The Corporation of the District of North Cowichan

Kingsview Comprehensive Development Plan Bylaw, 2016

Bylaw 3629

The Council of The Corporation of The District of North Cowichan enacts as follows:

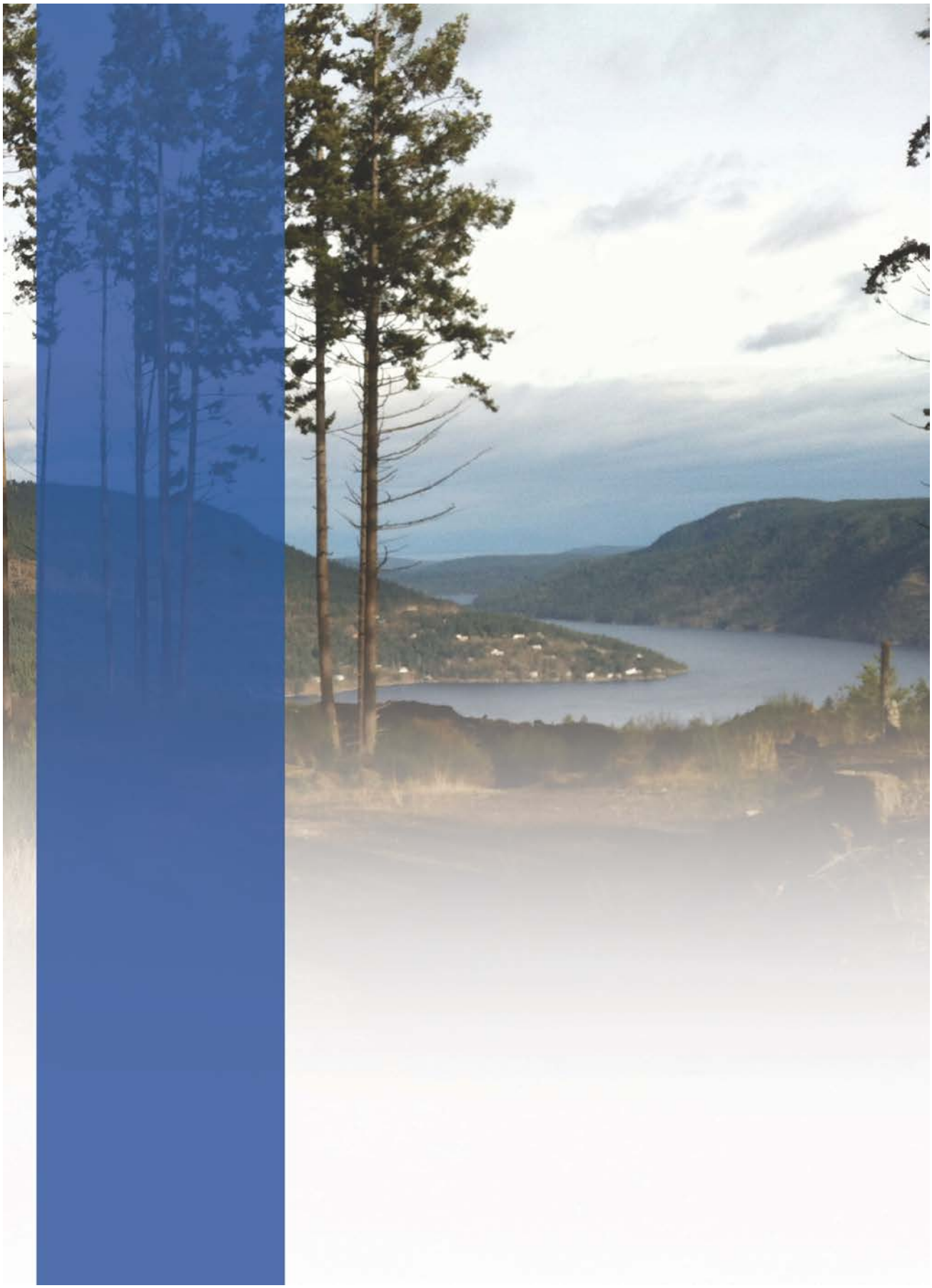
1 This Bylaw establishes and authorizes the Kingsview at Maple Bay Comprehensive Development Plan set out in schedule attached to and forming part of this Bylaw.

READ a first time on July 20, 2016
READ a second time on September 7, 2016
CONSIDERED at a Public Hearing on November 23, 2016
READ a third time on November 23, 2016
RESCINDED third reading on December 21, 2016
READ a second time, as amended, on December 21, 2016
CONSIDERED at a second Public Hearing on June 29, 2017
READ a third time on June 29, 2017
ADOPTED on July 19, 2017

CORPORATE OFFICER

PRESIDING MEMBER

Schedule A



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EXECUTIVE SUMMARY

The revised KingsView Comprehensive Development Plan, formerly known as *The Cliffs at Maple Bay*, responds to changes in the economic climate for golf course development. Substituting that development with provision of greater public access and use of the land, this revised plan recognizes the need to increase densities, and create improved comprehensive developments within existing urban settlement areas. The plan has undergone several iterations, and is the result of meetings with key stakeholders, a public open house, and internal reviews and direction from Municipality of North Cowichan (MNC) staff.

Key elements of the revised plan include:

1. A significant increase in the amount of public open space and public trail networks, in addition to other areas restricted from development.

2. Recognizing the downstream effects of past clearing; vegetation management, soil erosion control, and stormwater management are core determinants of the plan. Particular attention is paid to development impacts on Quamicham Lake, and mitigation measures to ensure water quality control. A comprehensive stormwater management plan is required, and must be accepted by MNC prior to the start of any further development. This plan will detail all requirements to achieve the stated goals of the management of stormwater quantity and quality from this site. Development is restricted on steeper slopes to limit soil disturbance. More than 50% of the total units proposed are attached units.

3. The plan shows 4.5 kilometres of trails,with park and open space comprising 37% of the overall plan area. The park dedication area includes conservation of the three most heavily treed areas on the site, and has been developed in consultation with MNC staff. Parks are categorized in three levels: 1) areas of no development or improvements; 2) areas of limited improvements (including trail networks and detention ponds); and, 3) active park areas, including playgrounds. Provision of strategic public parking areas at key trailheads and public viewpoints will provide the general public with good access to the vast trail network within the Municipal forest.

4. Density has also been increased to 1,190 units to be developed in phases. Buildout timelines will be subject to the market and absorption rates, however, the first phase is expected to begin development in Spring 2016. A minimum 20-year project development time-horizon is anticipated.

5. This strategy will allow for better site planning than has occurred historically in the surrounding single-family neighborhoods.

6. The importance of MNC's *Climate Action Plan* is recognized in the plan, which incorporates: a) increased neighborhood densities to encourage public transit use, b) increased areas of forest/tree conservation, c) homes that meet *EnerGuide 80* standards and incorporate passive solar features, and d) homes required to be plumbed for solar panel systems.

7. The plan responds to MNC's affordable housing policies by: a) including a mix of housing types, b) providing higher densities that can support opportunities for public transportation alternative, c) bringing homes on the market at more affordable levels because of servicing smaller lots is more economical, and d) allowing for secondary suites on the larger detached lots (subject to meeting all other municipal requirements). The plan proposes an agreement whereby each regular-sized detached lot would contribute $500 to the *Affordable Housing Fund*, and small lot and attached unit developed would contribute $250.

8. A traffic impact analysis has been prepared, and identifies timelines for specific upgrades to Maple Bay Road, as well as other infrastructure. The plan also identities future requirements for off-site servicing upgrades.

9. As an amenity contribution to assist with Quamichan Lake water quality initiatives, $500 per regular-sized detached lot and $250 per small lot and attached unit will be provided to the Municipality.

10. The developer will transfer the two multi-family sites in the northwest corner of the site (north of Highwood Drive and west of Viewtop Road), representing 45 multi-family units, to the Municipality as parkland to enhance the Garry Oak area.

The revised KingsView Comprehensive Development Plan has been an iterative process, and has evolved over time with respect to its character. The plan's innovative design features, and focus on the environment and public access will be its hallmarks, and will set a standard for future neighbourhoods within the MNC.

1. OVERVIEW & PURPOSE

In 2005, the Municipality of North Cowichan (MNC) adopted a Comprehensive Development Plan (CDP) referred to as "The Cliffs Comprehensive Development Plan". Integral to that plan was the development of an 18-hole golf course, with a resort hotel and 705 housing units. An initial phase extending Kingsview Road was installed, and 72 lots were registered, but the plan was never completed.

The land was cleared for a golf course and, except for the initial phase, was left in a raw, undeveloped state that has been extensively disturbed and left largely devoid of native vegetation. The site is now predominantly covered with invasive plant species, namely scotch broom, although there is evidence of the beginnings of self-regeneration of native species.

While elements of this new *Comprehensive Development Plan* are the same as the previous plan, the mix of housing types and focus of amenities has changed, with much greater emphasis on the provision of public open space, and access to that space for the enjoyment of all neighbourhood residents and the community at large.

The purpose of the *Comprehensive Development Plan* continues to be to:

- Offer current residents assurance about the future development of adjacent lands;
- Provide Council with objective guidelines for making land use decisions for the development of the lands;
- Inform transportation management relating to the project, including planning for vehicles and active transportation and pathways;
- Identify public amenities, such as green space, trails, and recreational facilities;
- Highlight future land uses and densities within the development area; and
- Outline project phasing.

The intention is to rebrand the neighbourhood from "The Cliffs" to "KingsView at Maple Bay" (KingsView) to reflect the change in the development's overall identity from a golf course resort property to a more complete, sustainable neighbourhood. The emphasis will be on a broader range of housing types and densities, creating greater housing choice, and significantly increasing public access to parks, open space, and a trail network.

In November 2014, a CDP was submitted, and received a comprehensive review. Numerous meetings have been held with MNC staff, and others and has culminated in the submission of this revised and updated plan.

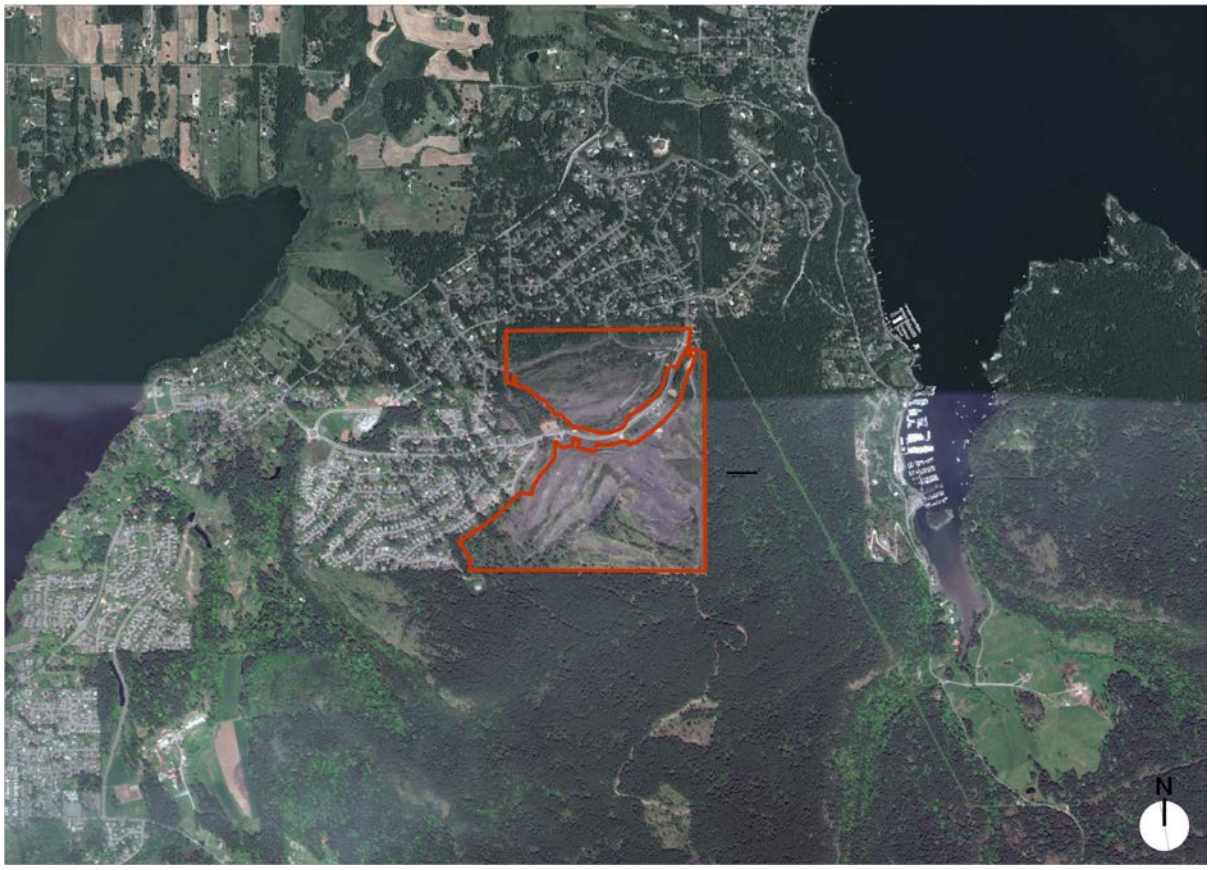
2. SITE CONTEXT

The site encompasses the undeveloped residential lands referred to in the 2005 plan known as “The Cliffs”. Approximately 123 hectares in size, of which 106 hectares is within the KingsView CDP, the site is located on the northern slope of Mt. Tzouhalem and the municipal forest lands, and slopes steeply from south to north. There are spectacular views to the north across Quamichan Lake, and to the east towards Maple Bay, Bird’s Eye Cove, and beyond. KingsView is a continuation of neighbourhoods that have been developed along the Maple Bay Road spine over the past 25 years, and was part of the original “The Properties” first developed in the 1970s.

