	4.4	3.2	0.4	4.8	143	1.00%	200	16.4	29%	50%	0.7	44.1		42.1	44.0		40.7	2.00		3.32	
Center			0.18	NA	0	0																											
Center			0.44	RM-30	206	91																											
Center	**026**	025	0.62				91	0.0	0.0	355	1.4	4.05	5.8	3.8	0.5	6.3	125	0.60%	200	12.7	50%	66%	0.6	44.0		40.7	42.4		39.9	3.34		2.45	
Center			0.36	NA	0	0																											
Center			0.83	RM-30	206	171																											
Center	**025**	024	1.19				171	0.0	0.0	526	2.1	3.96	8.4	5.0	0.6	9.1	135	5.10%	200	37.0	25%	46%	1.4	42.4		39.9	35.0		33.0	2.47		2.00	
Center			0.2	NA	0	0																											
Center	**024**	017	0.2				0	0.0	0.0	526	2.1	3.96	8.4	5.2	0.7	9.1	115	5.60%	200	38.8	23%	46%	1.5	35.0		33.0	28.5		26.5	2.02		2.00	
Center			0.27	NA	0	0																											
Center			0.26	RM-10	114	30																											

Unit Demand	350 L/person/day		
Infiltration	0.130 L/s/ha	11200 L/ha/day	
Manning's Coefficient (n)	0.013		

Project	Anniedale Tynehead NCP
Scenario	NCP - December 2010 Landuse
Client	City of Surrey
USL Job	1072.0173.01

184th Street Pump Station Catchment

Development Areas: Anniedale B2 & Port Kells

Sub Catchment	US Node	DS Node	Catchment Details					Flow Details									Pipe Design																
								Point Loads		Average Dry Weather Flow		Peak Dry Weather Flow		Infiltration Flow		PWWF	Pipe Design							US Node Elevation			DS Node Elevation			Depth to pipe invert (m)			
			Area (ha)	Zoning	Population Density (ppha) [1]	Parcel Population	Total Population	(L/s)	Accum. (L/s)	Acc. Popl'n	Flow (L/s)	Peak Factor	Flow (L/s)	Accum. Area (ha)	Flow (L/s)	(L/s)	Length (m)	Assumed Grade [2]	Size (mm)	Design Guideline Capacity [3] (L/s)	Qdes / Qcap [3] (%)	Ddes / Dcap [3] (%)	Velocity [4] (m/s)	Est. Rim	Con. [5] Rim	Est. Invert	Est. Rim	Con. [5] Rim	Est. Invert	US	Con. [5] US	DS	Con. [5] DS
Center			0.3	RM-30	206	62																											
Center	022	019	0.83				91	0.0	0.0	91	0.4	4.26	1.6	0.8	0.1	1.7	46	7.70%	200	45.5	4%	18%	1.0	37.6		35.6	34.0		32.0	2.00		2.00	
Center			0.35	NA	0	0																											
Center			0.4	RM-10	114	46																											
Center	021	020	0.75				46	0.0	0.0	46	0.2	4.32	0.8	0.8	0.1	0.9	92	3.30%	200	29.8	3%	16%	0.6	39.0		37.0	35.9		33.9	2.00		2.00	
Center	020	019					0	0.0	0.0	46	0.2	4.32	0.8	0.8	0.1	0.9	84	2.20%	200	24.3	4%	18%	0.5	35.9		33.2	34.0		31.3	2.70		2.68	
Center			0.31	NA	0	0																											
Center			0.47	RF-9	128	60																											
Center	023	019	0.78				60	0.0	0.0	60	0.2	4.30	1.0	0.8	0.1	1.1	129	1.50%	200	20.1	6%	22%	0.5	36.0		34.0	34.0	34.0	32.0	2.00		2.00	2.00
Center			0.32	NA	0	0																											
Center			0.62	RF-9	128	79																											
Center	019	018	0.94				79	0.0	0.0	277	1.1	4.09	4.6	3.3	0.4	5.0	136	5.20%	200	37.4	13%	34%	1.2	34.0	34.0	31.3	26.2	27.0	24.2	2.70	2.70	2.00	2.82
Center			0.2	NA	0	0																											
Center			0.45	RF-9	128	58																											
Center	018	017	0.65				58	0.0	0.0	334	1.4	4.06	5.5	4.0	0.5	6.0	94	0.50%	200	11.6	52%	68%	0.5	26.2	27.0	24.2	28.5	27.3	23.7	2.02	2.84	4.84	3.56
Center			0.46	NA	0	0																											
Center			0.44	RF-9	128	56																											
Center	017	016	0.9				56	0.0	0.0	917	3.7	3.83	14.2	10.0	1.3	15.5	146	8.00%	200	46.4	33%	54%	1.9	28.5	27.3	23.7	14.0	14.0	12.0	4.86	3.58	2.00	2.00
Center	016	015					0	0.0	136.1	2081	8.4	3.57	166.2	25.5	3.3	169.5	133	0.25%	525	178.9	95%	94%	1.0	14.0	14.0	11.7	13.8	13.8	11.4	2.29	2.29	2.38	2.38
Center			4.33	NA	0	0																											
Center	015	014	4.33				0	0.0	136.1	2081	8.4	3.57	166.2	29.8	3.9	170.1	132	0.25%	525	178.9	95%	96%	1.0	13.8	13.8	11.4	14.3	14.3	11.1	2.40	2.40	3.27	
Center-West			0.24	NA	0	0																											
Center-West			0.5	RF-9	128	64																											
Center-West	014	009	0.74				64	0.0	136.1	2145	8.7	3.56	167.1	30.5	4.0	171.0	97	0.25%	525	178.9	96%	96%	1.0	14.3	14.3	11.0	14.4	14.4	10.8	3.29	3.29	3.57	3.57
Center-West			0.8	NA	0	0																											
Center-West			0.73	C-8	60	44																											
Center-West			0.73	RM-10	114	83																											
Center-West	013	012	2.26				127	0.0	0.0	127	0.5	4.21	2.2	2.3	0.3	2.5	86	2.20%	200	24.3	10%	30%	0.7	47.7		45.7	45.7		43.7	2.00		2.00	
Center-West			0.29	NA	0	0																											
Center-West			0.25	RM-10	114	29																											
Center-West			0.81	RM-30	206	167																											
Center-West	012	011	1.35				195	0.0	0.0	322	1.3	4.07	5.3	3.6	0.5	5.8	131	4.60%	200	35.2	16%	38%	1.2	45.7		43.7	39.7		37.7	2.02		2.00	
Center-West			0.31	NA	0	0																											
Center-West			1.2	PI	50	60																											
Center-West			0.85	RM-10	114	97																											
Center-West	011	010	2.36				157	0.0	0.0	479	1.9	3.98	7.7	6.0	0.8	8.5	127	7.80%	200	45.8	19%	40%	1.6	39.7		37.7	29.7		27.7	2.02		2.00	
Center-West			0.25	NA	0	0																											
Center-West			1.14	PI	50	57																											
Center-West	065	010	1.39				57	0.0	0.0	57	0.2	4.30	1.0	1.4	0.2	1.2	103	3.90%	200	32.4	4%	18%	0.7	33.8		31.8	29.7		27.7	2.00		2.00	
Center-West			0.23	NA	0	0																											
Center-West			1.65	RF-9	128	211																											
Center-West	010	009	1.88				211	0.0	0.0	747	3.0	3.88	11.7	9.2	1.2	12.9	148	10.30%	200	52.6	25%	46%	2.0	29.7		27.7	14.4	14.4	12.4	2.02		2.00	2.00
Center-West			0.32	NA	0	0																											
Center-West			0.96	RF-9	128	123																											
Center-West	009	008	1.28				123	0.0	136.1	3016	12.2	3.44	178.2	41.1	5.3	183.5	96	0.20%	600	228.5	80%	84%	0.9	14.4	14.4	10.8	15.1	15.1	10.6	3.57	3.57	4.49	4.49
Center-West	008	000					0	0.0	136.1	3016	12.2	3.44	178.2	41.1	5.3	183.5	95	0.20%	600	228.5	80%	84%	0.9	15.1	15.1	10.6	15.0	15.0	10.4	4.51	4.51	4.60	4.60

	Unit Demand	350 L/person/day		Project	Anniedale Tynehead NCP
	Infiltration	0.130 L/s/ha	11200 L/ha/day	Scenario	NCP - December 2010 Landuse
	Manning's Coefficient (n)	0.013		Client	City of Surrey
				USL Job	1072.0173.01

184th Street Pump Station Catchment

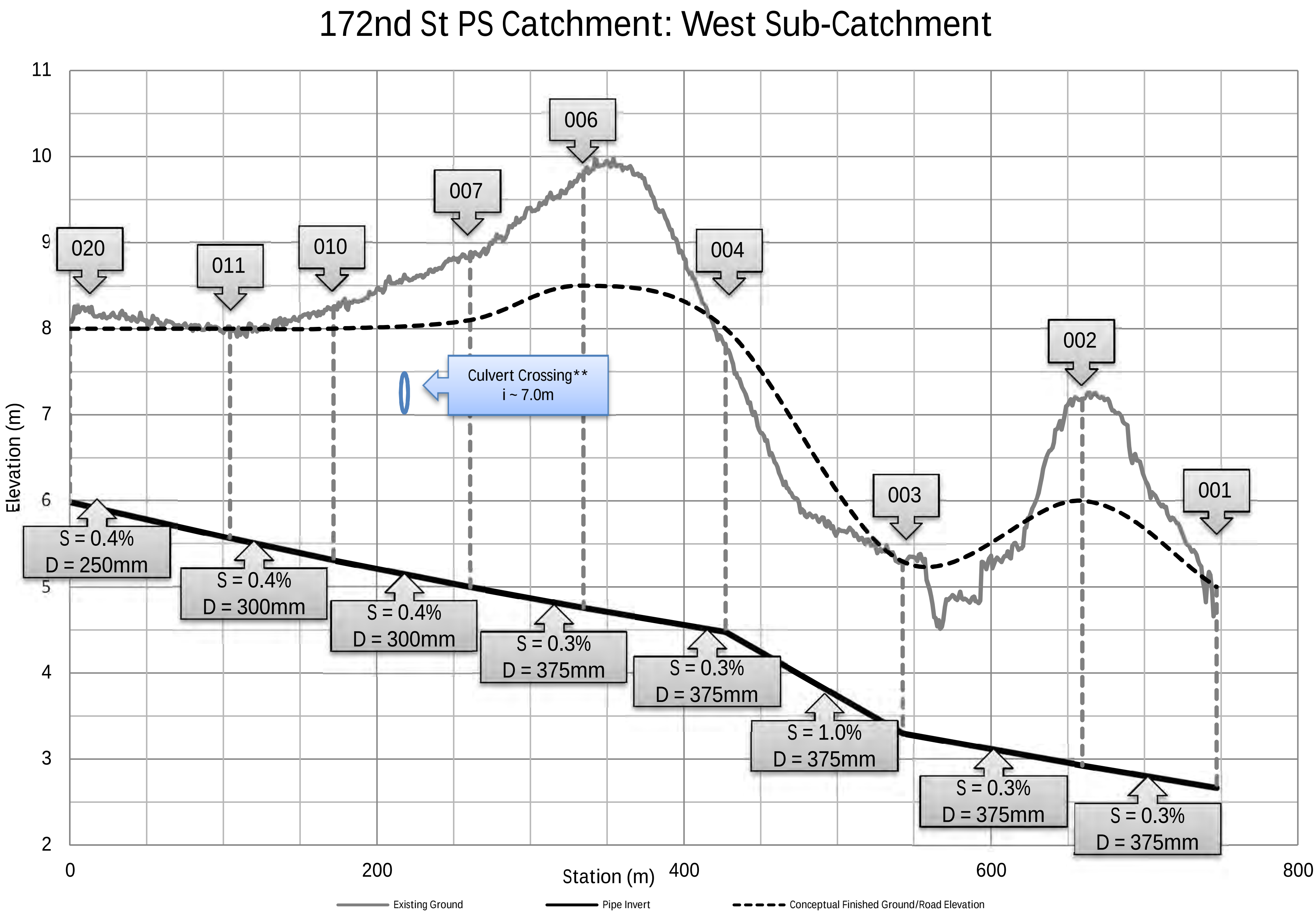
Development Areas: Anniedale B2 & Port Kells

Sub Catchment	US Node	DS Node	Catchment Details					Flow Details									Pipe Design																
								Point Loads		Average Dry Weather Flow		Peak Dry Weather Flow		Infiltration Flow		PWWF	Pipe Design							US Node Elevation			DS Node Elevation			Depth to pipe invert (m)			
			Area (ha)	Zoning	Population Density (ppha) [1]	Parcel Population	Total Population	(L/s)	Accum. (L/s)	Acc. Popl'n	Flow (L/s)	Peak Factor	Flow (L/s)	Accum. Area (ha)	Flow (L/s)	(L/s)	Length (m)	Assumed Grade [2]	Size (mm)	Design Guideline Capacity [3] (L/s)	Qdes / Qcap [3] (%)	Ddes / Dcap [3] (%)	Velocity [4] (m/s)	Est. Rim	Con. [5] Rim	Est. Invert	Est. Rim	Con. [5] Rim	Est. Invert	US	Con. [5] US	DS	Con. [5] DS
West			*0.52*	*NA*	*0*	*0*																											
West			*0.29*	*RF-9*	*128*	*37*																											
West	**007**	006	0.81				37	0.0	0.0	37	0.2	4.34	0.7	0.8	0.1	0.8	102	1.00%	200	16.4	5%	20%	*0.4*	48.6		46.6	48.5		45.6	2.00		2.88	
West	**006**	005					0	0.0	0.0	37	0.2	4.34	0.7	0.8	0.1	0.8	119	0.60%	200	12.7	6%	22%	*0.3*	48.5		45.6	47.3		44.9	2.90		2.40	
West			*1.17*	*NA*	*0*	*0*																											
West			*0.47*	*RM-30*	*206*	*97*																											
West	**005**	004	1.64				97	0.0	0.0	134	0.5	4.21	2.3	2.5	0.3	2.6	128	3.90%	200	32.4	8%	26%	0.9	47.3		44.9	41.9		39.9	2.42		2.00	
West			*2.52*	*NA*	*0*	*0*																											
West	**004**	003	2.52				0	0.0	0.0	134	0.5	4.21	2.3	5.0	0.6	2.9	123	6.00%	200	40.2	7%	26%	1.0	41.9		39.9	34.5		32.5	2.02		2.00	
West	**003**	002					0	0.0	0.0	134	0.5	4.21	2.3	5.0	0.6	2.9	80	8.40%	200	47.5	6%	24%	1.1	34.5		32.4	27.8		25.8	2.02		2.00	
West	**002**	001					0	0.0	0.0	134	0.5	4.21	2.3	5.0	0.6	2.9	77	11.50%	200	55.6	5%	22%	1.3	27.8		25.7	19.0		17.0	2.02		2.00	
West	**001**	000					0	0.0	0.0	134	0.5	4.21	2.3	5.0	0.6	2.9	66	6.00%	200	40.2	7%	26%	1.0	19.0		17.0	15.0		13.0	2.00		2.00	
Pump Station	**000**						0	0.0	136.1	3150	12.8	3.43	179.8	46.0	6.0	185.8								15.0		10.4				**4.60**			
Pump Station	**PS**									12221	12.8		179.8	225.6		185.8																	

1- ppha from Table 2.6 of surrey Design Criteria
2- Assumed grade based on existing ground elevations. To be confirmed with road profile design.
3- Q Capacity and D Capacity based on 50% of pipes when flows are less then 40 L/s, and 83.2% of pipe full capacity (equivalent to flow with normal depth of 70% of pipe diameter) when flows are greater than 40 L/s.
4- Velocity based on normal depth flow at 70% of PDWF.
5- Conceptual Rim and Depth based on conceptual finished ground. Does not take into account any review of road profile or geometry.