The most northwesterly part of the site, and the upper central portions of the southern half of the parent parcel contains stands of mature second growth fir trees and pockets of arbutus/garry oak mix. This revised plan directly calls for the retention of the remaining clusters of second growth fir trees.

The lands to the north and west consist of mostly low-density suburban detached residential development. Along the south and eastern boundary lines are the North Cowichan Municipal Forest Land. This area is regionally recognized for its hiking and mountain bike trail development.

A significant consideration in the development of this plan relates to stormwater conservation, revegetation, and impacts on the downstream environment, not the least of which is Quamichan Lake.



Site Map, Source: Google Earth

3. POLICY

MNC has a number of policy documents that inform the development scheme for KingsView. Key among these documents are the municipality's *Official Community Plan (OCP)*, and *Climate Change and Energy Plan*.

OFFICIAL COMMUNITY PLAN POLICIES

KingsView is located within the *Urban Containment Boundary* of the OCP, and is identified as a "Growth Centre". The OCP states that Growth Centres are "the priority for development and infrastructure upgrades". Within the context of the OCP, the relevant policy references are as follows:

- **Regional Growth**
  - Section 2.5.1.1 "The Municipality will manage growth through the establishment of a firm urban containment boundary".
  - Section 2.5.1.5 "The Municipality recognizes, as a priority the need to identify and plan for appropriate density in its growth Centres".
- **Housing**
  - Section 2.5.2.1 "The municipality recognizes the need for a variety of housing types (by size, tenure density and cost) integrated into a range of neighborhoods in all growth areas and especially for housing types suitable for the aging population and young families".
  - Section 2.5.2.3 "The Municipality support the development of new market forms of affordable housing both rent and affordable ownership". MNC policy recommends that 10% of the units incorporate an affordable housing component.
  - Section 2.5.2.5 "The Municipality will ensure that new residential development respects and complements the surrounding neighbourhood".
  - Section 2.5.2.6 "The municipality will encourage development of secondary suites and infill housing".
  - Section 2.5.2.8 "The Municipality encourages sensitive integration of increased density in growth centres..."
- **Environment**
  - Section 2.1.4.1 "The Municipality will ensure that site planning and proposed land development practices for steep and visually prominent slopes protect the visual values".
  - Section 2.2.1.3 "The Municipality protects and supports ecological functioning in watershed in its operations, and through the development approvals process".
  - Section 2.2.1.5 "The Municipality will address threats to biodiversity by:
    i) protecting the integrity of plant communities within ecosystems;
    ii) protecting Red and Blue listed species and the habitats on which they depend;
    iii) recognizing the importance of second-growth forests as a source of biodiversity;
    iv) discouraging and limiting the use of cosmetic pesticides within the municipality;
    v) encouraging the use of native plant species and drought-resistant plants for landscaping on both public and private lands; and
    vi) reducing impact of invasive species through enhanced management, better education, and partnerships".

- **Climate Action Change**
  - Section 2.3.1.2 “The Municipality will develop a community-wide Climate Change Action Plan, that will: 1) confirm or adjust the following proposed targets: carbon neutrality as soon as possible; 33% reduction by 2020 until an action plan is complete; sequestering more than we produce”.
  - Section 2.3.1.5 “The Municipality will require new developments to incorporate adaptations to respond to changing climate conditions”.
  - Section 2.3.1.7 “The Municipality supports the principles of no net increase in run-off and the water balance framework, and expects land and site developments to comply with the standards in the provincial *Water Quality Guidelines (2006)* and *Stormwater Management Guidelines (2005).* [See also Infrastructure (2.5.7)]”.
- **Local Commercial**
  - Section 2.4.5.3 “The Municipality will take the following into consideration for zoning to permit local commercial development:
    - The proposed use is for businesses selling convenience type goods or services to meet the needs of the immediate neighbourhood.
    - The proposed use is close to schools, parks and higher density areas.
    - The maximum aggregate commercial zoned area is 500 square metres (5,380 sq. ft.).
    - The business is located on an existing or proposed major road, preferably at an intersection.
    - There is safe and convenient pedestrian and cycling access to the location”.
- **Public Realm**
  - Section 2.5.3.2 “The Municipality will ensure that new development and redevelopment projects complement the appearance and function of the street, or streets, on which they are located”.
  - Section 2.5.3.7 “The Municipality will enhance community access to natural areas”.
- **Transportation**
  - Section 2.5.6.1 “The Municipality will design its transportation network to accommodate all modes of transportation (pedestrian, cyclist, transit and auto) and enhance connectivity throughout the municipality”.
  - Section 2.5.6.4 “The Municipality will plan cycling routes **-** Except in areas with the highest traffic volume, the Municipality will design roads to be shared by automobiles, bicycles and pedestrians. In areas where traffic volumes and/or speeds are higher, a separate bike lane or route may be warranted. The Municipality recognizes a hierarchy of streets based on functional differences”.
  - Section 2.5.6.8 “The Municipality will maintain a safe, functional urban multi-user road and parking network”. Right-of-way widths for local roads within the urban containment boundary have been set in such a way as to include space for street trees, rain gardens, sidewalks, trails and other infrastructure designed to improve streetscapes and to reduce negative environmental impacts.

- **Infrastructure**
  - Section 2.5.7.3 “The Municipality will promote water conservation and water reuse” – The Municipality will enhance water conservation policies and practices, including: water metering, restrictions or controls on water use during low summer supply period; education about water conservation; promotion of use of water conservation measures such as low-flow appliances and low water landscaping; and possibly use of consumption charges.
  - Section .5.7.6 “The Municipality will manage storm water in an environmentally conscious way while continuing to protect the community. [See also Goal 2: Environmental Protection, and 2.3.1.6]”.
  - Section 2.5.7.7 “The Municipality will reduce the volume of rainwater run-off by encouraging the use of means to ensure it infiltrates where it falls”. Development projects are encouraged to foster rainwater infiltration through the use of absorbent landscaping, swales, rain gardens, pervious paving, green roofs, infiltration trenches, and other appropriate methods.
- **Parks**
  - Section 2.5.8.2 “The Municipality is committed to supporting and enhancing its park system, with parks of varying size and function (e.g., neighbourhood parks, smaller play-lots, and community parks)”. The Municipality will continue to implement the Trail Network and Cycling Plan and Regional Multi-Use Trail Network Plan, which identifies three types of trails and trail networks: 1) major trails that connect one part of the community with another; 2) multi-use trails that serve various user groups within a community; and 3) neighbourhood links that connect residents to local destinations (e.g., school, store, park, waterfronts). The Municipality will also address issues related to motorized uses of trails.
  - Section 2.5.8.5 “The Municipality will use a variety of means to provide parks or open space land, including partnerships with others, land development negotiations and approvals, donations, and purchase when necessary”. The Municipality encourages the dedication of parkland and development of neighbourhood park facilities as part of the re-zoning application process, as long as such an amenity meets a need identified in the *Park and Open Space Strategy for the District of North Cowichan.* The Municipality may consider granting additional density in exchange for dedication of a significant portion of a parcel for park and/or for the provision of a community-wide recreational facility.
  - Section 2.5.8.7 “The Municipality will undertake park facilities management in a way that minimizes costs and negative environmental impacts”.
  - Section 2.5.8.8 “The Municipality will work to link natural areas”.

MUNICIPALITY OF NORTH COWICHAN *CLIMATE ACTION AND ENERGY PLAN*

The MNC's *Climate Action and Energy Plan* (2013) established targets and actions to reduce Green House Gas (GHG) emissions (both for the municipality and for the wider community), and identify carbon sequestering opportunities and adaptive measures for meeting established targets. Key actions include:

- Achieving a 33% emissions reduction on the 2007 baseline;
- Decreasing the average car trip length by 44%;
- Increasing the percentage of dwellings within 400 metres of a commercial core area;
- Increasing the percentage of dwellings within frequent public transit areas;
- Encouraging district energy systems (where viable);
- Encouraging renewable energy sources, displacing oil and gas heating sources for buildings;
- Decreasing per capita solid waste production;
- Increasing local food production;
- Increasing forests;
- Increasing the area of land farmed (sustainably);
- Increasing energy efficiency of new dwellings by 50% over existing building stock; and
- Decreasing the number of detached dwellings from 63% to 61% by 2050.

How KingsView is addressing climate action objectives is described in the following sections of this document.

4. DEVELOPMENT PRINCIPLES

The following development principles set out the framework for moving forward with the KingsView neighbourhood:

1. Adhere to the relevant policies and goals of the *MNC Official Community Plan* and the *Climate Action and Energy Plan*.
2. Create an interesting, diverse, and integrated neighbourhood that can respond to the needs of current and future generations of families living in KingsView.
3. Create a mix of housing options, accommodating a range of housing forms (detached, semi-detached, ground-oriented attached and apartments), and affordability options that provide choice for all ages, abilities, and mix of incomes.
4. Generally, provide cluster mixed housing and higher densities around the amenities and neighbourhood gathering places, or where geography or good site planning support it.
5. Provide for densities that will promote public transit.
6. Locate buildings near focal nodes closer to the street.
7. Provide opportunities for secondary suites and/or carriage units.
8. Provide opportunities for live-work units.
9. Promote low impact development by adopting best management practices.
10. The dominant amenity will be the provision of public open space, and the incorporation of walking/cycling trails within the public open space system, connecting to the regional trail network.
11. Separate pathways and sidewalks from vehicular roads, wherever possible.
12. Demarcate trailheads and gateways to the trail system to form an important part of the neighbourhood identity.
13. Strategically locate rest areas within the trail systems.
14. Establish viewscapes and vantage points for public enjoyment and recreation, including places where people can park and appreciate vistas from their vehicles.
15. Design streets to promote a high standard of environmental and neighbourhood design.
16. Design all major streets to have sidewalks on one side of the road, and incorporate landscaped curb bump-outs to improve the street aesthetic and provide traffic calming.
17. Recognize the amenities already provided from earlier development phases, and the importance of “kick starting” new development by spreading future amenities, and their costs, over the course of the overall phased development.
18. Implement sound planning measures that respond appropriately to environmentally sensitive areas.
19. Adopt practices and mitigation measures to minimize ground disturbance, and maximize erosion control during construction phases.