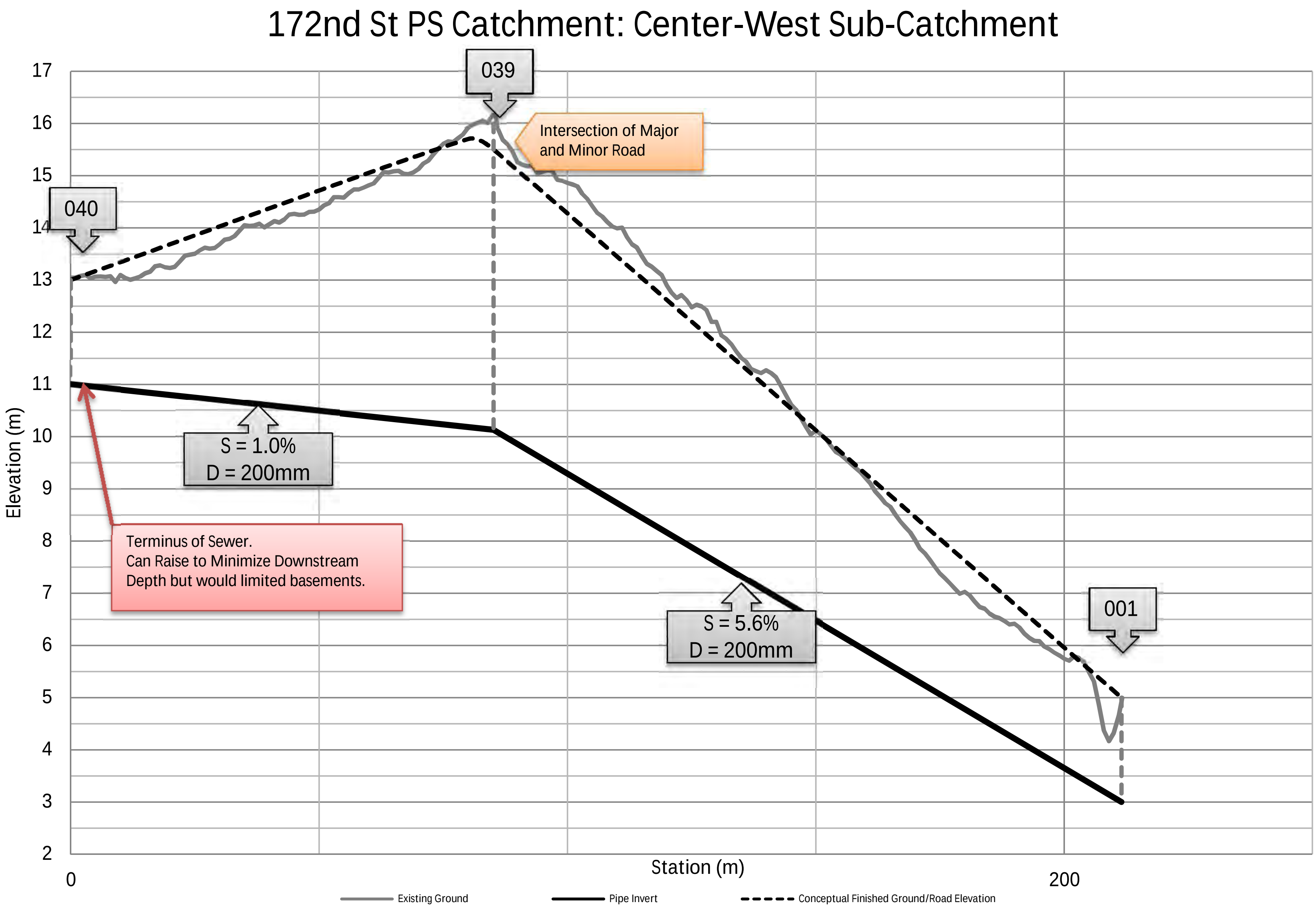
Q > 40 L/s
Size > 200mm
3.6 Pipe depth > 3.5m
0.5 Pipe Velocity < 0.6 m/s

Land Use	Assumed Zoning	Abbr.
Road	NA	NA
Buffer	NA	NA
Trail	NA	NA
Riparian	NA	NA
Park Acquisition	NA	NA
Potential Park	NA	NA
School	Institutional	PI
Community Centre	Commercial Recreation	CPR
Institutional	Institutional	PI
Commercial	CD (based on C-15)	C-15
Village Commercial	Community Commercial	C-8
Industrial Low Impact	Light Impact Industrial	IL
Industrial Business Park	Business Park	IB
Suburban Cluster	Half-Acre Residential (Gross Density)	RH, RH-G
Low Density Urban 6-10	Single Family Residential - 12m Frontage	RF-12
Cluster Residential 4-6	CD (based on RF)	RF
Cluster Residential 6-10	CD (based on RF-9)	RF-9
Cluster Residential 10-15	CD (based on RM-10)	RM-10
Medium Density 10-15	Single Family Residential - 9m Frontage	RF-9
Medium High Density 15-25	Multiple Residential Development	RM-30
High Density Residential 25-45	CD (based on RM-30)	RM-30
High Density Residential 30-45	CD (based on RM-45)	RM-45
Special Residential 15-25	CD (based on RM-30)	RM-30



*Conceptual Finished Ground/Road Elevation does not take into account any review of road profile or geometry , and is considered conceptual only. All pipe profiles should be confirmed once road profiles have been developed.

**Assumed 0.5m height, 1.2m wide culvert



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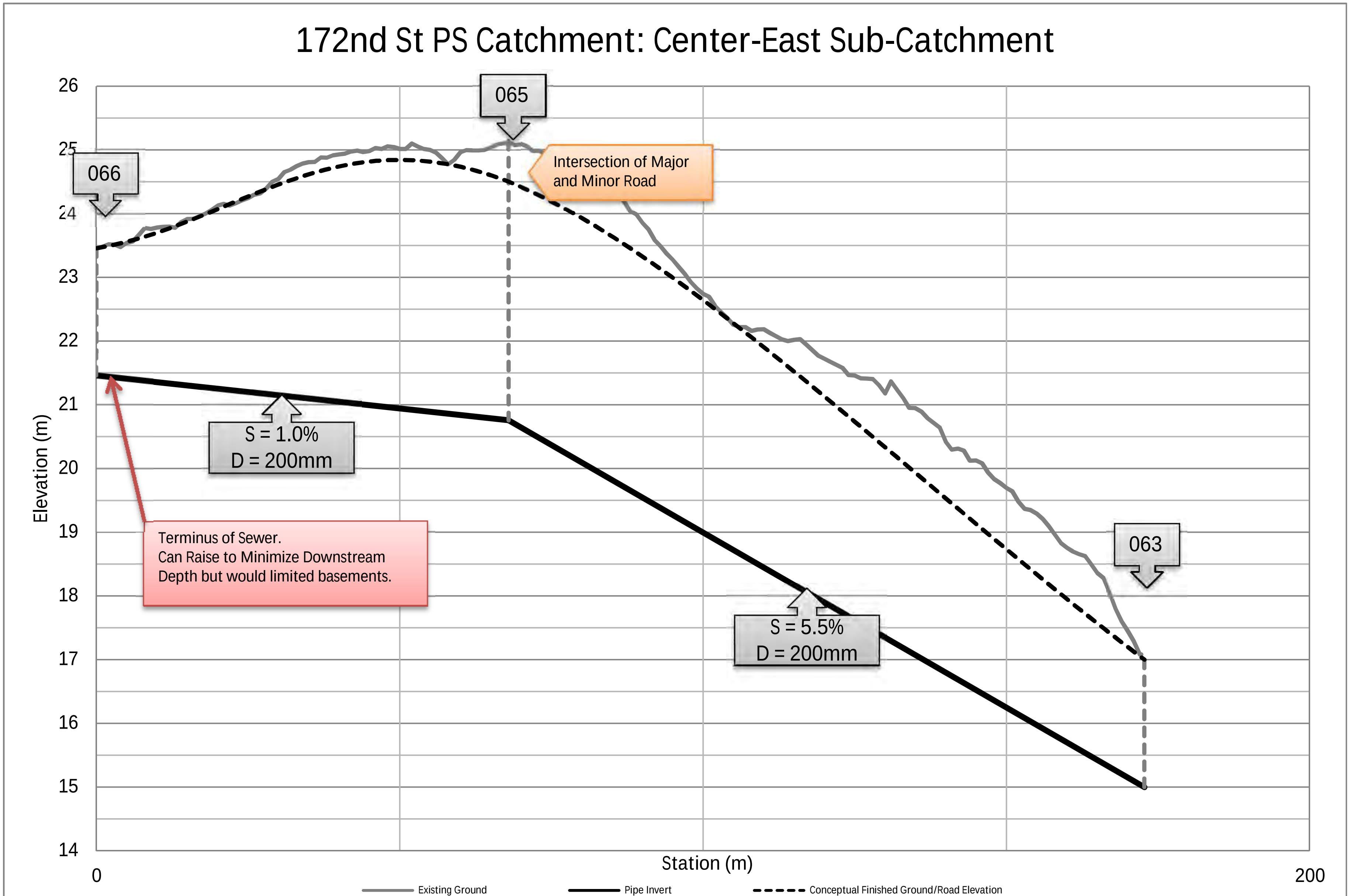

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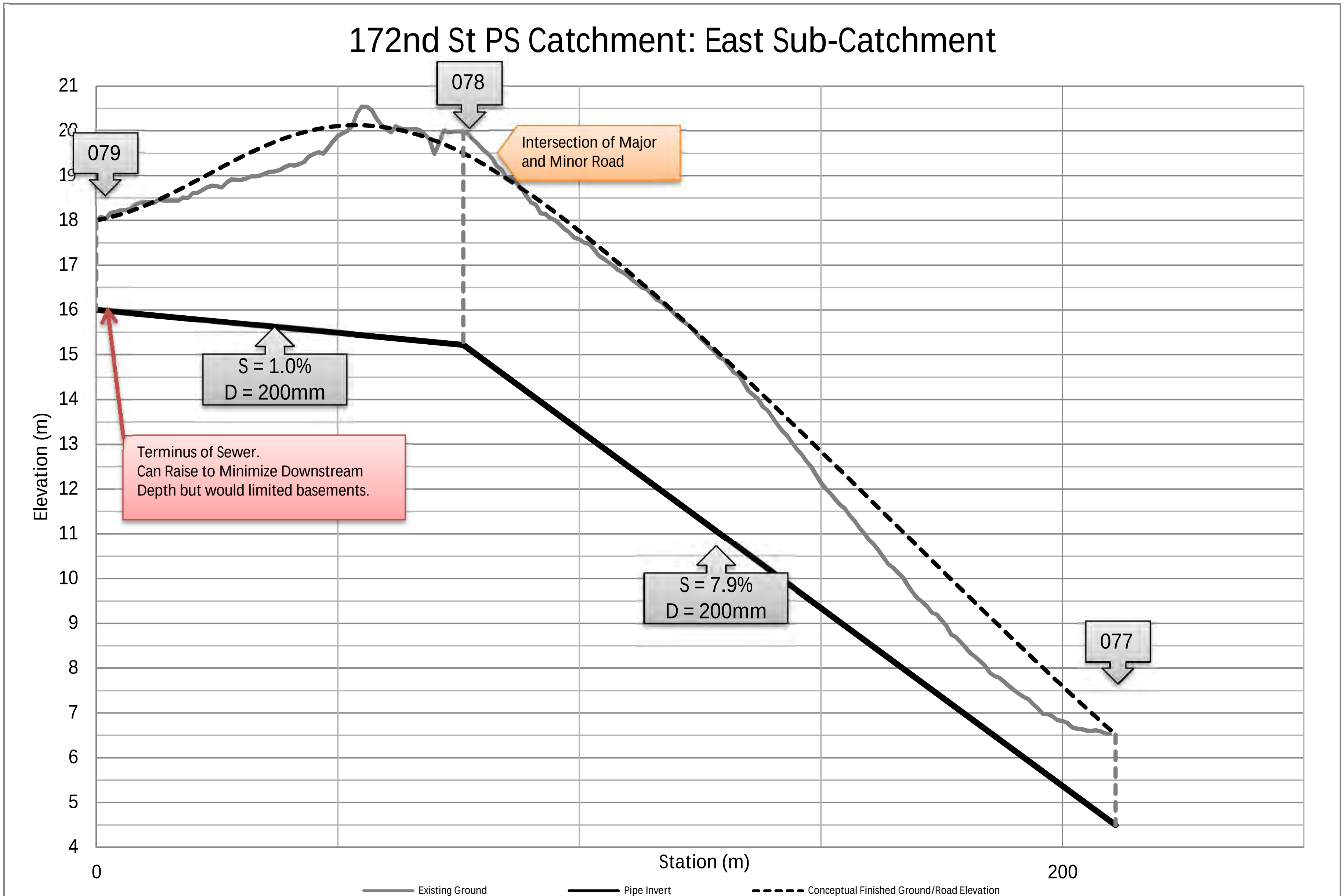

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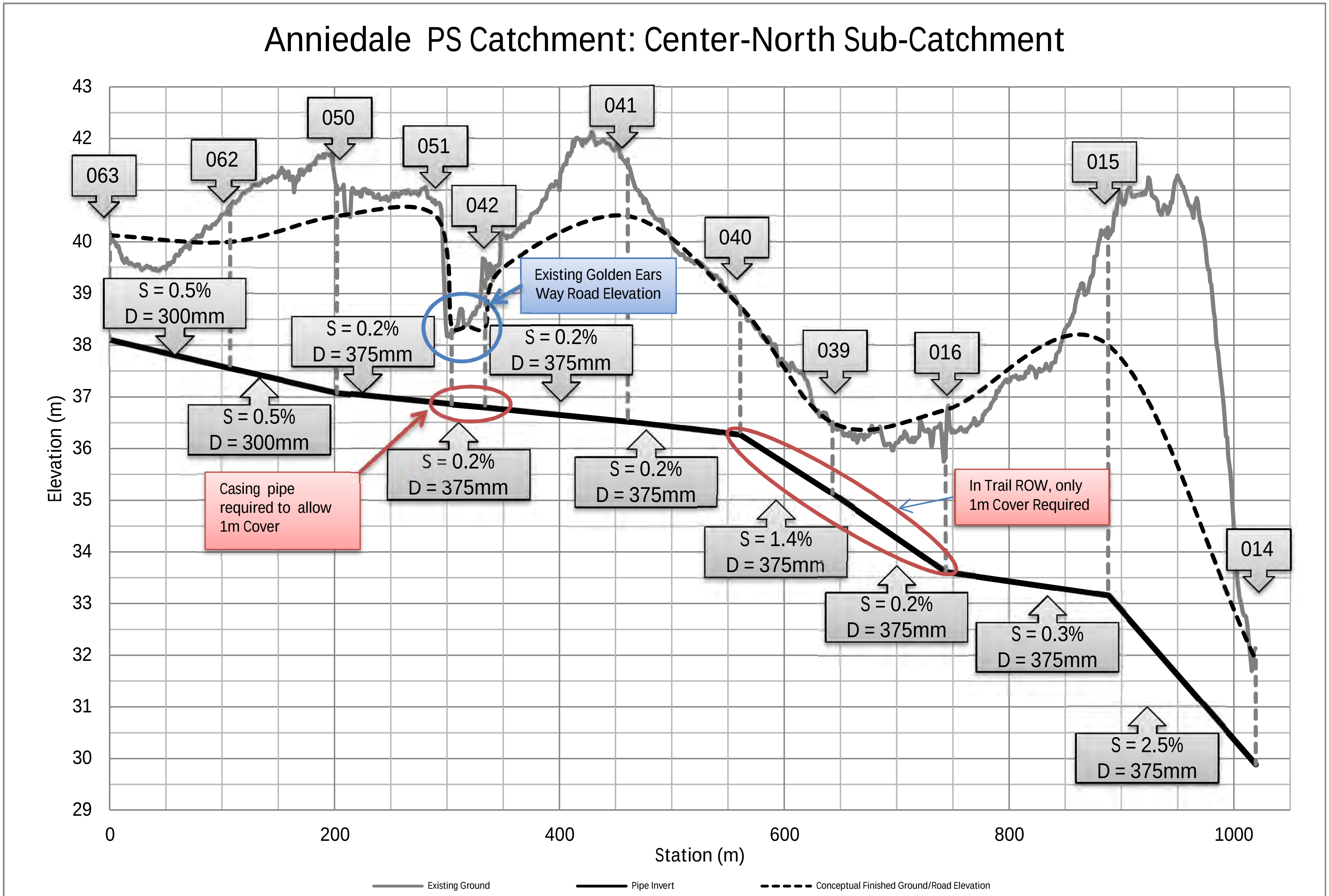

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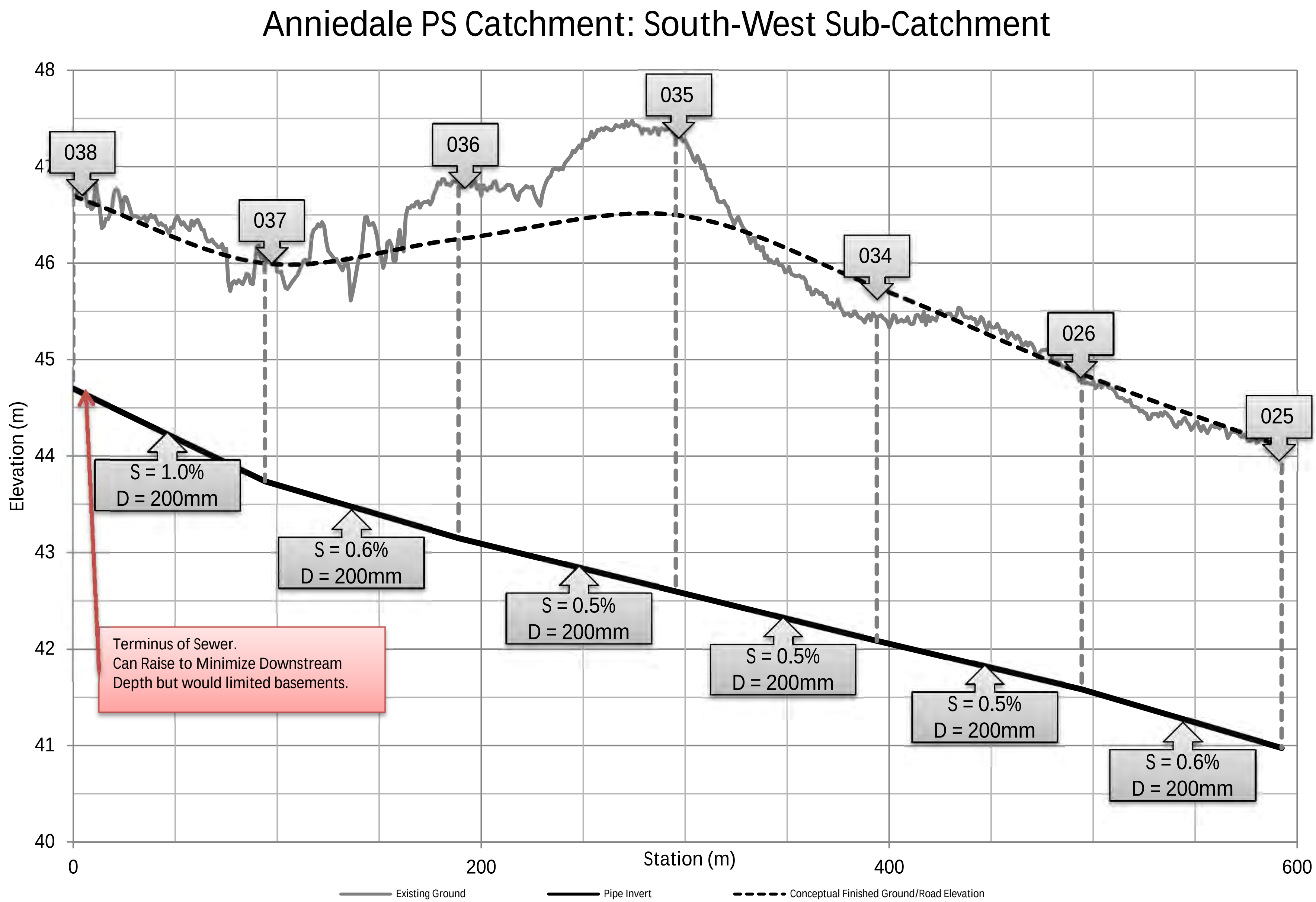

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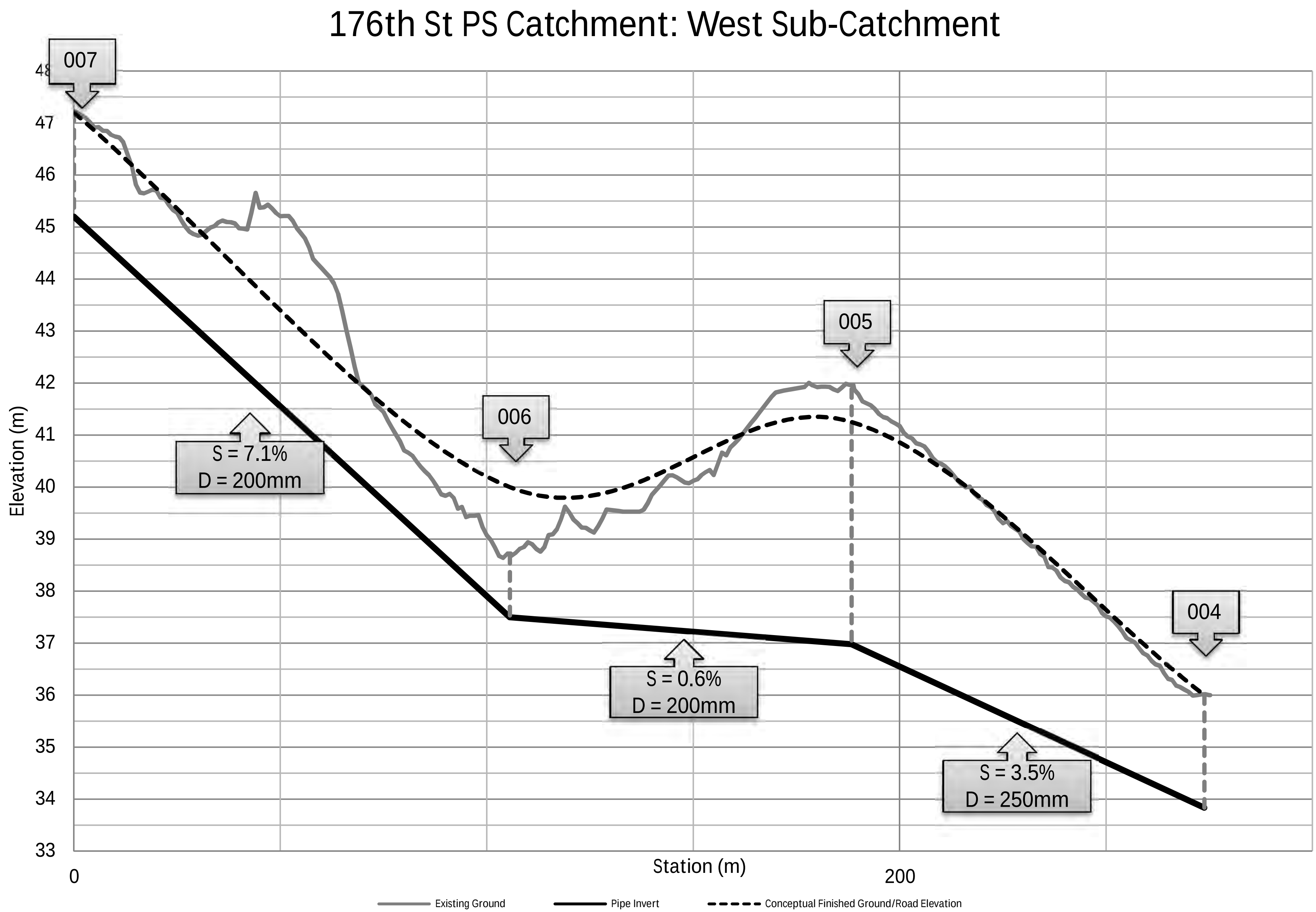

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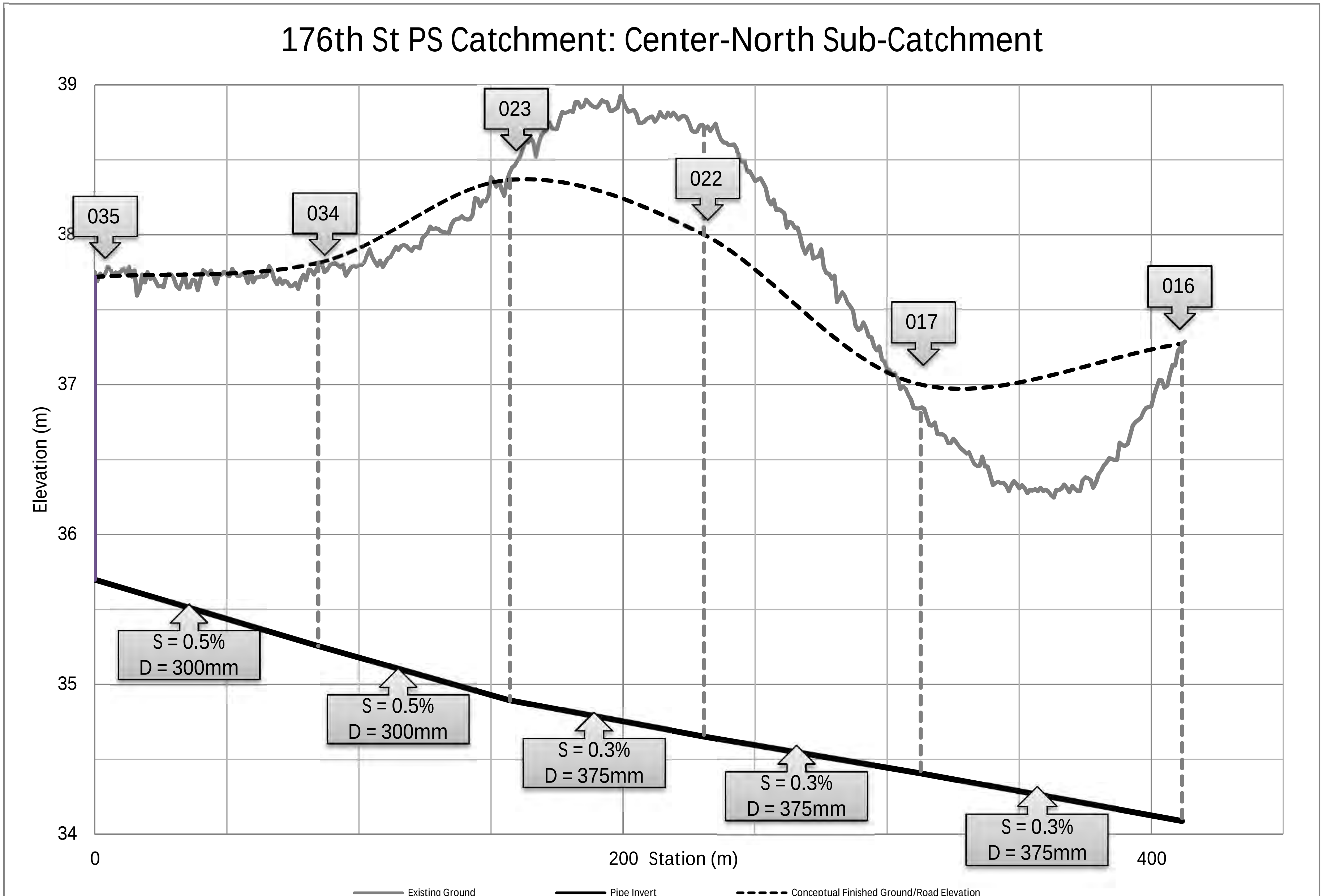

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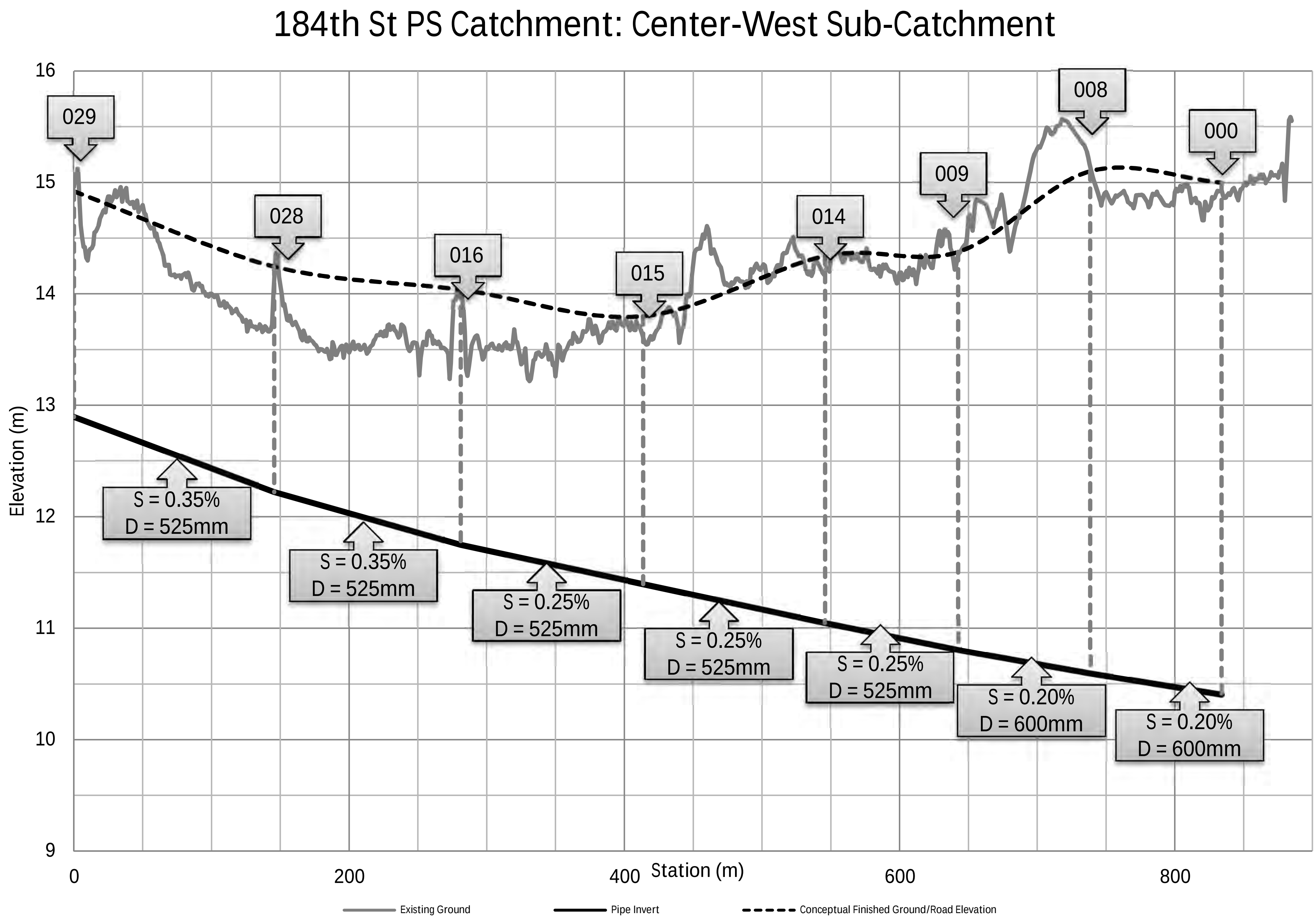

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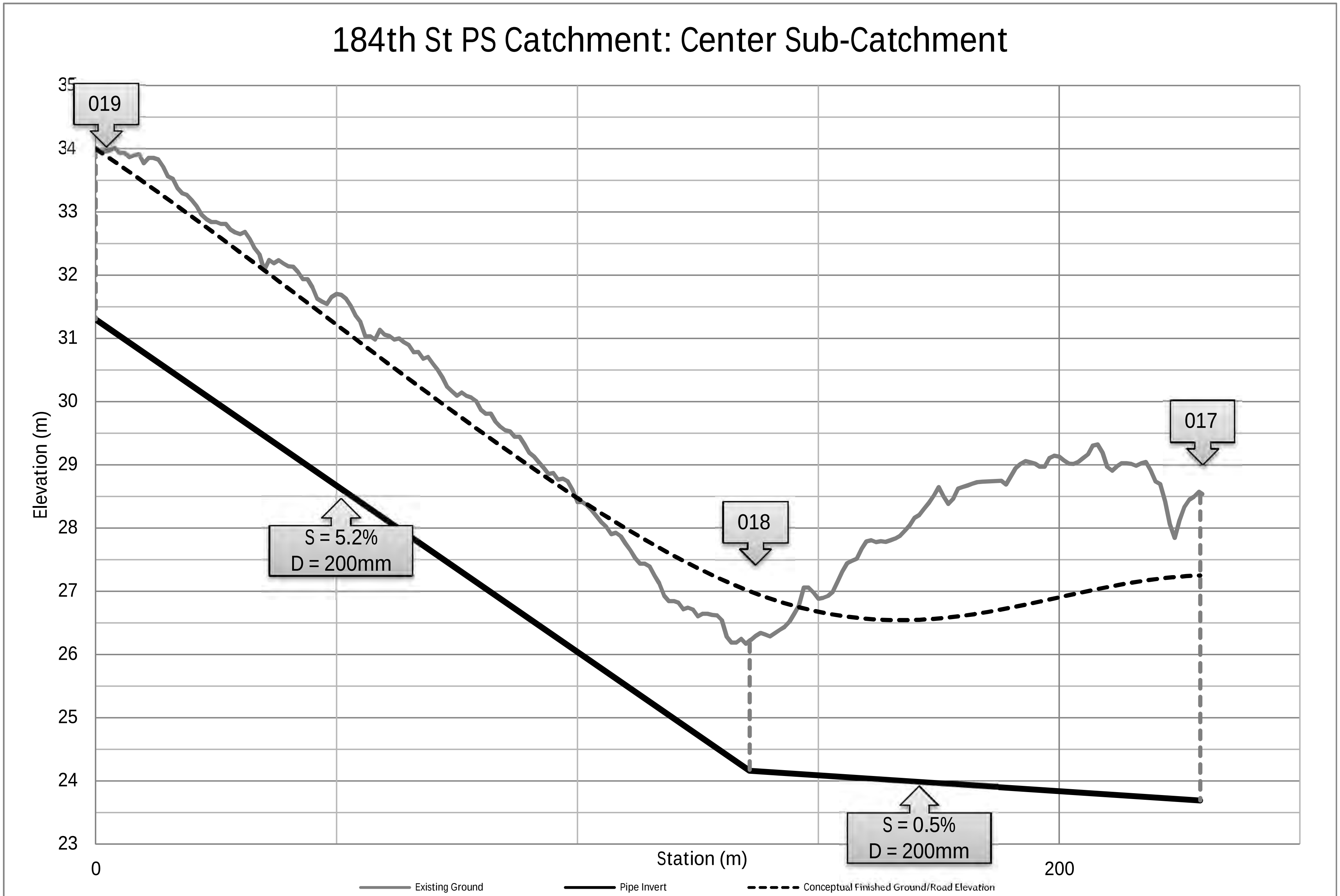