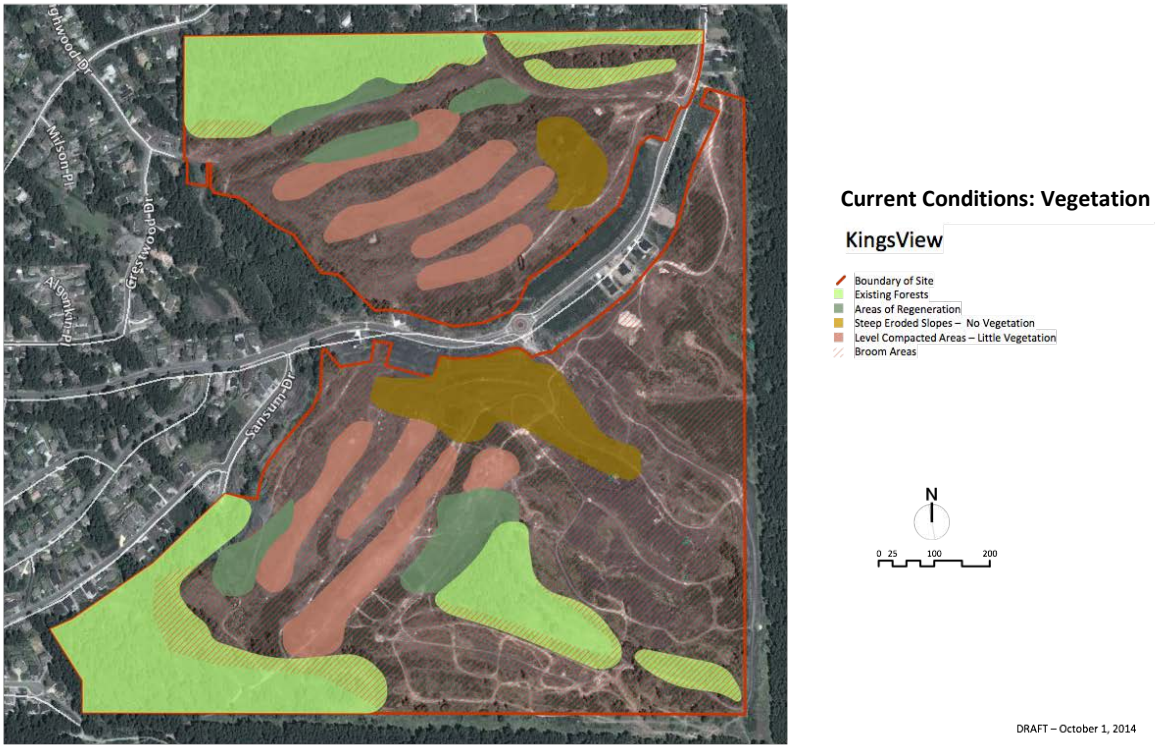
5. SITE CHARACTERISTICS & BIOPHYSICAL ASSESSMENT

Located on the north side of Mt. Tzouhalem, the KingsView site's highest point is approximately 335 metres in elevation, dropping to its lowest point near the northwest corner at approximately 90 metres. The slope varies, with parts of the land having slopes greater than 20%, particularly south of Kingsview Road.

Geologically, the hillside consists of exposed shale rock formations, and fill derived from on-site excavation. The natural state of the site has been extensively altered by previous land clearing, terra-forming, and processing of on-site materials for the now obsolete residential/resort development.

Prior to the land clearing, the site was mainly forested. The majority of the cleared areas are now covered with the invasive shrub, scotch broom. A current biophysical assessment of the site (see Schedule B) was completed to provide:

- A summary of current conditions;
- Identification of ecological/environmental issues on the site; and
- Appropriate protection/mitigation measures, and parameters for vegetation management if/where environmental features are found."



Significant environmental considerations/mitigations include:

- More than 80% of the site has been stripped of native vegetation, and is now covered with the invasive shrub scotch broom;
- Garry oak woodlands, located near the most north westerly part of the site, should remain as part of the designated park area, and mitigation measures should be designed for development activities adjacent to, or within, this feature;
- Use native plant species, and drought-resistant plants for landscape remediation; and
- Develop a phased, strategic plan for invasive species remediation, with detailed plans tailored to each phase (phase-specific) in order to maximize the likelihood of success. The plan is described in the next section of the report.
- Three remaining clusters of second growth fir trees are preserved or earmarked for limited development.

The recommendations of the biophysical assessment has been incorporated into the design of the plan by way of the locations of building sites, roads, and parks and open space.

Contour Map, Source: Google Earth

6. SLOPE DEVELOPMENT & FIRE PROTECTION INTERFACE STRATEGY

Mitigation measures listed below serve to address development associated with the "natural hazards" area designation. Specific measures for development on, or near, steep slopes and fire hazard interface will be submitted as part of the subdivision application process.

STEEP SLOPES & ERODIBLE SOILS

KingsView slopes north to south in a northeasterly direction. The land has been largely stripped of vegetation. Portions north of Kingsview Road are identified in *Map 8 (Natural Hazard Areas)* of the OCP as having slopes steeper than 20%, although much of the site has been disturbed, and the natural terrain has been reshaped. The mostly shale-rock base has permitted the relatively easy manipulation of the landscape

The following strategies will be employed to ameliorate conditions related to steep slopes and the potential for eroding soil:

- Replanting of the site in accordance with the *Vegetation Management Plan*;
- Within private development lands, areas will be covenanted to restrict vegetation removal without a replanting plan by a qualified professional approved by MNC.
- A stormwater management regime for the site;
- Site-specific geotechnical reports to be undertaken, and strategies implemented, as may be required, relating to each phase and considered as part of the subdivision application requirements;
- Overall site planning has considered the most compatible grades for road patterns, with development sites oriented toward less sloped areas; and
- Prominent building sites for attached housing developments will be subject to the issuance of Development Permits.

FIRE PROTECTION OF WILDLAND/URBAN INTERFACE

KingsView is immediately adjacent to municipal forest lands on the upper side at south end of the site. It is designated as "Fire Hazard" area in the OCP, although being stripped of most of its vegetation, hazardous conditions are limited.

The following strategies will be employed to ameliorate conditions related to wildland/urban interface:

- Fuel-free zones required around buildings near wildland interface areas;
- Scotch broom management;
- Consideration of fire resistant exterior building materials and sprinkler systems;
- Discouragement of single access development; and
- Working with emergency response and preparedness agencies.

7. LAND USE PLAN

The centrepiece of the former “Cliffs at Maple Bay” CD zoning was a golf course, with an allowance for 705 housing units, a hotel, and ancillary commercial activities associated with a golf resort facility. Approximately 72 lots were subdivided along Kingsview Road as part of the original plan, and detached residential units have slowly been built on those properties over the past five years.

Kingsview Road physically separates KingsView into two parts: the upper side located south of Kingsview Road, and the lower side located to the north. The lower side comprises approximately 35 ha of land, and the upper side is about 71 ha. The lower side will be developed first, as it has direct access to existing services and utilities – lots can more readily be brought “on-stream”. The upper side will be developed in the future, with timing dependent on market conditions and the absorption rate of the earlier development.

As golf course developments throughout North America have stalled and, in fact, the inventory has significantly declined, the revised plan focuses on providing park and open space, and trails and pathways available to the general public. It is planned that approximately 37% of the land base will be allocated to park and open space functions. The plan shows a series of connecting trailheads, and centrepiece park areas within each of the two main residential districts, north and south of Kingsview Road. To limit the amount of open space under MNC ownership, the revised plan accommodates more private land left in its natural state, and this will contribute to and form part of the overall parks and open space total. All lands incorporating public improvements, such as trails and playgrounds, will be dedicated to MNC, while other lands slated for conservation will be private, and covenanted against development.

An important consideration of the plan is the development of the housing mix and density. Consistent with OCP policies for affordable housing and climate action considerations, the revised plan calls for greater flexibility in housing layout and type with smaller lot development, opportunities for limited secondary suites, and higher densities over less land area.

The revised plan is characterized by more compact, higher density development that will improve the prospects for higher transit ridership. The plan also responds to the topography of the site, For example, individual lots on lesser-sloped lands, and clusters of attached housing located on lands with more complex topography, where placement of buildings closer together can better respond to specific site conditions. Higher density development is located near major roads and pathways, and small neighbourhood commercial focal points.

Targeting a total of 1,190 units, excluding secondary suites – an increase in density from the existing 2005 CD-1 plan, the revised plan limits secondary suites to lots larger than 600 m^2. Based on the updated plan, 189 secondary units could be developed.

It is important to point out that while the plan calls for a greater number of housing units, the design intention is affordability, and getting the project kick-started to generate development activity. Increased density does not directly translate into higher land lifts in terms of the amenities the project can sustain, in particular at the front end. It is more a matter of “relaunching” the new neighbourhood. A summary of the land uses is shown in the following table.

SUMMARY OF LAND USES BY NUMBER & TYPE				
Description	**Lower- Side (North units)**	**Upper-Side (South units)**	**Total**	**Percentage %**
Detached	151	230	381	32%
Multi-Family	230	579	809	68%
Subtotal	**381**	**809**	**1,190**	**100%**
Secondary Suites (potential)			**189**	
Neighbourhood Commercial	250 m^2	250 m^2	500 m^2	
Total KingsView Plan Area	35.2 ha	71.3 ha	106.5 ha	
Park/Open Space/Covenanted Area	13.2 ha	26.5 ha	39.9 ha	37%

Based on projected absorption rates, KingsView will be developed over a 20-year period. The complete land use plan, with the distribution of housing densities, and the housing mix can be found in Schedule C. Smaller versions of the plan have been inserted for guidance in this section of the report.

Development will start on the lower side of Kingsview Road, where infrastructure and services were previously installed, but not completed. The upper side will be developed as the build-out of the lower side is completed. Because it is expected that the upper side development is at least 10 years away, the final mix of housing could evolve from what is shown to meet changing market conditions, but will remain within the overall approved densities.

The seven core land uses are:

1. **Standard lot detached developmen**t: The minimum lot size is 650 m^2. This lot size is consistent with the surrounding neighbourhoods primarily developed prior to 2006. Standard lots are found equally on the upper and lower sides.
2. **Small lot development**: Development of affordable housing units is proposed in both the lower and upper phases. The minimum lot size for small lot is 350 m^2.
3. **Attached (townhouse) lot development**: Comprising the same net unit density as small lot development standards, attached housing (townhouse) has been identified for areas where ground-oriented, clustered housing would be a more effective method of development. Within the attached lot zoning, either attached or detached dwellings can be developed to provide flexibility. The maximum net density under this category is 27 units/ha (11 units/acre)*.
4. **Apartment**: Limited apartment units have been identified potentially above and adjacent to the proposed neighbourhood commercial area at Kingsview and Viewtop Roads. The density proposed for this site is a 74 units/ha (30 units/acre)* and limited to three storeys.
5. **Commercial**: There is one small area identified for neighbourhood commercial. It is limited to a maximum of 500 m^2 of floor space on the ground floor, and is proposed to encourage a “third place” neighbourhood gathering place. Apartment residential would be permitted above the first floor.

6. **Secondary suites**: To encourage affordability, large lot and standard lot sizes consisting of single detached residential would permit secondary suites. The total estimated number of eligible suites is estimated at 189 units. Homes with secondary suites would have to adhere to all zoning regulations, including parking,

7. **Parks and Trails**: Parks, open space and pathways are fundamental and dominate features of the overall development plan. Separate sections on the *Parks & Open Space Design Strategy* (Section 8) and the *Vegetation Management Plan* (Section 9) are provided in this document.

** Densities are based on "net" land area, meaning the area within a site suitable for development. Areas within a development site that are steep, or have other topographical or environmental characteristics are NOT included in the density calculations.*

KINGSVIEW LOWER SIDE: PLAN HIGHLIGHTS

The lower side of KingsView will see the extension of Viewtop Road and Highwood Drive to connect to Nevilane Drive, similar to the original plan. Detached lots along these two roads will be developed first, anticipating that servicing costs will be lower and building sites can be brought on-stream less expensively. This can build momentum, and be the financial catalyst to carry out the rest of the project, allowing for the amenities to be completed.

The first phase calls for detached housing. A neighbourhood-friendly, internal road will circle this phase along Viewtop Road and Highwood Drive. The main feature of the revised plan is a central open space spine that integrates trails and stormwater management, as well as active and passive park areas. The plan also features conservation of the oak grove in the lower west area of the site.

In the longer term, it is envisaged that the attached units will be developed, as well as the small neighbourhood commercial area, which is envisaged near the intersection of Viewtop and Kingsview Roads, and provides an opportunity for a neighbourhood gathering place outside of home and work.

KingsView Conceptual Plaza, CitySpaces Consulting

About 37% of the lower side is designated for parks, pathways and open space. About 30% of the open space area will consist of private lots, covenanted against development or vegetation removal without a replacement vegetation plan. See Schedule E of this report for a more detailed description of the parks strategy. A central feature is the active natural play area space available for neighbours and the general public. The other key element is inclusion of mature trees and garry oak features at the most northern portion of the site in the *Parks & Open Space Design Strategy*.

KINGSVIEW UPPER SIDE: PLAN HIGHLIGHTS

KingsView's most southern portion is also its highest point, and offers views both north and east, with opportunities for very desirable residential building sites. Along the southern property line, adjoining the municipal lands, land uses are primarily large lot detached or attached housing, accounting for both the need for fire-zone interface measures and topography.

The upper side will be developed later, with timing dependent on market conditions and absorption. The land area is larger than the lower side, and the topography is generally steeper. Because of this, the proposed number of attached units is higher than the lower side in response to more complicated topography. The road network is, in many ways, also pre-determined by the topography.

Key features of the plan include retention the remaining two stands of primarily second growth fir trees found in the southeast and southwest quadrants of the property. Earlier versions of the plan included some development of these lands. The single road that curves through the southwest quadrant will be designed as a rural road – narrower in width, without curbs or gutters – to create a more "country" feel while still accommodating traffic needs. Trails and trail connections to the Municipal forest will be maintained, along with a prominent public lookout.