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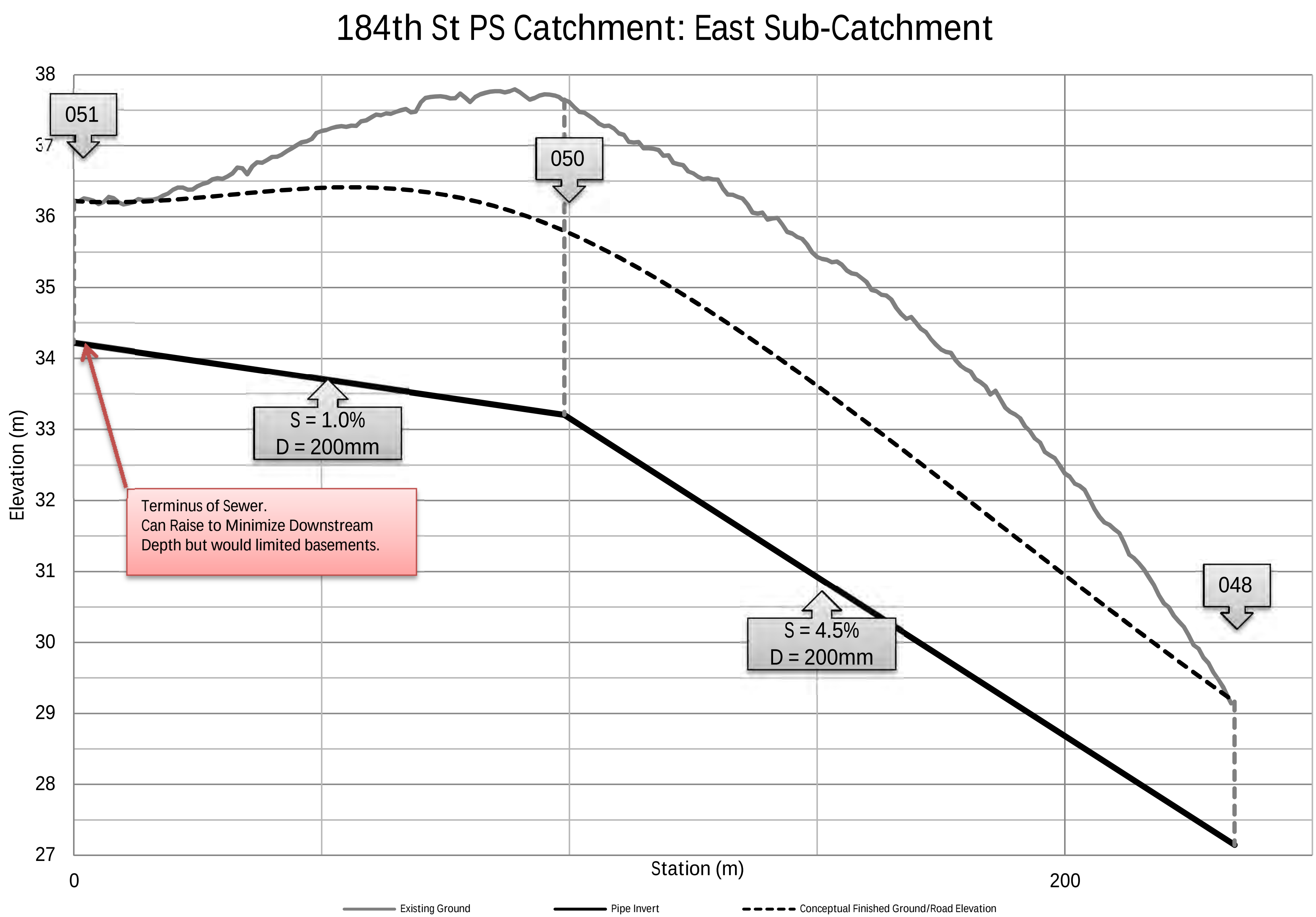

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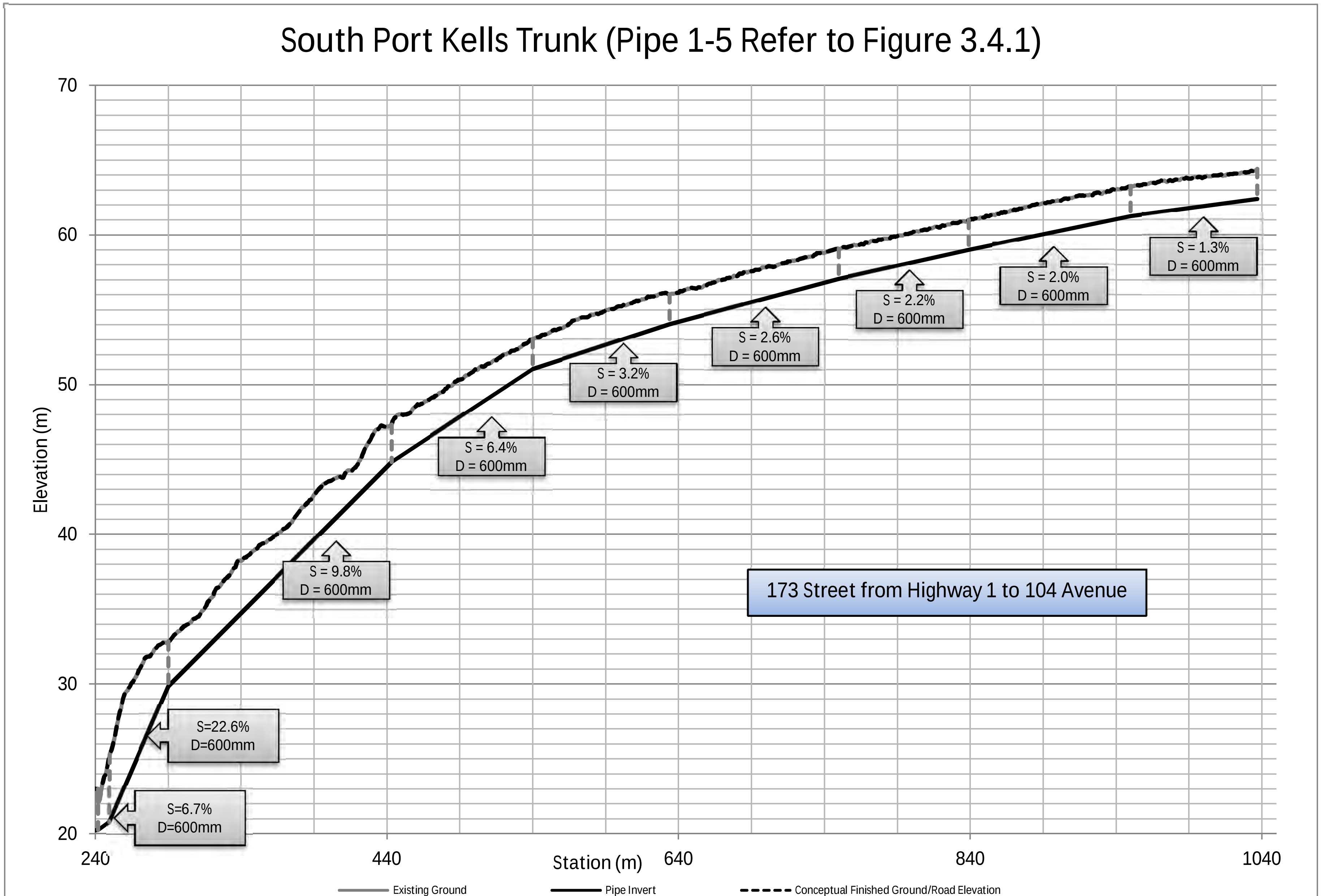

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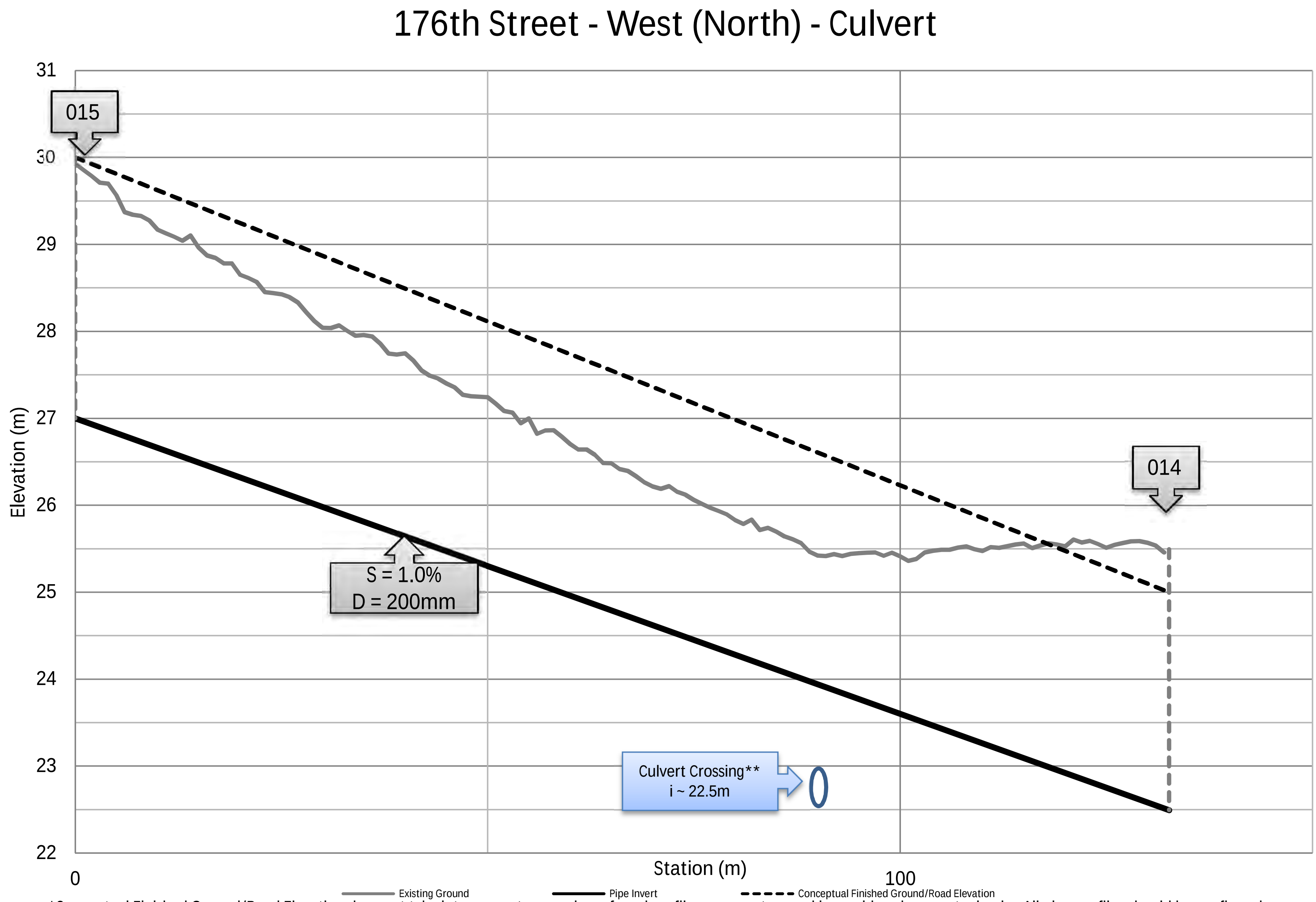


*Conceptual Finished Ground/Road Elevation does not take into account any review of road profile or geometry , and is considered conceptual only. All pipe profiles should be confirmed once road profiles have been developed.

**Assumed 0.5m height, 1.2m wide culvert

Anniedale/Tynehead NCP Stage 2
Sanitary System Option 2c-ii
Update - August 2011 - USL

INTERIM AND ULTIMATE CAPITAL COST ESTIMATES (in 2010 dollars)

Ref No.	Description	Size (nominal)	Unit	Unit Price	Unit	Quantity	Cost
	Phase 1						
	Tynehead						
	Forcemain and Gravity Sewer						
1-1	Tynehead Trunk	375	mm	$ 240.00	l.m	355	$ 85,200.00
1-2	Tynehead FM	400	mm	$ 971.00	l.m	835	$ 810,785.00
	Tynehead FM - Odour Control (allowance)			$ 60,000.00	L.S	1	$ 60,000.00
1-3	Tynehead - Anniedale FM	400	mm	$ 971.00	l.m	980	$ 951,580.00
1-4	South Port Kells FM	400	mm	$ 971.00	l.m	1150	$ 1,116,650.00
1-5	South Port Kells Trunk	600	mm	$ 1,416.00	l.m	800	$ 1,132,800.00
	South Port Kells Trunk - RoW (allowance)			$ 90,000.00	L.S	1	$ 90,000.00
	Highway 1 crossing			$ 500,000.00	L.S	1	$ 500,000.00
	South Port Kells Odour Control (w/land)			$ 660,000.00	L.S	1	$ 660,000.00
	Local Main Upsizing Allowance	250	mm	$ 64.00	l.m	270	$ 17,280.00
	Local Main Upsizing Allowance	300	mm	$ 136.00	l.m	160	$ 21,760.00
	Local Main Upsizing Allowance	375	mm	$ 240.00	l.m	435	$ 104,400.00
						Subtotal	$ 5,550,455.00
	Pump Station						
	Tynehead Pump Station (172 St.)	102	L/s	$ 3,300,000.00	L.S	1	$ 3,300,000.00
						Subtotal	$ 3,300,000.00
						Total (rounded)	$ 8,800,000.00
	Phase 2						
	Anniedale A/B1/B4						
	Forcemain and Gravity Sewer						
2-1	Anniedale A Trunk	375	mm	$ 240.00	l.m	1000	$ 240,000.00
2-2	Anniedale A FM	400	mm	$ 971.00	l.m	2140	$ 2,077,940.00
	Anniedale A FM - Odour Control (allowance)			$ 60,000.00	L.S	1	$ 60,000.00
2-3	Anniedale B4 Trunk - 1	375	mm	$ 240.00	l.m	265	$ 63,600.00
2-4	Anniedale B4 Trunk - 2	375	mm	$ 240.00	l.m	390	$ 93,600.00
2-5	Anniedale B3 Trunk - 2	300	mm	$ 136.00	l.m	690	$ 93,840.00
2-6	Anniedale B3 Trunk - 3	375	mm	$ 240.00	l.m	135	$ 32,400.00
2-7	Anniedale B4 FM	400	mm	$ 971.00	l.m	200	$ 194,200.00
	Anniedale B4 FM - Odour Control (allowance)			$ 60,000.00	L.S	1	$ 60,000.00
2-8	Tynehead - Anniedale FM Twin	500	mm	$ 1,087.00	l.m	980	$ 1,065,260.00
2-9	South Port Kells FM Twin	650	mm	$ 1,214.00	l.m	1150	$ 1,396,100.00
	Highway 15 crossing			$ 200,000.00	L.S	1	$ 200,000.00
	Local Main Upsizing Allowance	250	mm	$ 64.00	l.m	1135	$ 72,640.00
	Local Main Upsizing Allowance	300	mm	$ 136.00	l.m	350	$ 47,600.00
	Local Main Upsizing Allowance	375	mm	$ 240.00	l.m	75	$ 18,000.00
						Subtotal	$ 5,715,180.00
	Pump Station						
	Anniedale Pump Station (Hwy 1 @ 187 St.)	113	L/s	$ 3,600,000.00	L.S	1	$ 3,600,000.00
	Anniedale B4 Pump Station (176 St.)	143	L/s	$ 3,500,000.00	L.S	1	$ 3,500,000.00
						Subtotal	$ 7,100,000.00
						Total (rounded)	$ 12,800,000.00
	Phase 3						
	Anniedale B3						
	Forcemain and Gravity Sewer						
3-1	Anniedale B3 Trunk - 1	300	mm	$ 136.00	l.m	220	$ 29,920.00
	Anniedale B3 Trunk - RoW (allowance)			$ 250.00	sq.m	900	$ 225,000.00
	Local Main Upsizing Allowance	300	mm	$ 136.00	l.m	100	$ 13,600.00
						Subtotal	$ 268,520.00
						Total (rounded)	$ 300,000.00
	Phase 4						
	Anniedale B2						
	Forcemain and Gravity Sewer						
4-1	Anniedale B2 Trunk -1	525	mm	$ 464.00	l.m	890	$ 412,960.00
4-2	Anniedale B2 Trunk -2	600		$ 568.00	l.m	190	$ 107,920.00
	Anniedale B2 Trunk - RoW (allowance)			$ 235,000.00	L.S	1	$ 235,000.00
4-3	Anniedale B2 FM	250	mm	$ 760.00	l.m	1320	$ 1,003,200.00
	Anniedale B2 FM - Odour Control (allowance)			$ 60,000.00	L.S	1	$ 60,000.00
4-4	Anniedale B FM	250	mm	$ 760.00	l.m	850	$ 646,000.00
						Subtotal	$ 2,465,080.00
	Pump Station						
	Anniedale B2 Pump Station (184 St.)	58	L/s	$ 4,400,000.00	L.S	1	$ 4,400,000.00
						Subtotal	$ 4,400,000.00
						Total (rounded)	$ 6,900,000.00
	Anniedale/Tynehead (Phases 1 - 4)					TOTAL	$ 28,799,235.00
						BUDGET TOTAL	$ 28,800,000.00