Land Use Plan

KingsView

- Boundary of Site
- Proposed Trail Network
- Trailhead
- Viewpoint
- Stormwater System

Land Use Area	Total Area	Buildable Area
Area 1 – Standard Lot	16.7 ha	15.8 ha
Area 2 – Small Lot Comprehensive	8.0 ha	7.7 ha
Area 3 – Townhouse	35.9 ha	26.8 ha
Area 4 – Multifamily	4.5 ha	3.5 ha
Area 5 – Multfamily w/ commercial	0.5 ha	0.5 ha
Area 6 – Parks	28.1 ha	
Open & Covenanted Green Space	(11.8 ha)	
Road ROWs	12.9 ha	
Other (dedicated for servicing)	0.1 ha	
Totals	**106 hectares**	**54 hectares**

Note: Secondary suites permitted in Area 1.

North Side	
Detached	151 units
TH/Multifamily	230 units
South Side	
Detached	230 units
TH/Multifamily	579 units
Total:	**1,190 units***

*Based on 22 units/ha for THs and 54 units/ha for Multifamily.

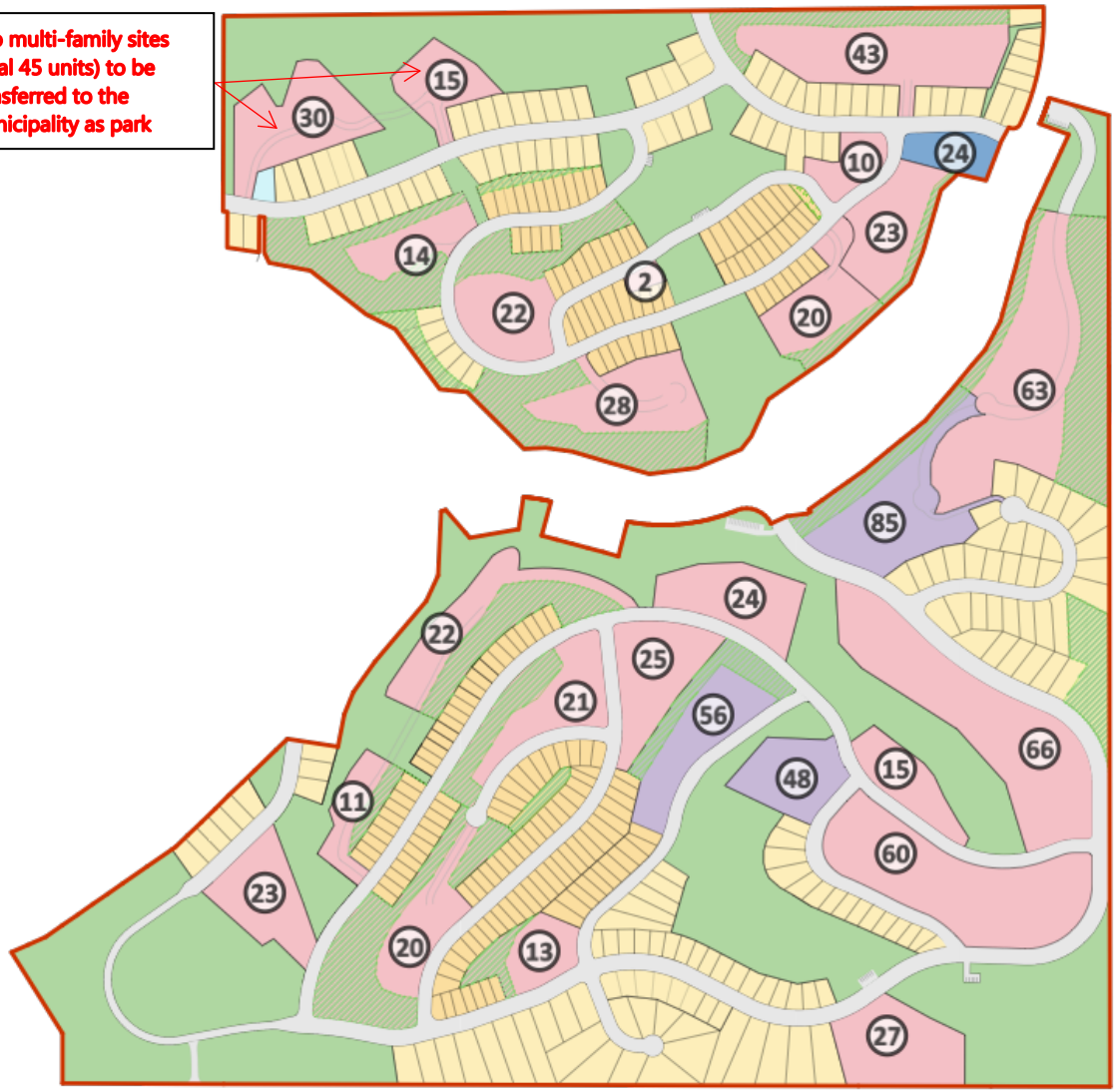
N

0 25 100 200

Scale 1:5,000

March 28, 2016

Two multi-family sites (total 45 units) to be transferred to the Municipality as park



Multi-family Development Sites: Max. Units Per Site

KingsView

Boundary of Site

(##) Maximum units permitted
Based on 9 units/ac for THs and 22 units/ac for Multifamily.

Type	Total Max Units
Townhouse	596
Other Multifamily	213
Total	809

Land Use Area
- Area 1 – Standard Lot
- Area 2 – Small Lot Comprehensive
- Area 3 – Townhouse
- Area 4 – Multifamily
- Area 5 – Multfamily w/ commercial
- Area 6 – Parks
- Open & Covenanted Green Space
- Road ROWs
- Other (dedicated for servicing)

Totals

Note: Secondary suites permitted in Areas 1 & 2.

N

0 25 100 200

Scale 1:5,000

March 28, 2016

8. STORMWATER MANAGEMENT

An integral part of the CDP is careful consideration of the treatment of stormwater developed on the site. An initial investigation has been completed, results of which appear in Schedule G, with the Preliminary Site Servicing Report. This report has been revised since 2013.

The site drains into more than one watershed, including Quamichan Lake, and the environmental importance of respecting watersheds and downstream waterflows is not underestimated. Where possible, the design intention is to daylight stormwater discharge. A plan showing where open channels can be established is also found in Schedule D. There are several components of the stormwater management plan that are dealt with in other sections of this report, the most important of which are the *Vegetation Management Plan*, and the *Parks & Open Space Design Strategy* dedication that permit a very high percentage of the site to be pervious, allowing for natural charging of groundwater.

Schedule G contains a plan for the site's overall stormwater collection system, including the location of detention ponds. A *Statement of Commitment* is also included Schedule D, relating to the preparation of detailed, phase-by-phase SWMPs to ensure a holistic approach, and that the needs of future phases developed upstream are accounted for in the first phases. This statement will be registered in the *Phased Development Agreement* to ensure a SWMP is completed and accepted by the Municipality of North Cowichan for the KingsView development as a whole, prior to any approvals for further development. The SWMP takes into account previous studies prepared for the site, and for the changes in this CDP.

Principles of the SWMP include:

- Limit flows from the site to pre-development rates;
- Maintain existing downstream drainage flows;
- Minimize sediment and pollutants from entering the downstream systems; and
- Wherever practical, maximize run-off infiltration to recharge groundwater.

9. PARKS & OPEN SPACE DESIGN STRATEGY

BACKGROUND

The *Cliffs Comprehensive Development Plan* (2005) required the development of both recreational facilities and the provision of open space and trail systems. The amenities provided and installed, at an estimated cost of $2.5 million, included:

- An all-weather playing field;
- Two softball diamonds;
- Sportsfield parking;
- Enhanced boulevard landscaping;
- Changeroom facilities; and
- A school land dedication.

KINGSVIEW PLAN

The most substantive change in the *KingsView Comprehensive Plan* is the provision of significantly more parks and open space for the entire site, with extensive connecting trail systems for the use and enjoyment of the general public. In the previous plan, open space was primarily provided in the form of a resort golf course, the direct use of which would have been largely restricted to playing golfers, and public green space was limited to 8% of the plan area. The revised plan improves outdoor public use experiences, and opens up access to the larger Quamichan and Maple Bay neighbourhoods, as well as to the broader community.

The revised plan incorporates conservation of the remaining treed areas on the site. The north side is dominated by a central spine with active park activities. The upper half (south side) is characterized by maintaining the mature fir trees, and providing public observation points and trail access into MNC lands.

The *Parks & Open Space Design Strategy*, found in Schedule E, includes active and passive park areas, and extensive trail networks that connect the public to the municipal forest lands adjoining the site. Key features of the plan, to be developed over the phasing of the development, include:

- Designation of 37% of the lands as open space and parkland (estimated at 39.9 ha);
- Provision of 4.5 km of designated trails, with an emphasis on connectivity;
- Placement of trailhead and wayfinding signage;
- Installation of two viewpoint promenades;
- Installation of public parking;
- Provision of a children's playground; and
- Regeneration of the natural landscape.

The locations of the parks and open space, trails, trailheads, public parking, and pedestrian viewpoints/ promenades are shown in Schedule E, along with a more detailed description of the core design elements.

PARK TYPES

The *Parks and Open Space Design Strategy* includes the protection of the garry oak woodland, the conservation of two existing stands of fir tress, trail networks, natural space, and one central active playground space. The plan has a hierarchy of park types described below, and found in Schedule E of this report:

- **Park Type 1**

  Type 1 park areas comprise large spaces that accommodate trails and pathways. The trails provide opportunities for passive forms of recreation, off-street means of moving throughout the neighbourhood, and connections to regional facilities, such as Mt. Tzouhalem Ecological Reserve and municipal forest lands. Three types of trails are envisaged, ranging from more urban hard surface (asphalt) paths, to secondary trails with hard packed surfaces (crushed limestone with fines or compacted gravel) for walking and biking, to low impact nature trails comprising native soil surfaces.

- **Park Type 2**

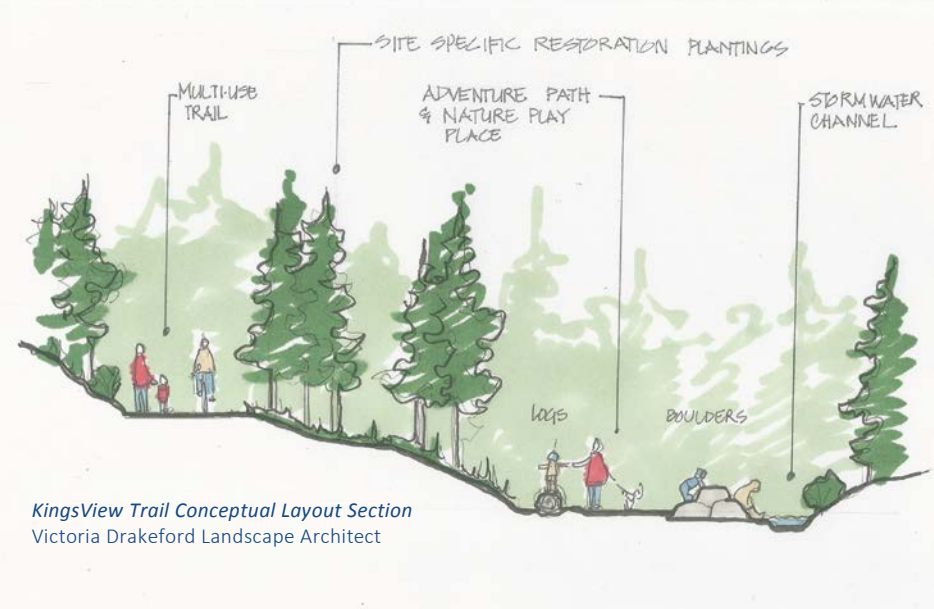
  Type 2 park areas are smaller and less defined "pocket parks", and provide connectivity with street and trail networks. These parks have three primary characteristics: (1) street crossings, (2) prominent viewpoints and special places of interest, such as the garry oak woodland, and (3) trail gateway landmarks.

- **Park Type 3**

  Type 3 parks are the most intensively developed, and one is proposed for KingsView. The site has been selected for its accessibility to surrounding housing, terrain characteristics and viewscapes. Park amenities include a play structure, natural playground, a landmark structure (i.e., pavilion), and picnic area.

TRAIL CONNECTIVITY & SIGNAGE

When complete, the trail system is designed to provide alternative traveling routes, and allow neighbourhood residents and other users to loop back rather than backtrack the same steps. The system is also designed to provide connectivity to the municipal forest lands and the small commercial focal point envisaged as a future



KingsView Trail Conceptual Layout Section
Victoria Drakeford Landscape Architect

public gathering space. Play and rest opportunities are part of the plan, along with trail signage.

PARKING

Provision of public parking is provided to access the trail systems:

- Four public parking areas will be designated and installed: two on each side of Kingsview Road;
- Each parking area will accommodate a minimum of four vehicle spaces;
- The parking areas will be clearly marked; and
- Parking surfaces for these areas will vary from hard surface to gravel, depending on their locations and approval by MNC at time of subdivision.

PUBLIC VS. PRIVATE OPEN SPACE STRATEGY

In discussion with MNC staff, parks and open space has been divided into two legal divisions in an effort to distribute the responsibility for ongoing management and maintenance. Parks and open space comprises:

1. Lands that will be dedicated to MNC, and
2. Lands that will be free from development, but privately owned and protected by covenant in favour of the Municipality.

Criteria for lands to be dedicated to the Municipality are:

- Major treed areas (three);
- Active parks space (located in northern spine);
- Lands incorporating public trails and access points; and
- Detention ponds incorporated within the park will be transferred to the MNC upon completion of the works.

The majority of the steep slopes (grades greater than 20%) are free from development. Rather than being dedicated to MNC, the plan calls for these lands to be incorporated into development plans, and be controlled by covenant at the time of subdivision approval. The Land Use Plan shows the location of the private land that will be protected by covenant.

IMPLEMENTATION & PHASING OF THE PARKS STRATEGY

The park and trail system will be developed in phases, corresponding to development phasing described in other sections. As each phase is developed, detailed construction plans will be submitted for review and approval by MNC.

10. VEGETATION MANAGEMENT PLAN

Victoria Drakeford Landscape Architects and Madrone Environmental Services Ltd. have undertaken a *Vegetation Management Plan* (VMP) strategy that considers:

1. The practical removal of invasive species (primarily scotch broom); and
2. A revegetation/remediation strategy adaptable to site conditions.

The *Vegetation Management Plan* sets out a framework for the principles, procedures and practices to be followed on a phase-by-phase basis when development occurs. With each development phase and submission for subdivision approval, a location-specific remediation plan, including a species-specific replanting plan, will be submitted. The plan is based on site topography, existing conditions, natural features, and connectivity of the overall neighbourhood.

The phased-in *Vegetation Management Plan* dovetails with the *Parks & Open Space Design Strategy*, and the phased implementation of park improvements. A detailed plan for each phase will be included with the submission of subdivision plans to MNC for each phase.

A summary of the significant elements of the *Vegetation Management Plan* are described below. The full plan can be found in Schedule F.

GOALS OF THE STRATEGY

- Long term control of invasive species at KingsView;
- Remediation and reforestation of the proposed parks and open space (approximately 37%);
- Fire hazard reduction along the fire interface zone with Mt. Tzouhalem forest land;
- Minimize soil erosion when undertaking removal of invasive species, and when preparing for development; and
- Manage run-off, and adopt practices that restrict nutrient gain within each watershed precinct, and in particular Quamichan Lake (See Section 11).

OVERALL STRATEGY

Given that each area of the site varies with respect to aspect, topography, and drainage, each planned phase of the development will have specific implementation measures, signed off by the appropriate professional and submitted to the MNC. Implementation will be triggered by the subdivision application and approval processes.

REMEDIATION OVERVIEW

The following is a brief summary of the remediation procedure for each phase:

1. Map and describe invasive species;
2. Map and describe other existing vegetation;
3. Undertake soils analysis to assist with determining how to improve soil conditions for the successful establishment of desired vegetation;
4. Identify regeneration species and locations, and prepare a final planting plan. Plant selection will be based on local nitrogen fixing ability, and its suitability as a pioneer species;
5. Remove invasive species and replace with new, preferred plant materials; and
6. Monitor site remediation; success is measured by the establishment of preferred plants.

BROOM MANAGEMENT

The predominant invasive species is scotch broom. The current maintenance program for the site and the fire break adjacent to the municipal forest lands will continue.

With the first phase of development (the lower side), a more comprehensive broom remediation program will be submitted and implemented for the entire lower side area.

The broom management and vegetation plan strategy will involve:

- Removal of broom plants in late spring:
  - With small seedling plants pulled by hand;
  - Large plants will be cut at just below the soil level; and
  - Cuttings will be removed from the site and mulched.
- Repeat as necessary while development phases occur.
- The revegetation strategy will be implemented for each development phase. Detailed planting treatment should take into account the park area use, and the potential for impacts on views. The standard practices for revegetation, subject to specific ground truthing for the phase being developed, will follow standard horticultural practices (BCSLA Landscape Standards, 2012) that include:
  - Plant in the fall;
  - Protect from browsing by deer;
  - Use woody debris and boulders as needed to capture moisture; and
  - Plant in a manner that mimics natural growing patterns of the tree and groundcover species.

11. SEDIMENTATION & NUTRIENT RUN-OFF CONTROL

As stated in the SWMP summary (Section 8), the environmental importance of respecting watersheds and downstream waterflows is not underestimated, and is very much a focus of this CDP. Reduction of sedimentation, through a detailed SWMP and VMP, is one of the fundamental principles of the CDP (Refer to Sections 8 through 10, and the corresponding Schedules E,F, and G.

Schedule G contains a report on the conceptual design of the stormwater management facilities for this property. The report shows the potential sites for proposed stormwater detention ponds, which will (a) serve to attenuate stormwater flows from the site to pre-development 1:2 year rates, and (b) provide removal of suspended sediments before discharge to the downstream system. Limiting flows from the site to 1:2 year rates follows best management practices, and is a recommended objective stated in *Land Development Guidelines for the Protection of Aquatic Habitat* (Habitat Management Division of the Department of Fisheries and Oceans & the Integrated Management Branch of the Ministry of Environment, Lands and Parks). Detailed design of the stormwater treatment system may show the need to construct at least one stormwater detention pond at the northern boundary of the property. Any ponds that will assist with the removal of sediments from downstream watersheds, including that of Quamichan Lake, can be constructed during the first phase of development if required.

To reduce additional sources of potential sedimentation from the site, it is proposed that scotch broom be removed once detailed vegetation planting plans are in place for a given phase or development site (i.e., do not remove the roots and disturb the soil until other vegetation is ready to be planted in its place). Management of scotch broom along the fire interface with the Municipality's forest lands, however, will remain an ongoing component of site management. As much as possible along the fire interface, broom control methods that do not disturb the soil will be applied until detailed site development plans are completed, and more permanent re-vegetation solutions are designed. In areas of private land with slopes greater than 30%, covenants will be registered to restrict the removal of vegetation within the steep slope areas, except where a revegetation plan has been submitted and approved by MNC. The plan will follow the strategies and practices outlined in the VMP.

Preparation of detailed, phase-by-phase development plans will also ensure that sedimentation control is addressed through the SWMP, and VMP, as well as soil and erosion plans contained within environmental monitoring plans (EMPs). These plans will ensure future development has measures in place to reduce both nutrient run-off and sediment from erosion.

All development permits, and associated site and management plans, will be approved by the Municipality of North Cowichan for the KingsView development.

As an amenity contribution to assist with Quamichan Lake water quality initiatives, $500 per regular-sized detached lot and $250 per small lot and attached unit will be provided to the Municipality.

12. CLIMATE CHANGE & ENERGY STRATEGY

The MNC *Official Community Plan* policies relating to climate change include implementing a *Climate Action Plan*. MNC adopted a *Climate Action and Energy Plan* in 2013 that lays out steps to conserve energy, reduce greenhouse gases emissions, and adapt to the expected effects of climate change.

The *KingsView Comprehensive Development Plan* has considered the *Climate Action and Energy Plan* objectives in a variety of ways, described below:

- Increased densities can encourage public transit use. LEED® Neighbourhood design and contemporary transit standards suggest that densities of 7 units/acre or more increase the likelihood of higher transit ridership. More than 50% of all of the housing units proposed permit net densities of 11 units/acre or more. The proposed zoning will also permit secondary suites under certain conditions.
- Stormwater design supports post-development run-off that does not exceed pre-development run-off.
- Increasing forest production is an integral part of the overall plan. The land base is currently stripped of nearly all vegetation, except for localized, small pockets of trees and groundcover. Revegetation, combined with natural germination, will help to purify stormwater, stabilize soil, recycle nutrients, moderate climate, and absorb $C0_2$. It will significantly contribute to MNC climate action objectives. The plan calls for dedication of approximately 37% of the land for parks and open space.
- Existing small clusters of vegetation will be retained. Protection of key environmental features, specifically garry oak woodlands, is recognized in the site planning.
- All homes will meet "EnerGuide 80" standards, in order to achieve higher energy efficiency and reduce GHG emissions, and require installation of energy-wise fixtures and equipment. These requirements will be defined in a building scheme covenant.
- District Energy Systems are impractical to implement on a development-wide basis given the anticipated pace of development. However, passive solar heating, optimizing the amount of solar absorption through the placement of windows and the siting of building solar panel systems, heat pumps, and augmented solar water heaters should be anticipated.
- All homes will be serviced with a rough-in conduit for future roof photovoltaic/solar panel systems. These requirements will be defined in a building scheme covenant.
- Principles of *LEED® for Neighbourhood Development* will be implemented as they relate to:
    - Provide for street design with landscaped boulevards within public road rights-of-ways;

Solar Roof Panel Example

- Promote active transportation, by providing convenient pedestrian linkages between streets within the neighbourhood ,and linkages between street sidewalks and planned off-street trail networks;
- Provide an easily accessible building site(s) that encourages “third place activities” (i.e., the concept of community building outside of where one lives or works; most notable are coffee houses) that allow residents to use active transportation measures to meet and gather. The land use plan specifically identifies a small local commercial opportunity at the corner of Kingsview and Viewtop Roads. It would also be an appropriate location for installation of cycling infrastructure.

- While there is no direct increase in farmland or commercial food production, there is no displacement of land with good agricultural capabilities.

13. SERVICING

WSP Engineering has completed a site servicing pre-design report relating to core service needs. The report was undertaken on the premise of developing up to 1,250 units for the KingsView project, at a population density of 3.1 persons per unit. Addition of legal suites will increase the unit count. The Municipality has accepted a change in the population density to 2.5 persons per unit with an addition of 0.85 units for each secondary suite. Increasing the number of units, but decreasing the density per unit results in no change to the conclusions of the pre-design report (see Schedule G).

A summary of the report is as follows:

- **Water.** There are no known issues with respect to the provision of water for domestic and fire protection services;
- **Sanitary sewer.** Sewage will be directed to existing infrastructure. There are no known technical issues that would prevent development of this site;
- **Storm drainage**. The site has up to fourteen drainage points of discharge, and 1:2 year storm return flow rates will need to be limited to predevelopment rates. Several detention ponds will be installed. These, and a number of other stormwater requirements, are outlined in the *Stormwater Management Plan* (See Section 8 of this report);
- **Shallow utilities.** There will be a requirement for upgrades to BC Hydro offsite feeders to this site. Phasing of the upgrades will depend on development phasing of the KingsView site; and
- **Other.** The report identifies a number of location-specific technical design requirements that will be addressed at the time of subdivision.

A *Statement of Commitmen*t has been developed outlining developers' responsibilities to produce a *Stormwater Management Plan* (SWMP) for the site. SWMPs must be completed and approved by the District prior to construction of any phase.

14. PHASING

The KingsView neighbourhood will not be built all at once, but rather in financially manageable parts. Based on projected absorption rates, KingsView will be developed over a minimum 15 to 20-year period.

There are two levels of detail to the phasing of the development. At the primary level, developing the lower side (north of Kingsview Road) will occur first, where infrastructure and services were previously installed, but not completed. As the first development of the upper side (south of Kingsview Road) is expected to be at least 10 years away, the final mix of housing could evolve from what is shown in the plan to meet changing market conditions and lifestyle needs, but is anticipated to remain within the overall approved densities.

Within the lower side, three sub-phases are planned, with four phases forecast for the upper side. A plan showing the anticipated phasing is shown in Schedule H. Part of the rationale for the phasing boundaries is the logical timing for installation of servicing infrastructure and access, as well as parks, amenities, and stormwater management.

At the time of subdivision application for each specific phase, all amenities associated with that phase will be installed to the satisfaction of the MNC.

1. Each phase will require the installation of works and services, including amenities (such as trails, trailheads, signage, and benches), and road curbs, sidewalks, and boulevard landscaping.
2. Each phase submitted will conform with this plan, subject to specific site conditions that may result in minor variances.

PHASED DEVELOPMENT AGREEMENT

It is anticipated that a phased Development Agreement pursuant to Section 905.1 - 905.6 of the *Local Government Act* will be entered into with the MNC, and will describe the terms of the development and the timing for implementation of the plan.

The key features of the Phased Development Agreement are:

- Description of the development phases and the subdivision infrastructure requirements (to municipal standards in the subdivision bylaw);
- Description of the timing and payment for any offsite improvements associated with the development; and
- Definition of the timeline for installation and/or provision of amenities, including vegetation management, parks and pathways, and other improvements and/or cash payments associated with the provision of amenities.