Notes:
- All pipe costs include: 15% contingency, 12% engineering, pavement cut costs, connections, manholes, etc. as provided by City of Surrey.
- All pump station costs include land costs (as provided by City of Surrey), 20% contingency, 15% engineering. Engineering is not applied to land costs. Land costs considered *preliminary* only.
- South Port Kells Trunk RoW allowance based on 6m wide RoW, calculated at $350,000/acre, includes 20% contingency.
- Anniedale B2 Trunk RoW allowance based on 6m wide RoW, calculated at $350,000/acre, includes 20% contingency.
- South Port Kells Odour Control, includes land and 20% contingency.
- Upsizing costs above 200mm.
- All pipe sizes indicated are nominal size.
- Land costs provided by Surrey
- Phase 5 costs have been omitted from this Cost Estimate

Tynehead Pump Station (172 St.) - (Ultimate - 102 L/s)

Item	Description	Unit	Quantity	Unit Price	Total
1	**Pump Station**				
1.01	Site preparation (shored excavation, dewatering, etc.)	m^3	450	$2,000.00	$900,000.00
1.02	Cast concrete wetwell (4mx4mx6m)	m^3	35	$2,200.00	$77,000.00
1.03	Cast concrete off line storage (9mx9mx4m) - 300mm walls	m^3	100	$2,200.00	$220,000.00
1.04	Supply and install 3 pumps (VFD's)	LS	1	$250,000.00	$250,000.00
1.05	Mechanical systems and piping (valves, meters, pipes, etc.)	LS	1	$100,000.00	$100,000.00
1.06	Valve and Flow Meter Chamber (cast concrete)	LS	20	$2,000.00	$40,000.00
1.07	Washdown system mechanical	LS	1	$10,000.00	$10,000.00
1.08	75mm water service with backflow prevention	LS	1	$5,000.00	$5,000.00
1.09	Control/Generator building	m^2	64	$2,000.00	$128,000.00
1.10	Site electrical (incl. generator)	LS	1	$300,000.00	$300,000.00
1.11	Surge control (allowance)	LS	1	$150,000.00	$150,000.00
1.12	Odour control system (allowance)	LS	1	$150,000.00	$150,000.00
1.13	Land Acquisition[1] (Approx. 625 m^2 footprint required)	LS	1	$93,750.00	$93,750.00
				Subtotal	$2,423,750.00
	Engineering and Contingency (15% eng., 20% contingency - eng. not applied to land costs)				$835,000.00
				TOTAL	**$3,300,000.00**

Anniedale Pump Station (187 St.) - (Ultimate - 113 L/s)

Item	Description	Unit	Quantity	Unit Price	Total
1	**Pump Station**				
1.01	Site preparation (shored excavation, dewatering, etc.)	m^3	600	$2,000.00	$1,200,000.00
1.02	Cast concrete wetwell (4mx4mx6m)	m^3	35	$2,200.00	$77,000.00
1.03	Cast concrete off line storage (9mx9mx4m) - 300mm walls	m^3	100	$2,200.00	$220,000.00
1.04	Supply and install 3 pumps (VFD's)	LS	1	$200,000.00	$200,000.00
1.05	Mechanical systems and piping (valves, meters, pipes, etc.)	LS	1	$100,000.00	$100,000.00
1.06	Valve and Flow Meter Chamber (cast concrete)	LS	20	$2,000.00	$40,000.00
1.07	Washdown system mechanical	LS	1	$10,000.00	$10,000.00
1.08	75mm water service with backflow prevention	LS	1	$5,000.00	$5,000.00
1.09	Control/Generator building	m^2	64	$2,000.00	$128,000.00
1.10	Site electrical (incl. generator)	LS	1	$300,000.00	$300,000.00
1.11	Surge control (allowance)	LS	1	$150,000.00	$150,000.00
1.12	Odour control system (allowance)	LS	1	$150,000.00	$150,000.00
1.13	Land Acquisition[1] (Approx. 625 m^2 footprint required)	LS	1	$78,125.00	$78,125.00
				Subtotal	$2,658,125.00
	Engineering and Contingency (15% eng., 20% contingency - eng. not applied to land costs)				$919,000.00
				TOTAL	**$3,600,000.00**

Anniedale B4 Pump Station (176 St.) - (Ultimate - 143 L/s)

Item	Description	Unit	Quantity	Unit Price	Total
1	**Pump Station**				
1.01	Site preparation (shored excavation, dewatering, etc.)	m^3	400	$2,000.00	$800,000.00
1.02	Cast concrete wetwell (4mx4mx6m)	m^3	35	$2,200.00	$77,000.00
1.03	Cast concrete off line storage (11mx11mx4m) - 300mm walls	m^3	120	$2,200.00	$264,000.00
1.04	Supply and install 3 pumps (VFD's)	LS	1	$300,000.00	$300,000.00
1.05	Mechanical systems and piping (valves, meters, pipes, etc.)	LS	1	$100,000.00	$100,000.00
1.06	Valve and Flow Meter Chamber (cast concrete)	LS	20	$2,000.00	$40,000.00
1.07	Washdown system mechanical	LS	1	$10,000.00	$10,000.00
1.08	75mm water service with backflow prevention	LS	1	$5,000.00	$5,000.00
1.09	Control/Generator building	m^2	64	$2,000.00	$128,000.00
1.10	Site electrical (incl. generator)	LS	1	$400,000.00	$400,000.00
1.11	Surge control (allowance)	LS	1	$200,000.00	$200,000.00
1.12	Odour control system (allowance)	LS	1	$150,000.00	$150,000.00
1.13	Land Acquisition[1] (Approx. 1,000 m^2 footprint required)	LS	1	$110,000.00	$110,000.00
				Subtotal	$2,584,000.00
	Engineering and Contingency (15% eng., 20% contingency - eng. not applied to land costs)				$888,000.00
				TOTAL	**$3,500,000.00**

Anniedale B2 Pump Station (184 St.) - (Ultimate - 186 L/s)

Item	Description	Unit	Quantity	Unit Price	Total
1	**Pump Station**				
1.01	Site preparation (shored excavation, dewatering, etc.)	m^3	700	$2,000.00	$1,400,000.00
1.02	Cast concrete wetwell (4mx4mx6m)	m^3	35	$2,200.00	$77,000.00
1.03	Cast concrete off line storage (11mx11mx4m) - 300mm walls	m^3	180	$2,200.00	$396,000.00
1.04	Supply and install 2 pumps (VFD's)	LS	1	$200,000.00	$200,000.00
1.05	Mechanical systems and piping (valves, meters, pipes, etc.)	LS	1	$100,000.00	$100,000.00
1.06	Valve and Flow Meter Chamber (cast concrete)	LS	20	$2,000.00	$40,000.00
1.07	Washdown system mechanical	LS	1	$10,000.00	$10,000.00
1.08	75mm water service with backflow prevention	LS	1	$5,000.00	$5,000.00
1.09	Control/Generator building	m^2	64	$2,000.00	$128,000.00
1.10	Site electrical (incl. generator)	LS	1	$400,000.00	$400,000.00
1.11	Surge control (allowance)	LS	1	$200,000.00	$200,000.00
1.12	Odour control system (allowance)	LS	1	$150,000.00	$150,000.00
1.13	Land Acquisition[1] (Approx. 625 m^2 footprint required)	LS	1	$125,000.00	$125,000.00
				Subtotal	$3,231,000.00
	Engineering and Contingency (15% eng., 20% contingency - eng. not applied to land costs)				$1,113,000.00
				TOTAL	**$4,400,000.00**
1.14	Install 3rd pump / update controls (+ 20% contingency) (Attributable to Port Kells only)	LS	1	$240,000.00	$240,000.00

[1] Costs as provided by City of Surrey.

APPENDIX C: STORMWATER

- ☐ Figures A.1 to A.4
- ☐ Table A.1 to A.4

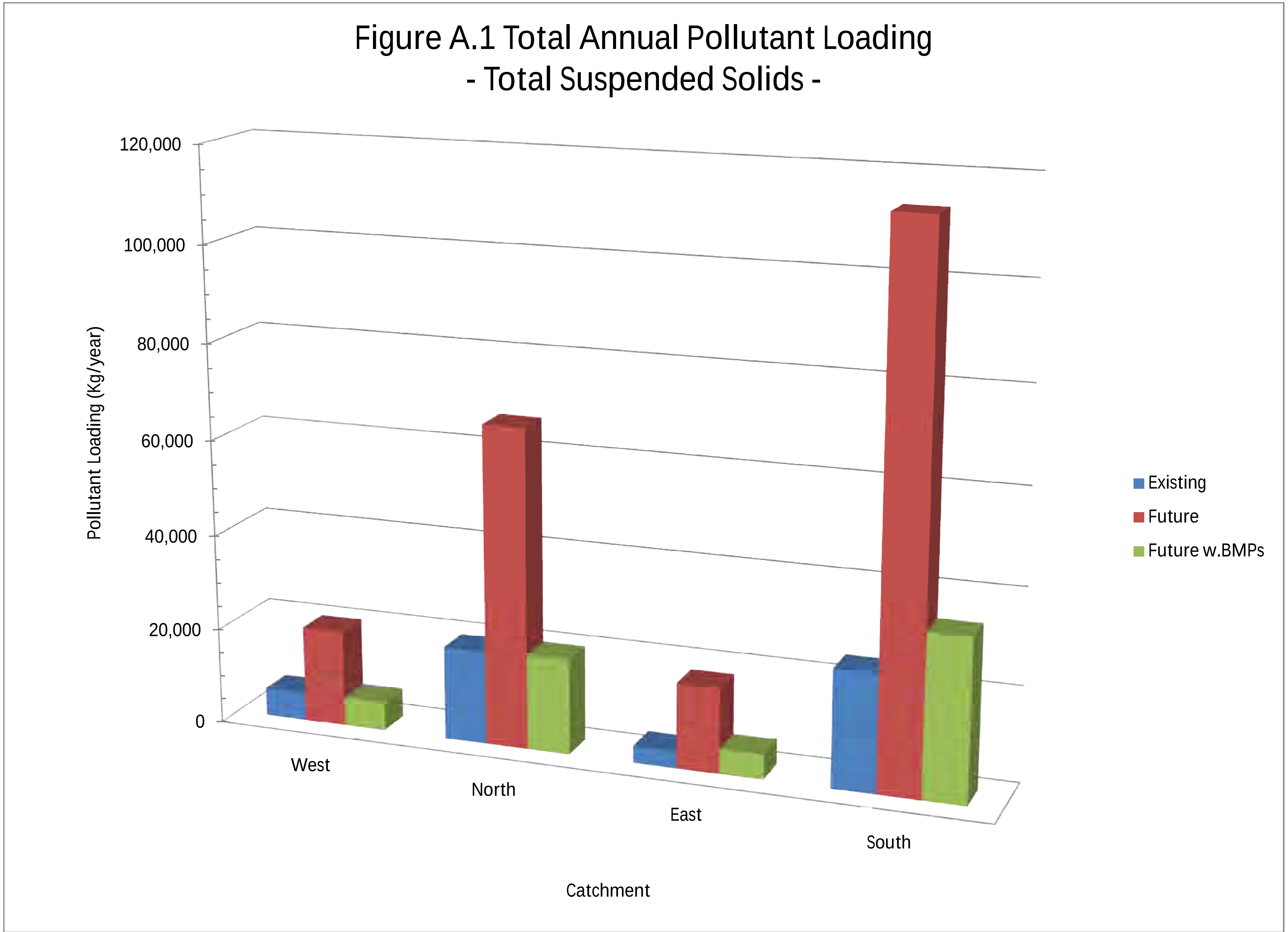
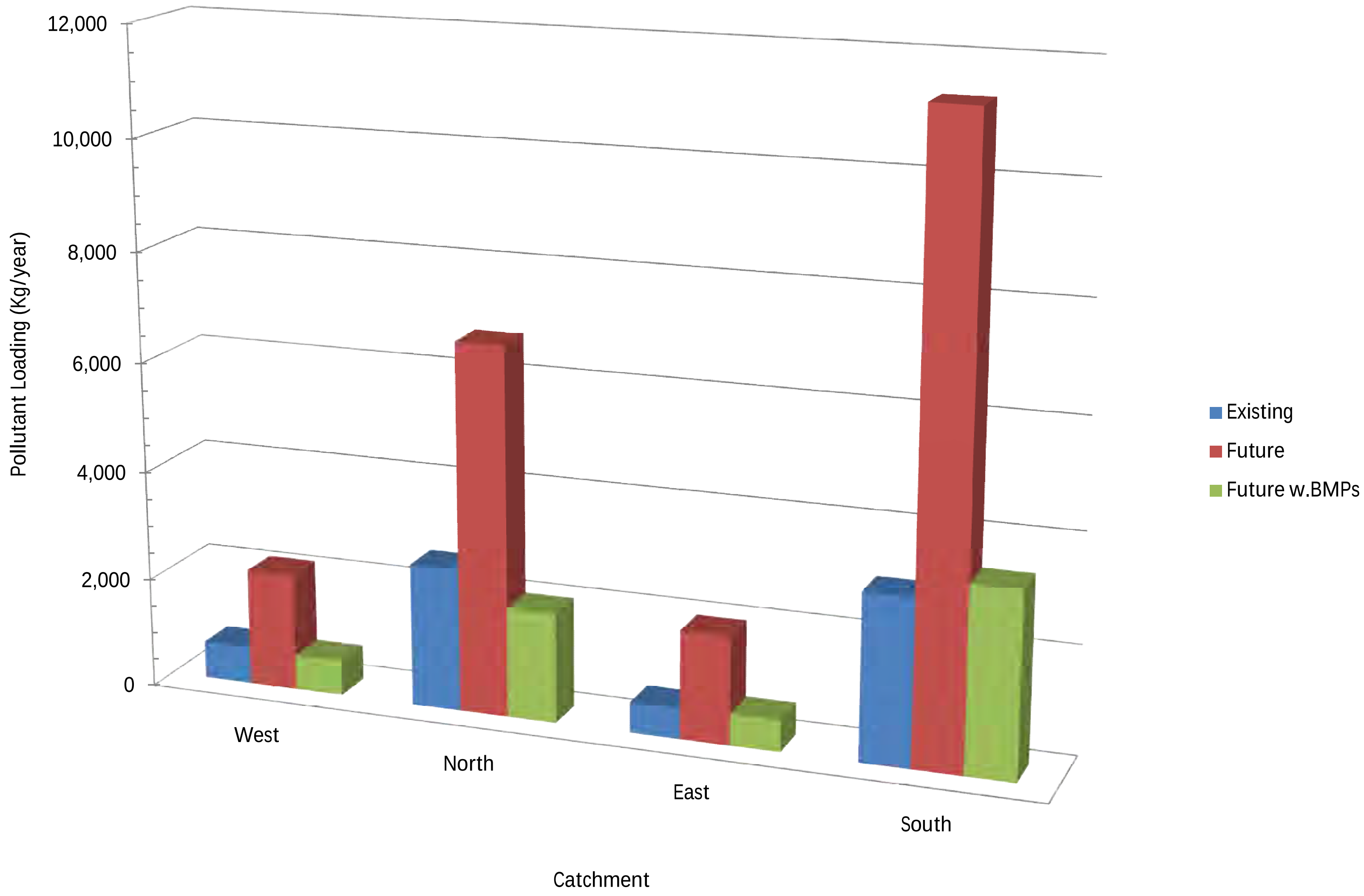