15. AFFORDABLE HOUSING STRATEGY

The MNC's *Official Community Plan* includes an affordable housing policy, and provides specific reference to supporting the development of new market, affordable housing, both rental and affordable ownership. The policy recommends that 10% of the units incorporate an affordable housing component. The plan further supports, as part of that strategy, "the development of secondary suites and infill housing."

BACKGROUND

CMHC's defines affordable housing as "housing for which an individual or family is spending no more than a certain proportion of its gross household income on shelter costs to secure adequate housing."

- For homeowners: No more than 32% of gross household income (30% before property taxes and utilities).
- For renters: No more than 30% of gross household income. Renter households that spend more on shelter are considered to be "in core need", and those who spend more than 50% are "at risk of homelessness".

Based on 2011 tax file data, the average family income in the Duncan area (not arranged by municipal jurisdiction) was $72,369, and overall the average family income within the CVRD was $74,396. The median house price for a detached unit within the CVRD was $303,192 (2013). Assuming a 10% downpayment, based on current rates (3.99% - five-year fixed term and 25-year amortization period), an average family could afford a new home costing approximately $375,000.

STRATEGY

The KingsView plan is consistent with the affordable housing policy in North Cowichan's OCP in the following ways:

- Offers a mix of housing types to accommodate diverse needs, and is suitable for both aging populations and young families;
- Provides for increased densities that will encourage and support alternate transportation, decreasing reliance on more costly private vehicle transportation;
- Small lot detached and attached housing is targeted a providing housing within the attainability level, as defined by CMHC;
- The lands are within walking distance of the elementary school, reducing the need for private vehicle transportation;
- KingsView will increase the densities of the overall "Properties" neighbourhoods, and add to the demand for and help trigger the development of the commercial centre proposed for the lower end of Kingsview Road;
- Proposes approximately half of the total detached lots as affordable smaller lots;

Duplex Example

Small Lot Detached Example

- Designates about half of the total units as multi-family;
- Allows up to 189 secondary suites, that exceeds the MNC OCP objective of 10% of the housing units meeting affordable housing objectives within a proposed development; and
- Agrees to support an affordable housing fund by providing cash funding deposited into a targeted reserve fund as follows:

Regular lot:	$500/lot
Small lot/attached unit:	$250/unit

Coach House Example

16. BUILDING DESIGN

Building designs for all housing, including all multi-family housing and local commercial, will be governed by a *Building Scheme Covenant* controlled by the developer and registered on title. Form and character requirements for all commercial and multi-family developments (3 units or more) will be further addressed through the issuance of Development Permits, as per the requirements contained in Development Permit Area #1 as they apply.

In general terms, building schemes will address the following core design principles:

- Establish a high quality of exterior finishes that include adequate roof overhangs for weather protection, and exterior trim designs that promote interest and character;
- Encourage porches, or porch elements facing the street, and discourage garage doors as the dominating feature;
- Encourage landscaping that promotes water conservation, and responds to the site and buildings;
- Safeguard key view corridors to optimize views from building sites, and public vantage points;
- Minimize site disturbance that may include large areas of land covenanted against removal of vegetation or soil without first obtaining MNC approval of a replanting plan; and
- Bring buildings in areas near public realm spaces closer to the street to enhance character and animation.

17. TRANSPORTATION

UPDATED TRAFFIC ASSESSMENT

Boulevard Transportation Group was retained to conduct a *Traffic Impact Assessment* for the proposed KingsView development, dated November 2015. An analysis of post-development conditions was undertaken to provide a clear view of impacts on the adjacent roadways after full build-out and occupancy. The study assessed traffic impacts of the development, reviewed the site access roads, and assessed the need for any mitigation measures. It is recognized that the future continuous connection of Donnay Drive will impact long term transportation patterns at KingsView.

The report, which is appended in Schedule I, recommends:

1. Depending on the build-out approach, since single family homes generate more trips than multi-family dwellings, installation of a single lane roundabout at Kingsview and Maple Bay Roads when:
    - If only single family units are developed, 215 south side single family units are completed; or
    - If only multi-family units are developed, 366 south side multi-family units are completed; or
    - If a mix of single and multi-family units is developed, 308 south side units (81 single family and 227 multi-family) are completed.
2. Installing a northbound right-turn lane on Maple Bay Road at Highwood Drive when 268 of 401 units are completed; and
3. Consider active transportation in the design of the roads.

ROAD & BOULEVARD DESIGN

The goal of KingsView is to create a neighbourhood that has a distinct identity. The neighbourhood has been designed to limit through traffic, and to link local roads with pedestrian and trail networks.

Key transportation considerations for the neighbourhood are:

- Incorporation of MNC traffic-calming policies in street design, including curb extensions, and on-street parking;
- Encouragement of treed, landscaped boulevards, and stormwater swale systems and raingardens (Note: These may require additional road right-of-ways; that will be determined at the time of subdivision application);
- Incorporation of character street lighting, ensuring that the quality of light chosen enhances the pedestrian routes, and respects night sky policies to minimize light pollution;
- Encouragement of bare land strata roads, and laneway width roads, where feasible; and
- Use of permeable pavers will be considered in parking areas only, as it is recognized that the MNC does not support permeable surfaces on public roads.

18. AMENITY PROVISION SUMMARY

The KingsView neighbourhood has been, or will be, contributing a variety of amenities for use, benefit and enjoyment of the broader community:

- Amenities already provided for development entitlements that included the KingsView lands: all-weather sportsfield, soft ball diamonds, school land dedication, sportsfield change rooms, sportsfield parking, and enhanced boulevard landscaping;
- Initiation of an early broom management program;
- Phased revegetation program;
- Provision of approximately 37% of the land for either public park and trails, or private open space restricted by a Section 219 Covenant in favour of the MNC;
- Provision of 4.5 kilometres of trails constructed to MNC standards and connecting with existing trail networks:
    1. Major trails that connect one part of the community with another;
    2. Multi-use trails that serve various user groups within a community; and
    3. Neighbourhood links that connect residents to local destinations (e.g., school, store, park, waterfronts).
- Significant parkland improvements based on three identified park and open space types;
- Provision of playground equipment, benches, parking, trailheads, and other pedestrian-oriented infrastructure;
- Off-site improvements to the overall road network; and
- Provision of a per lot/per unit funding contribution to an affordable housing fund.
- Provision of a per lot/per unit funding contribution to Quamichan Lake water quality initiatives.

Garry oak viewpoint promenade concept,
Victoria Drakeford Landscape Architect

19. PROCEDURE

This *Comprehensive Development Plan* is supported with a concurrent *Zoning Bylaw* that implements the plan objectives outlined in this report. The phasing of development, and the land use distribution and densities shown in the *Land Use Pla*n, will be matched in the *Zoning Bylaw* for KingsView.

Also, as part of the conclusion of the OCP and Zoning Bylaw amendments for KingsView, a *Phased Development Agreement* and associated PDA bylaw will also be considered.

Subsequently, prior to the time each development phase is initiated and detailed subdivision plans are submitted, the appropriate Development Permit applications will be made in accordance with “Schedule J” of the MNC OCP. Form and character Development Permits for specific attached housing projects will most likely be submitted after the subdivision is complete.

APPENDICES

SCHEDULE B: Ecological/Biophysical Assessment

SCHEDULE C: Land Use Plan

SCHEDULE D: Stormwater Management Plan & Statement of Commitment

SCHEDULE E: Parks & Open Space Design Strategy

SCHEDULE F: Vegetation Management Plan Strategy

SCHEDULE G: Servicing Schematics

SCHEDULE H: Phasing Plan

SCHEDULE I: Transportation

SCHEDULE B

Ecological/Biophysical Assessment

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November 18, 2015

Mr. Wayne Strandlund
Strandlund Investments Ltd. c/o Deane Strongitharm
CitySpaces Consulting Ltd. / Strongitharm Consulting Ltd.

Re: The Properties (COMB) CDP Requirements - Ecological/Bio-physical Assessment Related to the Re-zoning Application / Comprehensive Development Plan (CDP) (update to letter dated September 17, 2014)

Dear Mr. Strandlund:

I understand that you are submitting an application for an alteration of the "Cliffs Over Maple Bay" Comprehensive Development Plan (CDP). The main change in the CDP is to have the golf course and residential zoning updated to residential only and increased housing density. In preparation of the application, the Project team has been in regular communications with the Municipality of North Cowichan (MNC) regarding the scope of their plan for the site.

In a letter dated December 10, 2013 from Mr. Scott Mack, MNC Director of Development Services, a number of required aspects for a draft CDP for this property were outlined. One of the required aspects was the development of a comprehensive site management plan to address the current state of the project site. Madrone Environmental Services (Madrone) was contracted by the current landowner and project development team to address issues related to the bio-physical /environmental assessment of the Comprehensive Development Plan (CDP) and associated re-zoning application for your property (KingsView - formerly the Cliffs Over Maple Bay - COMB).

Madrone's Role

The key components of the bio-physical assessment of the property at this stage of the development (the CDP application) are:

1. To provide a summary of current conditions;
2. To identify if there are any ecological/environmental issues of concern on the property;
3. To determine if/where environmental features of significance are present (if any) that they are appropriately addressed within the updated CDP; and
4. To provide input into site re-vegetation/remediation plans where appropriate.

Please note that hydrology and associated surface and sub-surface water management as they relate to the Stormwater Management Plan (SWMP) are covered in the 2015 CDP *Schedule G* by WSP. A Statement of Commitment outlining the requirements for a SWMP will be submitted by KingsView as a condition to approval of a new CDP and zoning for the subject property. Where appropriate, Madrone will provide advice where required in relation to Phase-specific management plans for maintaining surface water quality during and following construction.

Bio-physical Assessment - Background

A site visit, current ortho-photography (purchased by the owner; flown on Nov 1, 2012), and applicable background documents were reviewed in conducting this assessment. Due to the highly altered, degraded and cleared nature of the property, a full-scale ecological assessment is not warranted. The probability of rare plants or valuable wildlife habitat being on the site is very low to nil throughout the majority of the property; the one exception being the Garry oak woodlands at the north end (bottom of the slope).

Tania Tripp conducted a field visit in partnership with the project Landscape Architect (Victoria Drakeford) in February of 2014; with additional visits in early March and August. While on site, particular attention was given to determining the best options for management of Scotch broom and re-vegetation at the site. As well the focus was on potential for the property to support rare, sensitive Garry oak ecosystems and/or plant assemblages. General observations were also made of potential wildlife habitat values and the dominant vegetation composition.

General Site Description - Current Conditions

The natural state of the site has been extensively altered by previous land clearing, terra-forming, and processing of on-site materials from 2006-2008. The most obvious change was the removal of almost all of the vegetation (>80%). The majority of the cleared areas are now covered with the invasive shrub, Scotch Broom (*Cytisus scoparius*).

Prior to land clearing, the site was predominately covered by second growth (approx. 40-50 years old), dry, Douglas-fir forest with scattered Arbutus (typical of the 03 site series in the CDF biogeoclimatic zone). Additional, visible alterations are the terra-forming (large terraces), and construction of the site drainage network. As well, a paved road that links Kingsview Road to Nevilane Road now exists and development of homes along that road has been occurring over the last 3-4 years. A number of services have also been established along previously planned residential sites.

The following sections of this assessment provide a summary of what remains on-site that is ecologically significant, and recommendations for measures to protect them. Input regarding re-

vegetation and remediation efforts was provided to the project team's Landscape Architect, and is covered in the related sections of the CDP. Victoria and I have been working closely together on this challenging aspect of the plan, and have met with North Cowichan, Municipal Forester Darrell Frank to discuss suitable options for re-vegetation and control of invasive plants (namely Scotch broom). The main concern about the extensive broom infestation is the associated fire hazard, as the site is adjacent to North Cowichan forestry lands.

Natural Areas and Key Environmental Features

Some second growth forest (Douglas-fir leading with scattered Arbutus) remain along the north end and southwest corner of the property. Two patches of established, second growth, Arbutus stands are present at the bottom of the slope (northern boundary). Key environmental features that remain at the site are the Garry oak (*Quercus garryana*) woodlands along the northwest boundary (bottom corner of the slope). These Garry oak ecosystems are extremely uncommon locally, provincially, and globally, and often contain or are associated with rare and threatened species. In addition, Garry oak ecosystems are red-listed in Canada and protected under the federal *Species at Risk Act*.

Garry oak ecosystems are distinct because their plant communities are formed by species adapted to harsh environmental conditions such as shallow, low-nutrient soils and extreme drying periods. Garry oak and terrestrial herbaceous ecosystems have the potential to support a variety of wildlife and biodiversity elements that are specifically adapted to these climatic conditions. These ecosystems are also important because they are amongst the most poorly represented of all sensitive ecosystems in the Municipality of North Cowichan.

Protection Measure for Existing Key Environmental Features

A key environmental feature, representative of Garry oak woodland, occurs within the property boundaries at the most northeasterly boundaries of the Plan area. It is my recommendation that these features be protected as dedicated park space.