Figure A.1 Total Annual Pollutant Loading
- Total Suspended Solids -
Pollutant Loading (Kg/year)
120,000
100,000
80,000
60,000
40,000
20,000
0
West
North
East
South
Catchment
Existing
Future
Future w.BMPs

Figure A.2 Total Annual Pollutant Loading
- Oil & Grease -



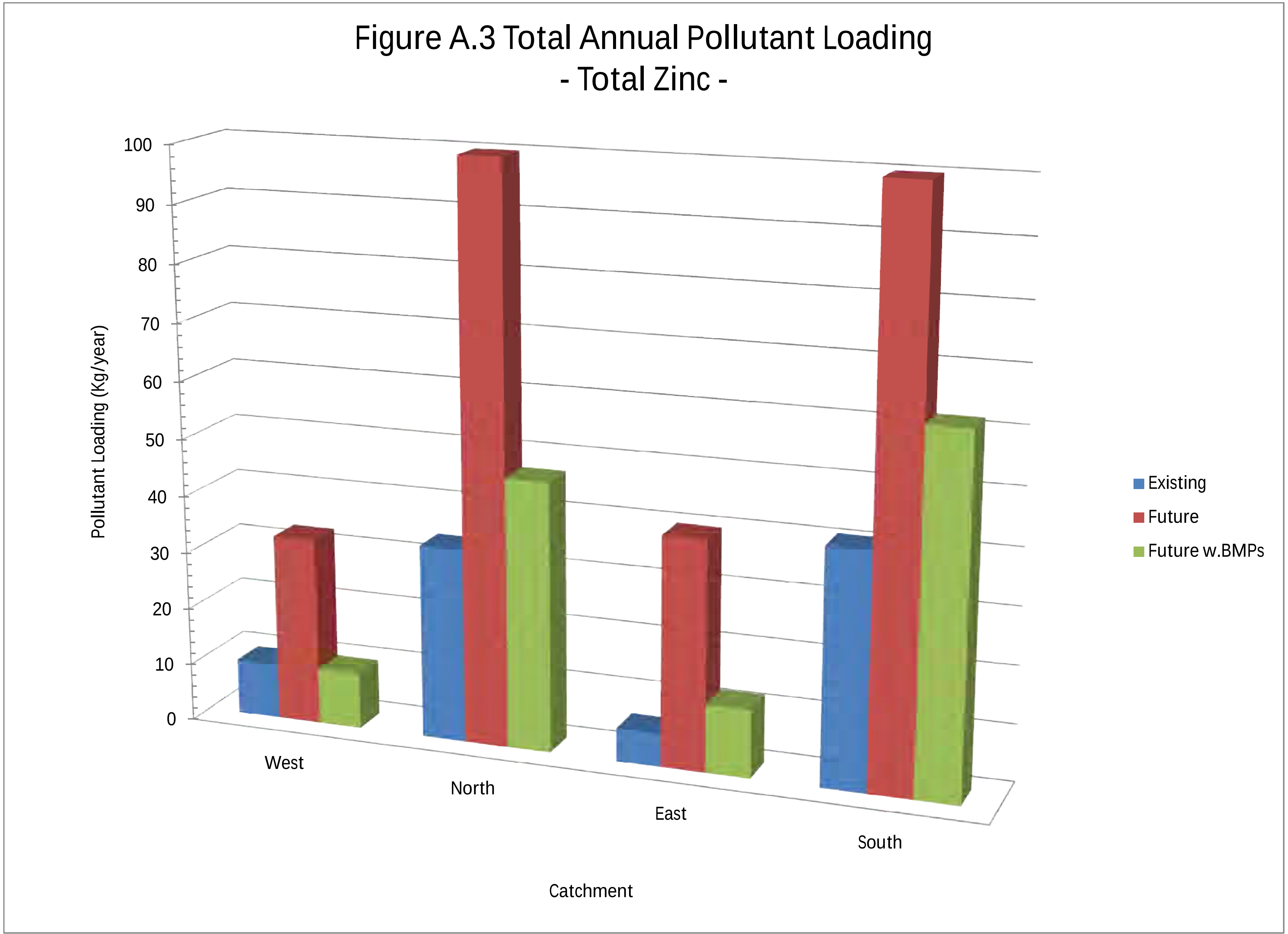


Figure A.3 Total Annual Pollutant Loading
- Total Zinc -
Pollutant Loading (Kg/year)
100
90
80
70
60
50
40
30
20
10
0
West
North
East
South
Catchment
Existing
Future
Future w.BMPs

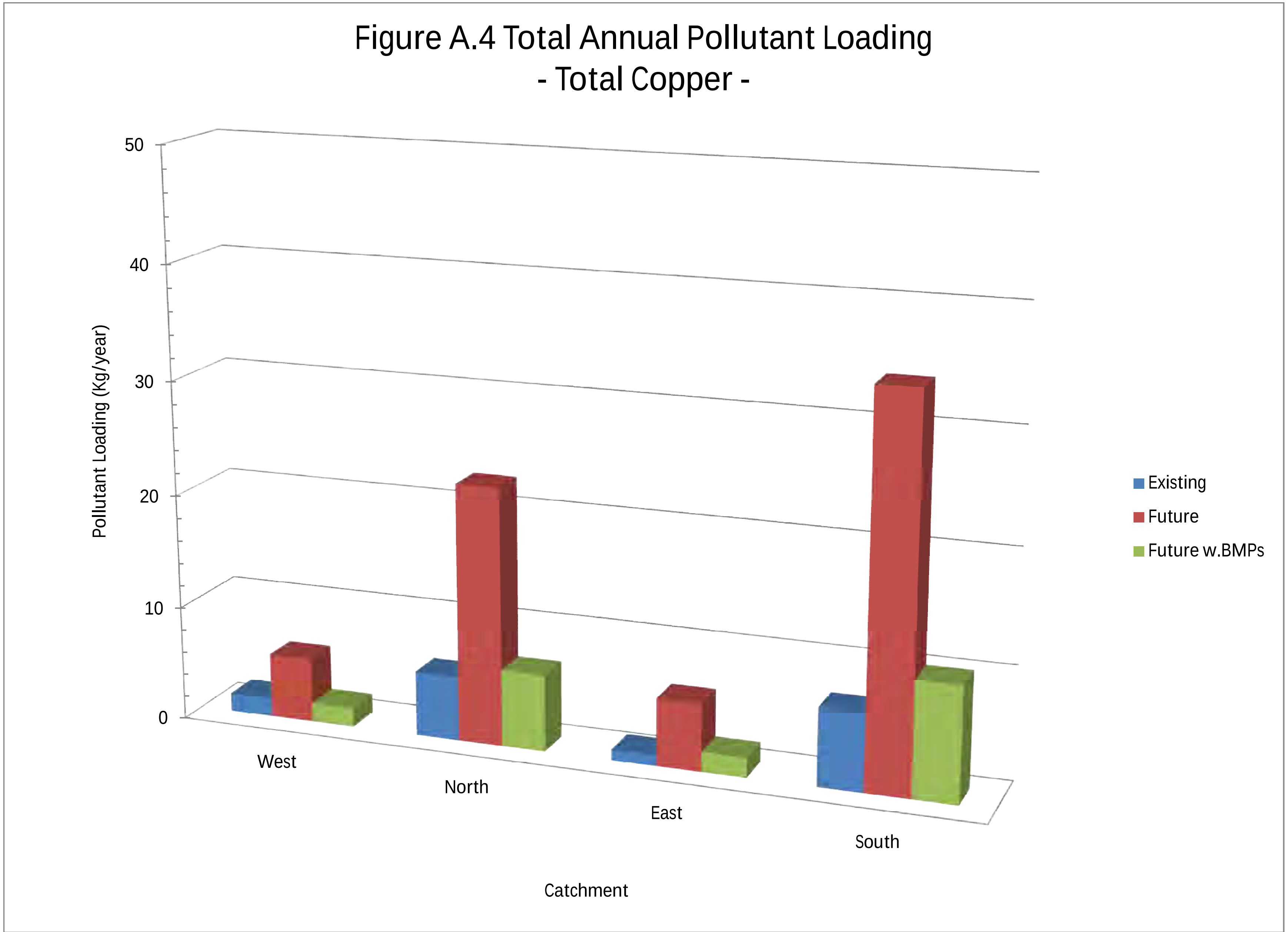


Figure A.4 Total Annual Pollutant Loading
- Total Copper -
Pollutant Loading (Kg/year)
50
40
30
20
10
0
West
North
East
South
Catchment
Existing
Future
Future w.BMPs

TABLES A.1 TO A.4

Table A.1 Summary of Background Drainage Info

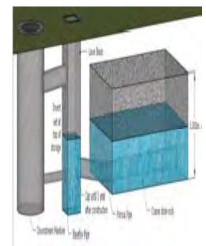
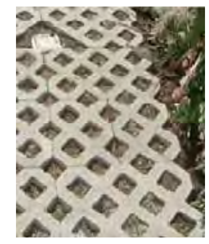
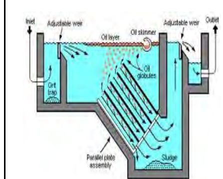
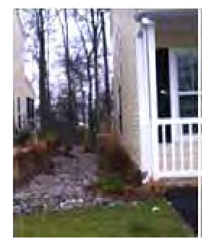
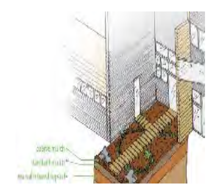
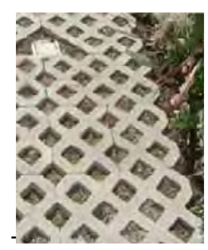
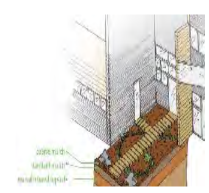
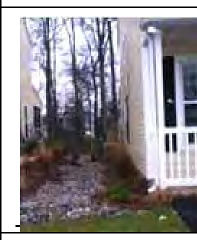
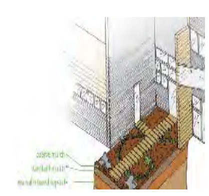
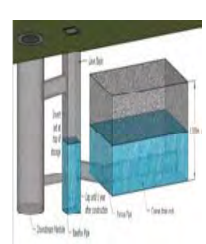
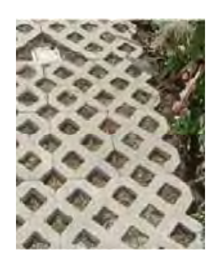
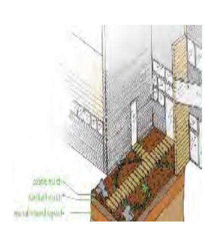
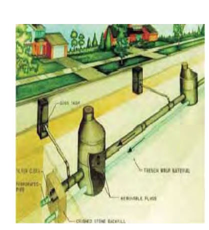
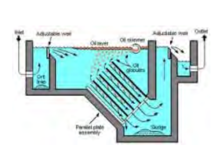
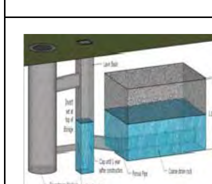
ISSUES		PLAN or STUDY				
		10 year Servicing Plan	Madrone Environmental Assessment	South Port Kells GLUP	North Bluff Drainage and Slope Stability Assessment	Master Drainage Plan Update Upper Serpentime System Environmental Considerations
		2010	2009	2005	2000	1994
Existing Condition	Hydrology (Groundwater and surface water)		**P 24, 29** ***The 'study area' as described in this report is the same as the current 'study area'.** • The aquifer underlying the study area is a confined aquifer having low vulnerability, low demand and high productivity. Most water infiltrating in the Anniedale/Tynehead NCP area will flow laterally downslope and confined within the top 1 m of the soil. Recharge of the aquifer occurs via lateral flow from the lowlands south of the study area, rather than directly from the uplands. • Point of diversion (along mid to lower slopes between 15 m and 25 m of asl) mapped on iMapBC indicate two springs in the southern portion of the study area. Two more springs identified at midslopes between 29 m and 31 m asl in the southern part (more steeper than other southern areas).			
	Ecosystem		**P 43** • Over 150 ha of forested rare ecosystems occur in the study area, occupying over 36% of the land base. The majority of these forests are immature and are dominated by broadleaf trees or a mix of broadleaf and coniferous trees. Although they will likely develop into mature conifer forests with time (in some cases centuries) they are still classed as red or blue listed ecosystems.			
	Environmentally Sensitive area		**P 51—referred to Phoenix Report (2004)** • The Serpentine River watershed in the west was identified as ESA #5 from the Phoenix report. This riparian area connects to forests to the north into Tynehead Park and south along the Serpentine River system. Polygons 2, 3, 6, 13, 15, 16, 19, 21, 22, 23, 27, and 28 are rated as moderate to high conservation value. The large forested polygons in the west central region of the study area are referred to as ESA #4 (Polygons 43, 44, and 157). These polygons have a total size of nearly 12 ha. ESA #3 is made up of deciduous and conifer forests and associated drainages from Lakiotis Creek watershed (Polygons 61, 62, 63, 78, 79, 171, 172, 173, 174, 175, 176 and 178). This is a large, relatively undeveloped area that has older agricultural fields and mixed forests.			
	Topography		**P 8** • Four areas with slopes > 30% have been identified (Figure 2: Terrain Map). • Evidence of debris slide at the southern border of the study area.			

ISSUES		PLAN or STUDY				
		10 year Servicing Plan	**Madrone Environmental Assessment**	**South Port Kells GLUP**	**North Bluff Drainage and Slope Stability Assessment**	**Master Drainage Plan Update Upper Serpentime System Environmental Considerations**
		2010	**2009**	**2005**	**2000**	**1994**
Existing Issues	**Watercourse erosion and other issues**		**P 29** • Significant erosion has occurred at the outlet of the culvert at 92nd Avenue, where ditchwater is discharged into a ditch running downslope, draining into a ravine south of 92nd Avenue. At the culvert outlet, the watercourse is deeply incised and undercut banks are present downslope of the culvert, indicating significant erosion and scour. We understand that erosion of this ditch began following the extension of 180th Street. A drainage ditch paralleling 180th Street feeds into the ditch parallel to 92nd Avenue. A culvert connects the ditch paralleling 92^{nd} Avenue to the ditch in question. Erosion of the ditch is likely associated with increased flow due to the extension of 180th Street. Diversion of additional water into this ditch will result in further erosion.			**P 5-10** --Tributaries of Serpentine River flowing from 96^{th} Ave along 172^{nd} St and flowing south from 96^{th} Ave along 173A St reported to be heavily silted, filled with debris and overgrown. Lower reaches are ditched. --A mainstem tributary flowing northwest from Bothwell Drive and 92^{nd} Ave to 168^{th} St was reported to have considerable siltation on river bed and erosion along stream banks. Metal sheet piles immediately downstream of 168^{th} St provide no cover. --Tributary flowing east under 168^{th} St to main stem near 92^{nd} Ave has instream vegetation that makes fish passage difficult in lower section. A waterfall exists about 700 m upstream from 168^{th} St that creates fish barrier. --Tributary flowing southwest from under 96^{th} Ave to mainstem east of 168^{th} St was reported to be silted and choked with vegetation. Stream bed consists of silt and exposed clay.
	Fish Passage		**P 60, 61,** • **Leoran Brook**: The first culvert underneath 96th Avenue upstream of Highway 1 on the Leoran brook drainage appears to be too steep to allow the upstream movement of fish (Photo 5). Upstream of the second culvert (Photo 6), likely impedes upstream fish migration.			
	Fish presence		**P 57, 59** • **Mainstem Serpentine and connected tributaries**: During field assessment, fish presence observed both in the mainstem Serpentine River and connected tributaries (including ditches). The majority of the fish we observed were rearing juvenile coho salmon fry. The mainstem river exhibits a perennial flow regime and offers relatively diverse habitat where it flows through the study area. • **Leoran Brook**: The existence of coastal cutthroat trout was confirmed in drainages located in the study area during fish sampling exercises carried out by Phoenix Environmental Services Ltd. in 2007. Observations of salmonid fish were made by Madrone in late July 2009 while carrying out the fish habitat/riparian assessments, further confirming the presence of fish in this system. The observations were of resident trout (likely coastal cutthroat trout). The fish were located in pool habitat units immediately upstream of the Highway 1 crossing and in the roadside ditch paralleling the northern side of 96th Avenue.			