The integrity of this feature should be maintained in association with the implementation of a buffer around the edge of the woodland. The buffer may vary from 5 to >15 meters depending on the terrain and specific site conditions. The buffer should be flagged by a Professional Biologist and surveyed prior to the start of construction of any phase to ensure correct delineation and protection of the ecosystem. To assist this process, the largest cluster of Garry oaks has already been professionally surveyed. Additional inventory and surveys of Garry oaks will be needed prior to approval of adjacent building footprints to ensure protection of this environmental feature. The Garry oak woodlands are located within the area identified as "Phase 1" of the KingsView CDP, and as such their protection will be addressed within the first phase of development.

To further protect the Garry oak woodland features, temporary snow fencing (bright orange) should be installed at the outer-most extent of the buffer prior to any construction adjacent to them. This precautionary measure has been highly effective at other construction sites for keeping vehicles and heavy equipment from damaging the integrity of these sensitive sites. Additional mitigation measures may be required if development is proposed within this feature.

In the March 9, 2014 draft version of the CDP that I reviewed, the planned trail network indicated a trail going through the Garry oak woodlands. I recommended that the trail be removed in order to minimize further fragmentation. Instead of a trail through the woodlands, a viewpoint with signage and a bench could be provided for enjoyment, education, and protection. As of September 2014, these recommendations have been adopted and are reflected in the current 2015 CDP.

Parks and Open Space

The CDP Parks and Open Space Strategy indicates that a significant portion of the land will be provided throughout the development as an amenity for residents and the general public. These spaces will include passive green spaces, as well as more active recreation areas (such as playgrounds and public parking for access to biking/hiking trailheads) and areas of environmental significance. The dedicated green space will serve as a number of different amenity areas, including parks, open spaces, key environmental features (Garry oak woodlands), natural trail systems and recreational spaces. Merging of the existing pathways and trails with the new interconnecting trail system could provide extensive opportunities for walking, running and cycling; as well as educational/interpretive opportunities related to the Garry oak woodlands.

Invasive Plant Management - Scotch Broom

The presence of invasive species on the subject property is extensive and predominately Scotch broom. A Vegetation Management Plan (VMP) overview for the entire property that focuses on broom control along the fire interface with the North Cowichan forest lands will be provided to MNC as part of the CDP application. Madrone has provided input and review of documents related to broom management to Victoria Drakeford.

In addition to the general broom management plan for the property, Phase-specific (detailed) VMPs are recommended. Due to the site variation in aspect, topography, drainage and current conditions, remediation plans tailored to each planned phase of the development should be completed and provided to MNC for approval. Each Phase-specific remediation and vegetation management plan should provide appropriate strategies, plants lists/schemes, with input and guidance from qualified professionals.

Phase-specific VMPs should, at a minimum, include the following:

1. Mapping of
    a) location of the Scotch Broom
    b) location and description of existing native vegetation if applicable
    c) location and description of regenerating patches of native vegetation within parks and open spaces
    d) existing and proposed stormwater channels
2. Detailed planting schemes should take into account the uses of the park areas and their view potential.
3. A discussion and agreement with MNC on strategies for broom removal, to include:
    a) feasibility of methods
    b) timing/phasing in accordance with the phased development

Rehabilitation and Landscaping with Native Species

Landscaping in the proposed development should give priority to native plants. Using native plants for landscaping purposes is beneficial, as once the plants become established, very little maintenance is required. Native species are inherently drought tolerant and provide benefits to local fauna. Native plants can also be used to help manage competition from invasive species.

In particular, care should be taken to source native grasses to minimize colonization by exotic species. Xeriscapes (drought tolerant landscaping) should be incorporated as much as possible to increase the likelihood of successful growth, and will be representative of the natural ecological character of the site. This input has been discussed with and provided to the Landscape Architect. Please refer to the report by Victoria Drakeford for details related to re-vegetation concepts suitable for the site.

Wildlife Management - Breeding Birds

Prior to further land clearing occurring on the property, it is important to be aware of the following legal protection measures that apply to all breeding birds (taken from Section 34 of the Wildlife Act):

Birds, nests and eggs

34) A person commits an offence if the person, except as provided by regulation, possesses, takes, injures, molests or destroys:

(a) a bird or its egg,

(b) the nest of an eagle, peregrine falcon, gyrfalcon, osprey, heron or burrowing owl, or

(c) the nest of a bird not referred to in paragraph when the nest is occupied by a bird or its egg.

Section 6 (a) of the federal Migratory Birds Convention Regulations (MBCR) also applies. Under Section 6 (a), it is illegal to destroy or take a nest, egg or nest shelter of a migratory bird. Migratory birds covered under the regulation include a number of species known to visit and likely to breed in terrestrial habitats within the general vicinity of the assessment area, including hummingbirds, warblers, flycatchers and swallows.

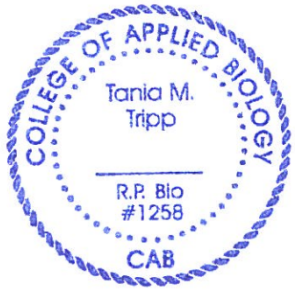
The MBCR does not explicitly limit the protection of nests to active nests, as is the case with the Wildlife Act. Removing a nest of a migratory bird after the nest has been used outside the breeding season, however, will generally have no impact upon the bird, as the majority of species will construct or use different nests from season to season.

The vast majority of all of the migratory species that may breed in the study area have generally left the south coast of BC by the end of August. Even if there are a few remaining stragglers of some species, they are unlikely to have young still in the nest.

Therefore, based on breeding cycles, an acceptable window for any type of vegetation clearance to avoid impact upon active nests would be August 1st to April 1st. The main areas of the property that this should be applied to include: vegetated riparian areas, standing trees (patches of second growth Arbutus and Douglas-fir), and natural shrub areas dominated by native vegetation.

Due diligence has been followed in hiring a Qualified Environmental Professional (QEP) to carry out an ecological/biophysical assessment of current site conditions. If there are any questions regarding the results of our assessment, please do not hesitate in contacting the undersigned.

Prepared By:



Tania Tripp, M.Sc., R.P.Bio
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SCHEDULE C

Land Use Plan

Schedule C
Land Use Plan

KingsView

- Boundary of Site
- Proposed Trail Network
- Trailhead
- Viewpoint
- Stormwater System

Land Use Area	Total Area	Buildable Area
Area 1 – Standard Lot	16.7 ha	15.8 ha
Area 2 – Small Lot Comprehensive	8.0 ha	7.7 ha
Area 3 – Townhouse	35.9 ha	26.8 ha
Area 4 – Multifamily	4.5 ha	3.5 ha
Area 5 – Multfamily w/ commercial	0.5 ha	0.5 ha
Area 6 – Parks	28.1 ha	
Open & Covenanted Green Space	(11.8 ha)	
Road ROWs	12.9 ha	
Other (dedicated for servicing)	0.1 ha	
Totals	**106 hectares**	**54 hectares**

Note: Secondary suites permitted in Area 1.

North Side

Detached	151 units
TH/Multifamily	230 units

South Side

Detached	230 units
TH/Multifamily	579 units
Total:	**1,190 units***

*Based on 22 units/ha for THs and 54 units/ha for Multifamily.

N

0 25 100 200

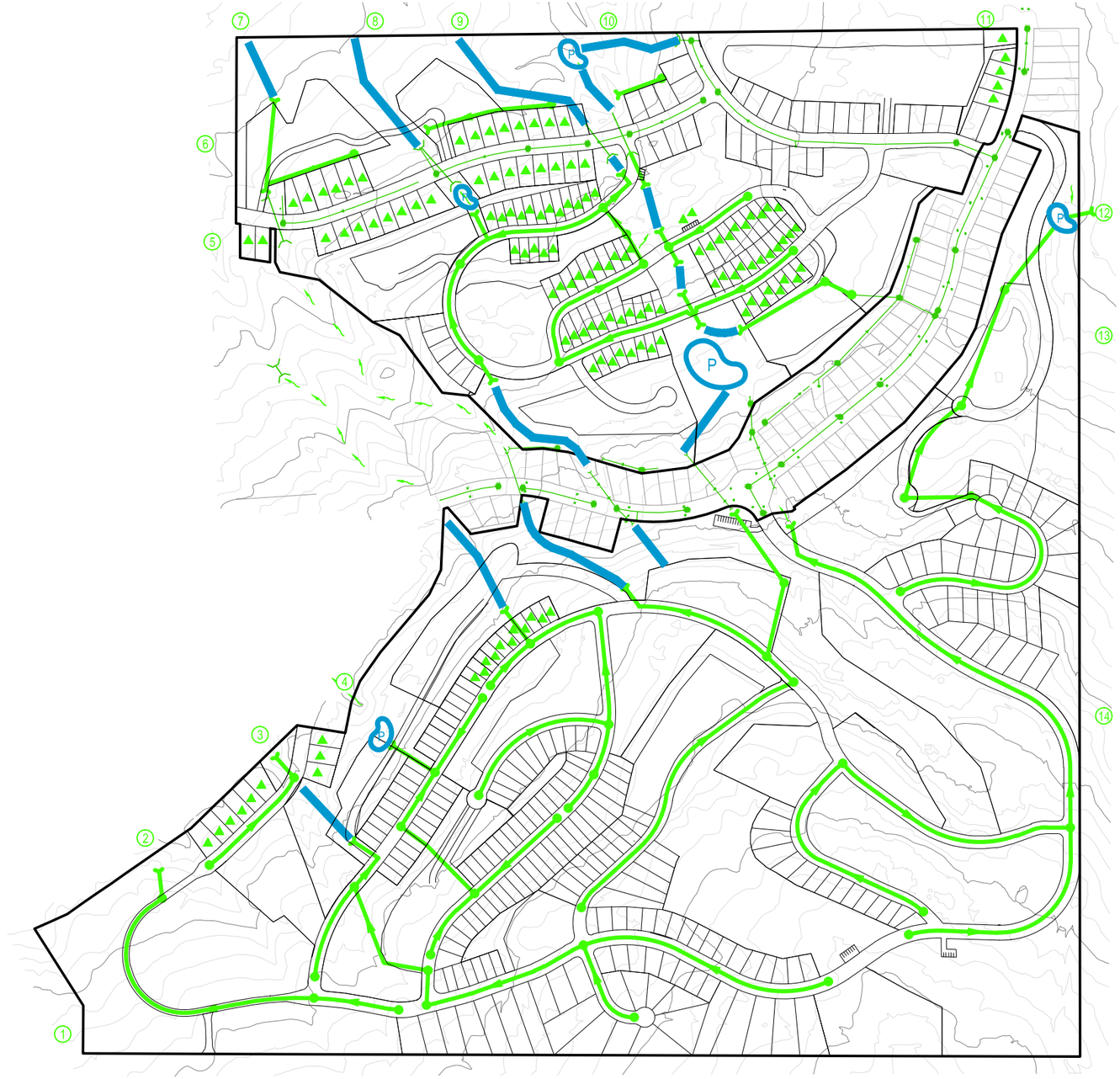
Scale 1:5,000

March 28, 2016

SCHEDULE D

Stormwater Management Plan

Statement of Commitment



N

LEGEND

- Existing Drain Main
- Proposed Drain Main
- (11) Outfall ID
- (P) Pond
- Single Family, On-Lot Detention
- Open Channel

Figure D.1
Storm Drain Schematic - Drainage Channels
Kingsview at Maple Bay
1:6000

WSP

4 April, 2014

STATEMENT OF COMMITMENT FOR PREPARATION AND APPROVAL OF A STORMWATER MANAGEMENT PLAN FOR "KINGSVIEW"

For the referenced project, this document is offered by the owner (Strandlund Investments Ltd.) to the Municipality of North Cowichan (MNC) as a Statement of Commitment (SoC) to complete a Stormwater Management Plan (SWMP) to the satisfaction and approval of MNC as a condition to approval of a new CDP and zoning for the subject property

The following will be included in the final SWMP document ("pre-development" and "original" refers to before land-clearing for the project original known as 'The Cliffs Over Maple Bay'):

1. A list and discussion on the goals that are to be achieved by the SWMP, including:
    a. Limit flows from the site to pre-development rates,
    b. Maintain existing downstream drainage flow patterns,
    c. Minimize sediments and pollutants from entering downstream systems,
    d. Wherever practical, maximize runoff infiltration to recharge groundwater.
2. A report on pre-development conditions as best as they can be determined, including but not limited to:
        i. Ground cover,
        ii. Watercourses,
        iii. Estimated stormwater flow rates from the site.
3. A report on existing conditions:
        i. Infrastructure already in place, such as:
            1. Roads,
            2. Piped drainage systems,
            3. Culverts,
            4. Flow-through drains,
            5. Ponds and channels (albeit they may be temporary).
        ii. Groundwater and locations of groundwater breakout,
        iii. Soil and vegetation groundcover.
4. A discussion on the proposed land use and phasing of the development,
5. A drainage model of the original conditions,
6. A drainage model of the proposed development, including a revised topographic plan of the current site,
7. Submit and have approved by MNC the final Stormwater Management Plan, including recommendations on what is required to achieve the stated goals. The SWMP is to be approved prior to the start of construction of any phase of the project. The SWMP is to include specific infrastructure requirements that need to be in place where practical for treatment requirements during the land development process.