ISSUES		PLAN or STUDY				
		10 year Servicing Plan	Madrone Environmental Assessment	South Port Kells GLUP	North Bluff Drainage and Slope Stability Assessment	Master Drainage Plan Update Upper Serpentime System Environmental Considerations
		2010	2009	2005	2000	1994
	Riparian Vegetation		**P 64** • Serpentine River generally bounded by open, grassy fields with limited extent of treed riparian vegetation. • Limited riparian (extent and function) vegetation along Leoran Brook. • Limited riparian (extent and function) vegetation along 96th Avenue ditches.			
Recommended BMPs or other Measures	**Detention**	• Detention pond facility south of 95th Ave and E of 168th St.			Detention volume for controlling to 2-year pre development flows is 23,200 m3 and for controlling to 5 year peak flows is 9,050 m3	
	Watercourse	• Erosion and Ravine works between 96th Ave and 168th St.	**P 64, 73, 77** • Four candidate areas (labeled "A" to "D") were identified as having the most potential for habitat restoration and enhancement (Figures 8 and 9). • General opportunities occur throughout areas of existing fish habitat. Instream habitat enhancement projects that would be of benefit include (but are not limited to): log bank cover construction, rock/log weir construction, strategic instream boulder placement, gravel catchment/placement, installing wing/flow deflectors, LWD placement and off channel habitat development. • Minor changes were made to the existing City of Surrey watercourse classification map during the field assessment. Two unclassified drainage ditches were upgraded to "Class C" drainages, due to direct connectivity to larger, fish bearing systems. The majority of the Leoran Brook headwater streams were upgraded from "Class B" drainages to either "Class A" or "AO" drainages, based on direct observations of salmonids during the field assessments and available habitat attributes. Modifications to the drainage network adjacent to the newly installed "Golden Ears Way" were also made, due to inaccurately mapped drainage locations (Figures 8 and 9). • Due to the sensitivity of the habitat and the considerable site potential for the development of riparian habitat, the setback should be no less than 30 m for the Serpentine River regardless of the proposed density of development. In general, when development densities are determined in the future, setbacks will range from 15 m to 30 m adjacent to Class A, AO and B streams. The provincial Riparian Areas Regulation (RAR) methodology could potentially be used by individual developers as a means of further delineating the riparian setback area after the default 15 m or 30 m setback has been applied.	**P 20** Detention ponds to the south of Highway #1 and E of Harvie Rd.		**Tributary 1.1.2a/b** Clearing of debris and inspection/monitoring of culverts to ensure improved fish passage. **Tributary 1.1.3 mainstem** Encourage landowners to plant stabilizing vegetation and install shot rock or gabions at appropriate locations. If possible, replace sheet pile with shot rock and gabion structures that incorporate cover. **Tributary 1.1.3a** --Clean up dumpsite. --Fence off stream trampled by cattle --Clear instream vegetation, maintain necessary flow and reduced sedimentation. **Tributary 1.1.3b** --Gravel cleaning and additional gravel might improve spawning habitat. --Clear away vegetation to improve fish passage.

ISSUES		PLAN or STUDY				
		10 year Servicing Plan	Madrone Environmental Assessment	South Port Kells GLUP	North Bluff Drainage and Slope Stability Assessment	Master Drainage Plan Update Upper Serpentime System Environmental Considerations
		2010	2009	2005	2000	1994
	Wildlife Hubs and Corridor		**P 91** • Recommendations for wildlife hubs and corridors are built on the results of wildlife habitat suitability ratings in conjunction with the results from the vegetation and ecosystem ratings in this report. Figure 11 illustrates the recommendations for best potential wildlife hubs and travel corridors.			

Table A.2 Potential BMP/LID Options for Anniedale/Tynehead NCP Area

LAND USE	BMP/LID OPTIONS	ILLUSTRATIONS		
Village Commercial	1. Pre-fab infiltration trenches or Drain rock Infiltration trenches 2. Permeable Pavement 3. Oil-water separator			
Cluster Residential 4-6 upa Cluster Residential 6-10 upa	1. Disconnected Roof leaders 2. Enhanced topsoil on lawns (depth to be determined later) 3. Rain barrels (rainwater harvesting)			
Cluster Residential 10-15 upa Medium Density 10-15 upa Medium High Density 15-25 upa	1. Permeable Pavement 2. Planter boxes 3. Enhanced topsoil on lawns (depth to be determined later)			
Low Density Urban 6-10 upa	1. Disconnected Roof leaders 2. Enhanced topsoil on lawns (depth to be determined later)			
Cluster Residential 10-15 upa Medium Density 10-15 upa Medium High Density 15-25 upa High Density Residential 25-45 upa High Density Residential 30-45 upa	1. Pre-fab infiltration trenches or Drain rock Infiltration trenches 2. Permeable Pavement 3. Planter boxes			
Road ROW	1. Enhanced topsoil (depth to be determined later) 2. Infiltration Swale 3. Pervious storm sewers			
Industrial Low Impact	1. Oil-water separator (Parking lot) 2. Hydro-dynamic Separator 3. Filter Insert for Catchbasins 4. Pre-fab infiltration chamber or Drainrock infiltration trenches 5. Green Roof 6. Infiltration pond/Constructed wetland			
Industrial Business Park				
All	1. Diversion sewer 2. Detention / WQ ponds 3. Ditch Upgrade/ Pump station Upgrade			

Based on the BMP/LID table (AECOM) provided by the City on January 11, 2011

Table A.3 Anniedale/Tynehead NCP: Drainage Servicing
Class D Cost Estimate for Proposed Ponds

Sub-Catchment	DESCRIPTION	Pond Type	Land Reqmt	Pond Excavation volume	Unit cost	Total Cost
			(ha)	(m^3)		
N-1	**Pond Site 7: 96th Ave**	Detention		23,000	$100	$ 2,300,000
	Engineering, Administration and Contingency				35%	$ 805,000
	Land		0.72		$2,476,000	$ 1,783,000
	Subtotal Sub-Catchment N-1					**$ 4,888,000**
N-2	**Pond Site 8: Industrial Site near Highway 1**	WQ		7,250	$100	$ 725,000
	Engineering, Administration and Contingency				35%	$ 254,000
	Land		0.5		$2,476,000	$ 1,238,000
	Subtotal Sub-Catchment N-2					**$ 2,217,000**
E-1	**Pond Site 6: 90th Ave and Harvie Road**	Detention		11,270	$100	$ 1,127,000
	Engineering, Administration and Contingency				35%	$ 394,000
	Land		0.71		$2,476,000	$ 1,758,000
	Subtotal Sub-Catchment E-1					**$ 3,279,000**
S-2	**Pond Site 1: Northwest Corner of 173A St and 92nd Ave**	WQ		3,975	$100	$ 398,000
	Engineering, Administration and Contingency				35%	$ 139,000
	Land		0.64		$2,476,000	$ 1,585,000
	Subtotal Sub-Catchment S-2					**$ 2,122,000**
S-3	**Pond Site 2: South side of 90A Ave**	WQ		8,410	$100	$ 841,000
	Engineering, Administration and Contingency				35%	$ 294,000
	Land		0.74		$2,476,000	$ 1,832,000
	Subtotal Sub-Catchment S-3					**$ 2,967,000**
S-4	**Pond Site 3: Southeast corner of 180th St and 92nd Ave**	WQ		4,250	$100	$ 425,000
	Engineering, Administration and Contingency				35%	$ 149,000
	Land		0.47		$2,476,000	$ 1,164,000
	Subtotal Sub-Catchment S-4					**$ 1,738,000**
S-5	**Pond Site 4: Northeast corner of 184th St and 89B Ave**	WQ		4,000	$100	$ 400,000
	Engineering, Administration and Contingency				35%	$ 140,000
	Land		0.46		$2,476,000	$ 1,139,000
	Subtotal Sub-Catchment S-5					**$ 1,679,000**
S-6	**Pond Site 5: Southwest corner of 187th St**	WQ		2,410	$100	$ 241,000
	Engineering, Administration and Contingency				35%	$ 84,000
	Land		0.45		$2,476,000	$ 1,114,000
	Subtotal Sub-Catchment S-6					**$ 1,439,000**
					Ponds	**$ 8,716,000**
					Land Only	**$ 11,613,000**
	TOTAL		**4.69**	**64,565**		**$ 20,329,000**

1. Total cost does not include GST/HST.
2. Unit land price provided by City of Surrey is $1,000,000 per acre, or $2,476,000 per hectare.

Table A.4 Anniedale / Tynehead NCP: Drainage Servicing
Class D Cost Estimate for Trunk Storm Sewers

	DESCRIPTION	UNIT	QUANTITY	Existing Status of Street along Proposed Pipe Alignment	UNIT PRICE	AMOUNT
Sub-Catchment N-1						
N-1	180 St - Concrete storm sewer - 1050 mm dia.	Lin.m.	160	Local Road	$ 1,857	$ 297,000
N-1	96 Ave - Concrete storm sewer - 1050 mm dia.	Lin.m.	65	Local Road	$ 1,663	$ 108,000
N-1	97 Ave - Concrete storm sewer - 900 mm dia.	Lin.m.	250	Green Field	$ 1,386	$ 347,000
	Subtotal Sub-Catchment N-1					**$ 752,000**
Sub-Catchment N-2						
N-2	94 Ave - Concrete storm sewer - 1050 mm dia.	Lin.m.	200	Local Road	$ 1,857	$ 371,000
N-2	184 St - Concrete storm sewer - 1050 mm dia.	Lin.m.	150	Local Road	$ 1,857	$ 279,000
N-2	Along Hwy 1 - Concrete storm sewer - 1050 mm dia.	Lin.m.	1050	Green Field	$ 1,547	$ 1,624,000
	Subtotal Sub-Catchment N-2					**$ 2,274,000**
Sub-Catchment S-2						
S-2	173A St - Concrete storm sewer - 900 mm dia.	Lin.m.	150	Local Road	$ 1,663	$ 249,000
	Subtotal Sub-Catchment S-2					**$ 249,000**
Sub-Catchment S-3						
S-3	176 St - Concrete storm sewer - 900 mm dia.	Lin.m.	350	Highway	$ 2,310	$ 809,000
S-3	177 St - Concrete storm sewer - 600 mm dia.	Lin.m.	170	Local Road	$ 1,274	$ 217,000
S-3	92 Ave - Concrete storm sewer - 750 mm dia.	Lin.m.	150	Local Road	$ 1,469	$ 220,000
	Subtotal Sub-Catchment S-3					**$ 1,246,000**
Sub-Catchment S-4						
S-4	180 St - Concrete storm sewer - 450 mm dia.	Lin.m.	150	Green field	$ 894	$ 134,000
S-4	180 St - Concrete storm sewer - 525 mm dia.	Lin.m.	270	Green field	$ 984	$ 266,000
	Subtotal Sub-Catchment S-4					**$ 400,000**
Sub-Catchment S-5						
S-5	184 St - Concrete storm sewer - 900 mm dia.	Lin.m.	290	Local Road	$ 1,663	$ 482,000
	Subtotal Sub-Catchment S-5					**$ 482,000**
Sub-Catchment W-2						
W-2	172 St - Concrete storm sewer - 750 mm dia.	Lin.m.	150	Local Road	$ 1,469	$ 220,000
	Subtotal Sub-Catchment W-1					**$ 220,000**
	Subtotal (All trunk Storm Sewers)					**$ 5,623,000**
Minor Ditch Improvement Works Downstream of Proposed Ponds						
E-1	Allowance for ditch improvements within existing ROW	Lin.m.	100		$ 135	$ 14,000
S-1	Allowance for ditch improvements within existing ROW	Lin.m.	200		$ 135	$ 27,000
S-2	Allowance for ditch improvements within existing ROW	Lin.m.	350		$ 135	$ 47,000
S-4	Allowance for ditch improvements (additional ROW as required)	Lin.m.	400		$ 135	$ 54,000
S-4	Additional ROW for improved ditch (5 m width x 400 m)	Ha.	0.20		$ 2,476,000	$ 495,000
S-5	Allowance for ditch improvements within existing ROW	Lin.m.	400		$ 135	$ 54,000
S-6	Allowance for ditch improvements within existing ROW	Lin.m.	250		$ 135	$ 34,000
	Subtotal (All Ditch Improvements)					**$ 725,000**
	Grand Total					**$ 6,348,000**

Notes:

1. Trunk costs based on unit rates provided by Surrey 16-Feb-2010; engineering and contingency are included in the unit rates.
2. Total cost does not include HST.
3. Unit land price provided by City of Surrey is $1,000,000 per acre, or $2,476,000 per hectare.

APPENDIX D: WATER

☐ Water Cost Estimates

Anniedale / Tynehead NCP

Stage 2 - Bulk Water Servicing Cost Estimate
Cherry Hill Connection (Initial Development)

Item	Description	Unit	Quantity	Unit Price	Total
1	**Pipe Works**				
1.01	450mm Connection from Cherry Hill (to 96 Avenue)	m	3180	$850.00	$2,703,000.00
1.02	450mm Trunk Water Main	m	350	$850.00	$297,500.00
1.03	300mm Trunk Water Main	m	505	$740.00	$373,700.00
	[1, 2] **Subtotal Pipe Works**				**$3,374,200.00**
2	**Other Fees/Works**				
2.01	PRV Station between 90m and 135m HGL pressure zones	LS	1	$100,000.00	$100,000.00
	Subtotal				$100,000.00
	10% Engineering				$10,000.00
	5% Allowance for Tender Increase				$5,000.00
	Subtotal Other Fees/Works				**$115,000.00**
	CONSTRUCTION TOTAL				**$3,500,000.00**

Notes:
1. Unit prices for pipe works as provided by City of Surrey.
2. Costs for pipe works include mains, appurtenances, tie-ins, service connections, hydrants, pavement cuts (and restoration), 10% Engineering and 5% allowance for tender increase.
3. Costs do not include any permit, RoW, land acquisition costs, or contingencies.
4. Costs do not include any Fleetwood Reservoir connection costs.

Anniedale / Tynehead NCP

Stage 2 - Bulk Water Servicing Cost Estimate
Fleetwood Reservoir Connection (Full Build Out)

Item	Description	Unit	Quantity	Unit Price	Total
1	**Pipe Works**				
1.01	750mm Connection from Fleetwood Reservoir (to 92 Avenue)	m	3550	$1,700.00	$6,035,000.00
1.02	750mm Trunk Water Main	m	2405	$1,700.00	$4,088,500.00
1.03	600mm Trunk Water Main	m	955	$1,320.00	$1,260,600.00
1.04	450mm Trunk Water Main	m	780	$850.00	$663,000.00
1.05	350mm Trunk Water Main	m	1530	$770.00	$1,178,100.00
1.06	300mm Trunk Water Main	m	1540	$740.00	$1,139,600.00
1.07	300mm distribution main upsized from 200mm	m	9345	$200.00	$1,869,000.00
1.08	300mm distribution main upsized from 250mm	m	1595	$100.00	$159,500.00
	[1, 2] **Subtotal Pipe Works**				**$16,393,300.00**
2	**Other Fees/Works**				
2.01	PRV Station between 90m and 135m HGL pressure zones	LS	1	$100,000.00	$100,000.00
	Subtotal				$100,000.00
	10% Engineering				$10,000.00
	5% Allowance for Tender Increase				$5,000.00
	Subtotal Other Fees/Works				**$115,000.00**
	CONSTRUCTION TOTAL				**$16,600,000.00**

Notes:
1. Unit prices for pipe works as provided by City of Surrey.
2. Costs for pipe works include mains, appurtenances, tie-ins, service connections, hydrants, pavement cuts (and restoration), 10% Engineering and 5% allowance for tender increase.
3. Costs do not include any permit, RoW, land acquisition costs, or contingencies.
4. Costs do not include any Cherry Hill connection costs.
5. Costs do not include any costs associated with Port Kells.

Anniedale / Tynehead NCP

Stage 2 - Bulk Water Servicing Cost Estimate
Port Kells Apportioned Costs - Upsizing

Item	Description	Unit	Quantity	Unit Price	Total
1	**Pipe Works**				
1.01	750mm upsized from 600mm (92-168 to Cat-6)	m	1780	$380.00	$676,400.00
1.02	750mm upsized from 500mm (Cat-6 to Cat-9)	m	625	$615.00	$384,375.00
1.03	600mm upsized from 500mm (Cat-9 to Cat-10)	m	955	$235.00	$224,425.00
1.04	450mm upsized from 400mm (Cat-10 to Cat-11)	m	780	$40.00	$31,200.00
	[1, 2] **Subtotal Pipe Works**				**$1,316,400.00**
	CONSTRUCTION TOTAL				**$1,400,000.00**

Notes: 1. Unit prices for pipe works as provided by City of Surrey.
2. Costs for pipe works include mains, appurtenances, tie-ins, service connections, hydrants, pavement cuts (and restoration), 10% Engineering and 5% allowance for tender increase.
3. Costs do not include any permit, RoW, land acquisition costs, or contingencies.

- Indicates cost difference calculated from Surrey unit costs

APPENDIX E: FINANCING

- ☐ 10-Year Servicing Plan Projects

10-Year Servicing Plan Projects

The projects listed in the following tables are eligible for the inclusion into the 10-Year Servicing Plan.

Water

Project	Project Cost	Non-Growth Component (DCC)	Ultimate Growth Component (DCC)
1,060 of 450mm diameter 168 Street: 106 Avenue - Hwy 1	$901,000		$901,000
1,060 of 450mm diameter Hwy 1: 168 Street - 173 Street	$901,000		$901,000
1,060 of 450mm diameter Hwy 1: 173 - Hwy 15/96 Avenue	$901,000		$901,000
350m of 450mm diameter 96 Avenue: Hwy. 15 - 178 Street	$297,500		$297,500
505m of 300mm diameter 96 Avenue: Hwy. 15 - 173A Street	$373,700		$373,700
PRV station 96 Avenue/173 Street	$115,000		$115,000
MV Connection Cherry Hill Cresc./168 Street	$102,500		$102,500
	135m Pressure Zone Total Estimate		**$3,591,700**
PRV station 96 Avenue/180 Street	$115,000		$115,000
550m of 750mm diameter 153 Street: 90 - 92 Avenue	$935,000		$935,000
3,000m of 750mm diameter 92 Avenue: 153 - 168 Street	$5,100,000		$5,100,000
2,405 of 750mm diameter 92 Avenue: 168 - 180 Street	$4,088,500		$4,088,500
955m of 600mm diameter 92 Avenue: 180 - 185 Street	$1,260,600		$1,260,600
780m of 450mm diameter 92 Avenue: 185 - 189 Street	$663,000		$663,000
760m of 350mm diameter 168 Street: 96 - 92 Avenue	$585,200		$585,200
770m of 350mm diameter 180 Street: 96 - 92 Avenue	$592,900		$592,900
440m of 300mm diameter 96 Avenue: 177 - 180 Street	$325,600		$325,600
1,095m of 300mm diameter 96 Avenue: 173 - 168 Street	$814,000		$814,000
9,345m of 300mm diameter upsizing mains 200 to 300mm diameter	$1,869,000		$1,869,000

1,595m of 300mm diameter upsizing mains 250 to 300mm diameter	$159,500		$159,500
		90m Pressure Zone Total Estimate	**$16,508,300**
		GRAND TOTAL	**$20,100,000**

Sanitary Sewer

Project	Project Cost	Non-Growth Component (DCC)	Ultimate Growth Component (DCC)
355m of 375mm diameter 92 Avenue: 171 - 172 Street	$85,200		$85,200
835m of 400mm diameter 92 Avenue: 176 - 172 Street	$810,785		$810,785
Tynehead forcemain odour control Hwy 15	$60,000		$60,000
980m of 400mm diameter Hwy 15: 96 - 92 Avenue	$951,580		$951,580
1150m of 400mm diameter Hwy 1: 176 - 173 Street	$1,116,650		$1,116,650
800m of 600mm diameter 173 Street: Hwy 1 - 104 Avenue	$1,132,800		$1,132,800
Tynehead Trunk ROW Tynehead Park	$90,000		$90,000
Hwy 1 crossing Hwy 1/173 Street	$500,000		$500,000
South Port Kells odour control 173 Street	$660,000		$660,000
270m of 250mm diameter upsizing mains to 250mm diameter	$17,280		$17,280
160m of 300mm diameter upsizing mains to 300mm diameter	$21,760		$21,760
435m of 375mm diameter upsizing mains to 375mm diameter	$104,400		$104,400
Tynehead Pump Station 92 Avenue/172 Street	$3,300,000		$3,300,000
		Tynehead Sub-Total	**$8,850,455**
1000m of 375mm diameter Golden Ears Way: 182 - 187 Street	$240,000		$240,000
2140m of 400mm diameter Hwy 1: 187 - 176 Street	$2,077,940		$2,077,940
Anniedale A odour control 96 Avenue	$60,000		$60,000
265m of 375mm diameter 92 Avenue: 178 - 177 Street	$63,600		$63,600
390m of 375mm diameter 92 Avenue: 177 - 176 Street	$93,600		$93,600

Project	Project Cost	Non-Growth Component (DCC)	Ultimate Growth Component (DCC)
690m of 300mm diameter 91 Avenue: 180 - 178 Street	$93,840		$93,840
135m of 375mm diameter 90A Avenue: 178 - 176 Street	$32,400		$32,400
200m of 400mm diameter Hwy 15: 91 - 92 Avenue	$194,200		$194,200
Anniedale B4 odour control Hwy 15	$60,000		$60,000
980m of 500mm diameter Hwy 15: 92 - 96 Avenue	$1,065,260		$1,065,260
1150m of 650mm diameter Hwy 15: 96 Avenue - 173 Street	$1,396,100		$1,396,100
Hwy 15 crossing Hwy 15 /97 Avenue	$200,000		$200,000
1,135m of 250mm diameter upsizing mains to 250mm diameter	$72,640		$72,640
350m of 300mm diameter upsizing mains to 300mm diameter	$47,600		$47,600
75m of 375mm diameter upsizing mains to 375mm diameter	$18,000		$18,000
Anniedale Pump Station Hwy 1/187 Street	$3,600,000		$3,600,000
Anniedale B4 Pump Station 176 Street/91 Avenue	$3,500,000		$3,500,000
		Anniedale A/B1/B4 Sub-Total	**$12,815,180**
220m of 300mm diameter 91 Avenue: 180 - 181 Street	$29,920		$29,920
Anniedale B3 Trunk ROW 91 Avenue	$225,000		$225,000
100m of 300mm diameter upsizing mains to 300mm diameter	$13,600		$13,600
		Anniedale B3	**$268,520**
890m of 525mm diameter 90A Avenue: 189 - 186 Street	$412,960		$412,960
190m of 600 diameter 90 Avenue: 186 - 184 Street	$107,920		$107,920
Anniedale B2 Trunk ROW 89 Avenue	$235,000		$235,000
400m of 250mm diameter 184 Street: 90 - 92 Avenue	$304,000		$304,000
920m of 250mm diameter 92 Avenue: 184 - 180 Street	$699,200		$699,200
850m of 250mm diameter 92 Avenue: 180 - 176 Street	$646,000		$646,000
Anniedale B2 odour control 90 Avenue	$60,000		$60,000

Project	Project Cost	Non-Growth Component (DCC)	Ultimate Growth Component (DCC)
Anniedale B2 pump station 184 Street/89 Avenue	$4,400,000		$4,400,000
		Anniedale B2	**$6,865,080**
		GRAND TOTAL	**$28,799,235**

Drainage

Project	Project Cost	Non-Growth Component (DCC)	Ultimate Growth Component (DCC)
160m of 1050mm diameter 180 Street: 96 Avenue - Golden Ears Way	$297,000		$297,000
65m of 1050mm diameter 96 Avenue/180 Street	$108,000		$108,000
250m of 900mm diameter 97 Avenue:179 - 180 Street & 180 Street: 97 - 96 Avenue	$347,000		$347,000
		Sub-Catchment N-1	**$752,000**
200m of 1050mm diameter 94 Avenue: 183 - 184 Street	$371,000		$371,000
150m of 1050mm diameter 184 Street: 94 - 95 Avenue	$279,000		$279,000
1050m of 1050mm diameter Hwy 1: 184 - 187 Street	$1,624,000		$1,624,000
		Sub-Catchment N-2	**$2,274,000**
150m of 900mm diameter 173A Street: 92 - 93 Avenue	$249,000		$249,000
350m of ditch improvement 92 Avenue: 173A - 176 Street	$47,000		$47,000
		Sub-Catchment S-2	**$296,000**
350m of 900mm diameter 176 Street: 90 - 92 Avenue	$809,000		$809,000
170m of 600mm diameter 177 Street: 93 - 92 Avenue	$217,000		$217,000
150m of 750mm diameter 92 Avenue: 176 - 177 Street	$220,000		$220,000
		Sub-Catchment S-3	**$1,246,000**
150m of 450mm diameter 180 Street: 91 - 92 Avenue	$134,000		$134,000
270m of 525mm diameter 180 Street: 91 - 92 Avenue	$266,000		$266,000
400m of ditch improvement & ROW 180 Street: 90 - 88 Avenue	$509,000		$509,000
		Sub-Catchment S-4	**$909,000**

Project	Project Cost	Non-Growth Component (DCC)	Ultimate Growth Component (DCC)
290m of 900mm diameter 184 Street: 91A Avenue - 90 Avenue	$482,000		$482,000
400m of ditch improvement 184 Street: 90 - 88 Avenue	$54,000		$54,000
		Sub-Catchment S-5	**$536,000**
150m of 750mm diameter 172 Street: 93 - 92 Avenue	$220,000		$220,000
		Sub-Catchment W-2	**$220,000**
100m of ditch improvement Harvie Rd: 91 -90 Avenue	$14,000		$14,000
		Sub-Catchment E-1	**$14,000**
200m of ditch improvement 92 Avenue: 173 - 173A Street	$27,000		$27,000
		Sub-Catchment S-1	**$27,000**
250m of ditch improvement 187 Street: 89 - 90 Avenue	$34,000		$34,000
		Sub-Catchment S-6	**$34,000**
		GRAND TOTAL	**$6,308,000**

Drainage - Ponds

Project	Project Cost	Non-Growth Component (DCC)	Ultimate Growth Component (DCC)
Anniedale 7 detention pond 96 Avenue/180 Street (N-1)	$4,888,000		$4,888,000
Anniedale 8 water quality pond 187 Street/Hwy 1 (N-2)	$2,217,000		$2,217,000
Anniedale 6 detention pond 96 Avenue/Harvie Rd (E-1)	$3,279,000		$3,279,000
Tynehead 1 water quality pond 173A Street/92 Avenue (S-2)	$2,122,000		$2,122,000
Anniedale 2 water quality pond 90 Avenue/Hwy 15 (S-3)	$2,967,000		$2,967,000
Anniedale 3 water quality pond 180 Street/92 Avenue (S-4)	$1,738,000		$1,738,000
Anniedale 4 water quality pond 184 Street/90 Avenue (S-5)	$1,679,000		$1,679,000
Anniedale 5 water quality pond 90 Avenue/187 Street (S-6)	$1,439,000		$1,439,000
		GRAND TOTAL	**$20,329,000**

Transportation

Project	Project Cost	Ultimate Anniedale-Tynehead Growth Component (DCC)	External Funding	Development Obligation
ARTERIALS				
Highway 15 at Golden Ears Way Interchange	$48,263,000	$12,065,750	$36,197,250	
Highway 1 at 192 Street Interchange	$20,000,000	$5,000,000	$15,000,000	
088 Avenue - 168 Street to 192 Street (Ultimate Arterial Widening)	$43,530,500	$10,882,625	$32,647,875	
090 Avenue - Harvie Road to 192 Street (Ultimate Arterial Widening)	$3,030,300	$1,515,150	$1,515,150	
092 Avenue - 180 Street to Harvie Road/90 Avenue (Interim Arterial Upsizing) Special Section II	$16,016,000	$16,016,000		
168 Street - 88 Avenue to 96 Avenue (Ultimate Arterial Widening)	$10,914,800	$5,457,400	$5,457,400	
180 Street - 88 Avenue to 96 Avenue (Ultimate Arterial Widening & New Arterial) Including Special Section HH	$11,425,400	$11,425,400		
184 Street - 80 Avenue to 93 Avenue (Ultimate Arterial Widening & New Arterial)	$15,082,860	$7,541,430	$7,541,430	
192 Street - 80 Avenue to 92 Avenue (Ultimate Arterial Widening)	$5,573,100	$2,786,550	$2,786,550	
Arterials - Roads & Structures Sub-Total	**$173,835,960**	**$72,690,305**	**$101,145,655**	**$ -**

ARTERIAL INTERSECTION IMPROVEMENTS				
88 Avenue at 180 Street (Traffic Signal)	$180,700	$45,175	$135,525	
88 Avenue at 184 Street (Traffic Signal)	$180,700	$45,175	$135,525	
88 Avenue at 188 Street (Traffic Signal)	$180,700	$45,175	$135,525	
88 Avenue at 192 Street (Traffic Signal) 10 YSP or at Harvie Road?	$180,700	$45,175	$135,525	
90 Avenue at Harvie Road (Traffic Signal)	$180,700	$90,350	$90,350	
90 Avenue at 192 Street (Traffic Signal)	$180,700	$90,350	$90,350	
92 Avenue at 180 Street (Traffic Signal)	$180,700	$180,700		
92 Avenue at 184 Street (Traffic Signal)	$180,700	$180,700		
96 Avenue at 173A Street (Traffic Signal)	$180,700	$90,350	$90,350	
92 Avenue at 188 Street (Traffic Signal)	$180,700	$180,700		
168 Street at Ridgeline Dr (94A Avenue) |Traffic Signal	$180,700	$90,350	$90,350	
180 Street at Ridgeline Dr (93A Avenue) | Traffic Signal	$180,700	$180,700		
180 Street at 96 Avenue | Traffic Signal	$180,700	$180,700		
184 Street at 90 Avenue | Traffic Signal	$180,700	$90,350	$90,350	
184 Street at 80 Avenue | Traffic Signal	$180,700	$90,350	$90,350	
192 Street at 80 Avenue | Traffic Signal	$180,700	$90,350	$90,350	
Arterials - Traffic Signals Sub-Total	**$2,891,200**	**$1,716,650**	**$1,174,550**	**$ -**

ARTERIALS TOTAL	**$176,727,160**	**$74,406,955**	$102,320,205	**$ -**

Project	Project Cost	Ultimate Anniedale-Tynehead Growth Component (DCC)	External Funding	Development Obligation
COLLECTOR UPSIZING, STRUCTURES & INTERSECTION IMPROVEMENTS				
Anniedale Road Overpass of GEW | Structure	$3,360,000	$3,360,000		
Ridgeline Dr (94 Avenue) overpass at Highway 15 | Structure	$4,670,000	$4,670,000		
Ridgeline at 173A Street | Roundabout | Intersection Improvements	$500,000	$500,000		
90 Avenue at 188 Street | Roundabout | Intersection Improvements	$500,000	$250,000	$250,000	
90 Avenue - 184 Street to 187 Street (Upsizing) ** 187 Street to Harvie Road in SPK	$1,806,800	$600,600		$1,206,200
92 Avenue - 172 Street to 176 Street (Upsizing & South Side) Special Section CC	$2,270,580	$613,470		$1,657,110
92 Avenue - 176 Street to 180 Street (Upsizing)	$31,122,000	$653,562		$30,468,438
Ridgeline Dr - 168 Street to 184 Street (Upsizing & South Side of 94A Avenue) Special Section AA Included	$13,175,760	$2,966,270		$10,209,490
95 Avenue - 172 Street to 175 Street (Upsizing) Special Section DD	$1,107,600	$147,638		$959,962
96 Avenue - 177A Street to 181A Street (Upsizing)	$2,511,600	$527,440		$1,984,160
Anniedale Road - 181 Street to 188 Street (Upsizing & East Side) Special Section GG	$6,366,360	$3,188,640		$3,177,720
97 Avenue & 177A Street & 179 Street in Anniedale Triangle (Upsizing)	$2,987,400	$679,770		$2,307,630
172 Street - 92 Avenue to 96 Avenue (Upsizing)	$2,870,400	$602,780		$2,267,620
173A Street - 92 Avenue to 96 Avenue (Upsizing)	$2,870,400	$602,780		$2,267,620
175 Street - 92 Avenue to 95 Avenue (Upsizing) Including Special Section EE	$1,544,400	$532,116		$1,012,284
177 Street - 92 Avenue to Ridgeline Dr (93A Avenue) (Upsizing)	$1,004,640	$210,970		$793,670
184 Street - 92A Avenue to Anniedale Road (Upsizing)	$1,474,200	$309,582		$1,164,618
188 Street - 90A Avenue to Anniedale Road (9300 Block) (90A Avenue south SPK)	$3,533,400	$742,010		$2,791,390
COLLECTORS TOTAL	**$83,675,540**	**$21,157,628**	**$250,000**	**$62,267,912**