To complete the SWMP, at a minimum the following tasks will be performed:

1. Identify what work previously undertaken in the February 2008 by Bullock Baur SWMP is still relevant and which can be used for the new SWMP. Previously completed work includes:
    a. Hydrogeology study results,
    b. Geotechnical testing results,
    c. With discussion and agreement with MNC:
        i. assignment of values used for the new SWMM model (such as: surface runoff coefficients, groundwater flow estimates, hydraulic conductivity, SCS infiltration curves, Soil Group numbers), for both pre-development and development scenarios,
        ii. confirmation of original catchment characteristics (including areas, slopes, groundcover),
    d. Original points of discharge from the site, and cataloging receiving structures,
    e. Original pre-development flows,
    f. Rainfall data,
    g. Water quality data,
    h. Environmental protection plans (with modifications and additions as needed):
        i. Spill prevention and spill response plans,
        ii. Sediment and erosion control plan,
        iii. Tree protection plan,
        iv. Sensitive ecosystem protection plan,
        v. Fertilizer and pesticide management plan.
2. Meet with MNC, other consultants and stakeholders to discuss and understand historical and current conditions related to the changes in stormwater characteristics brought by changes to the site. Include discussions as required with the Ministry of Environment on the status of Section 9 approvals.
3. Meet with MNC to discuss and resolve stream replacement issues,
4. Collect data:
    a. With consultation with MNC and other stakeholders, compile a list of complaints and observations from downstream residents,
    b. Gather maintenance records (as related to downstream drainage) from MNC public works and engineering staff,
    c. With assistance from a QEP, record visual observations from the subject site and downstream watercourses (preferably scheduled during a dry period and during or immediately following a heavy rainfall):
        i. Identify new watercourses, if any,
        ii. Record locations and approximate flow rates of groundwater breakout,
        iii. Confirm operation of existing flow-through-drains,
        iv. Observe and record areas of ponding,
        v. Observe and record effectiveness of existing controls such as channels, ponds, and dams.

END

SCHEDULE E

Parks & Open Space Design Strategy

KingsView at Maple Bay
Parks & Open Space Design Strategy

CONCEPT PLAN

The KingsView Parks and Open Space Design Strategy provides a framework and vision to guide the future parks and open space system in the development.

PUBLIC VS. PRIVATE OPEN SPACE

In discussion with MNC staff, parks and open space has been divided into two legal divisions in an effort to distribute the responsibility for ongoing management and maintenance. Parks and open space comprises:

1. Lands that will be dedicated to MNC, and
2. Lands that will be free from development, but privately owned and protected by covenant in favour of the Municipality.

Criteria for lands to be dedicated to the Municipality are:

- Major treed areas (3);
- Active parks space (located in northern spine);
- Lands incorporating public trails and access points; and
- Detention ponds incorporated within the park will be transferred to the MNC upon completion of the works.

The majority of the steep slopes (grades greater than 20%) are free from development. Rather than being dedicated to MNC, the plan calls for these lands to be incorporated into development plans, and be controlled by covenant at the time of subdivision approval. The Land Use Plan (KingsView CDP, Schedule C) shows the location of the private land that will be protected by covenant.

IMPLEMENTATION & PHASING OF THE STRATEGY

The park and trail system will be developed in phases, corresponding to development phasing described in other sections of the KingsView CDP. As each phase is developed. detailed construction plans will be submitted for review and approval by MNC.

PARK TYPES

The following are brief descriptions of the park types proposed for the development, with further details on the park hierarchy provided in the following sections. The general locations of the three park types are depicted in Figure 1 (page 3).

Park Type 1: Existing Treed Area

These parks consist of three areas of existing native vegetation to be preserved:

- Garry Oak
- Southwest corner
- Southeast corner

Park Type 2: Trail Network, Stormwater Features & Landmarks

These parks consist of small open spaces associated with trails and stormwater features. They also include trailheads, viewpoints, points of interest, and gateway spaces with landmark features.

Park Type 3: North Park

This park will contain:

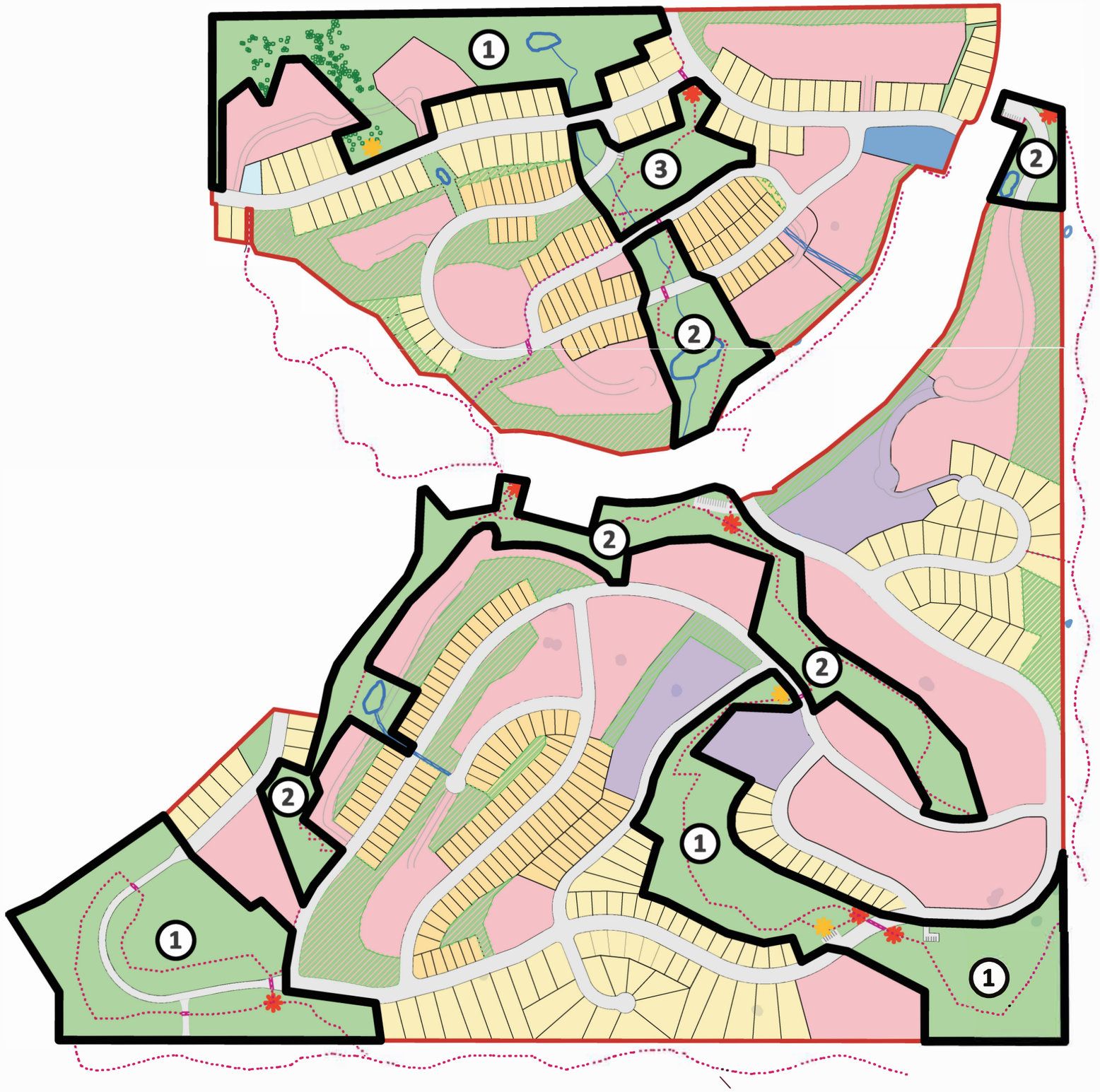
- A playground
- Open space for playing ball
- A gazebo

Most of the park will be revegetated with native vegetation, requiring no maintenance.

Schedule E

Figure 1

Parks & Open Space Strategy – Park Type



- Boundary of Site
- Park & Open Space Dedication
- Covenanted Green Space
- Proposed Trail Network
- Trailhead
- Viewpoints

Park Type

1. Existing Treed Area
2. Trail Network, Stormwater Features
3. North Park – Active Park Space

N

0 25 100 200

Scale 1:5,000

March 28, 2016

PARK TYPE 1: Existing Treed Areas

These parks consist of existing vegetation and will have limited access. Maintenance will be limited to removal of invasive species and monitoring the trees for hazards.

- **Garry Oak**. The most significant area of Park Type 1 is located at the northern boundary of the property, and consists of an existing natural feature that contains Garry Oak woodlands. This area will have no trails.
- **Southwest Trees.** Invasive plant species will be removed and natural regeneration allowed to take place. There will be trails with trailheads and interpretive signs.
- **Southeast Trees.** Invasive plant species will be removed. Natural regeneration will take place, but this area has a poor understory so additional planting is recommended. There will be trails, interpretive signs, and a gazebo at the high point.

PARK TYPE 2: Trail Network, Stormwater Features & Landmarks

TRAIL NETWORK

The Municipality of North Cowichan *Official Community Plan 2011* recognizes informal networks of recreational trails and pathways as one of two primary types of recreation facilities. Trail networks are a highly desired element in North Cowichan, because they provide a way to connect communities, promote health and fitness, and create opportunities for social interaction and to enjoy natural viewscapes.

The trail network proposed for the KingsView development is extensive, and will provide links within the new community to the existing trail system, connecting to Mt. Tzouhalem Ecological Reserve, and to the North Cowichan Municipal Forests to the south and east. Some of the planned features associated with the trail network include:

- Trails with benches placed at viewpoints.
- Opportunities to incorporate signage that will be directional as well as interpretive, and will showcase the different revegetation strategies along the trails.
- Opportunities for unscripted play with natural materials, encouraging a lasting environmental ethic in children.

Vegetation management at these sites will focus on low maintenance, hardy, drought-resistant plants.

The trail network proposes two types of trails (hard surface and soft surface), built to MNC and equivalent standards, as recommended by the MNC. The two trail types are described on page 6.

Hard Surface Trails

- Paved two-way paths for smooth, all-weather use
- Walking/biking and inline skating where appropriate
- Accessible to wheelchairs
- Asphalt or chip-seal coat surface
- 2-3 m width
- Clear width to max 6.2 m
- Clear height of 3.0 m
- Machine built
- Grades less than 8%
- Designated fire access routes

Example of Hard Surface Trail

Soft Surface Trails

- Secondary trails, grade less that 8%
- 0.5 m width
- Hard packed soft surface for walking and biking (crushed limestone with fines, or well compacted gravel)
- Clear width to 1.4 m
- Clear height to 2.4 m

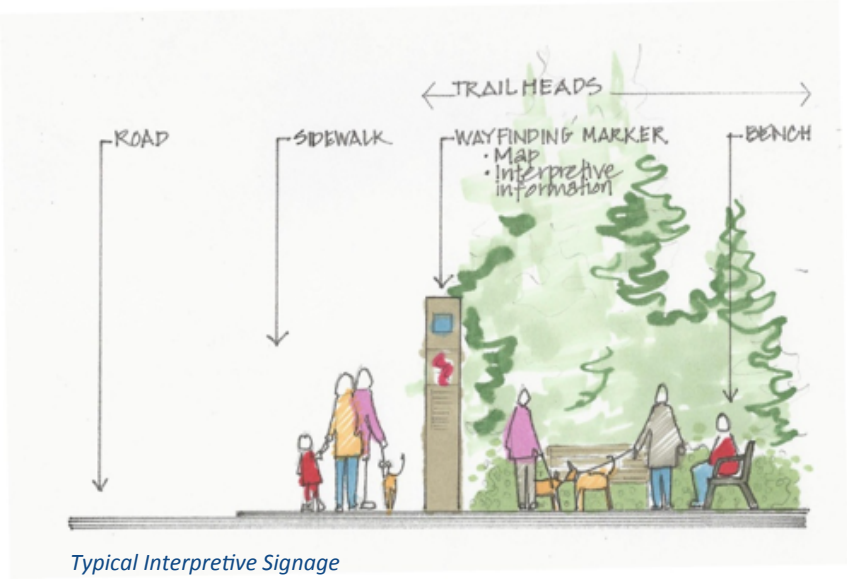
Example of Soft Surface Trail

STORMWATER FEATURES

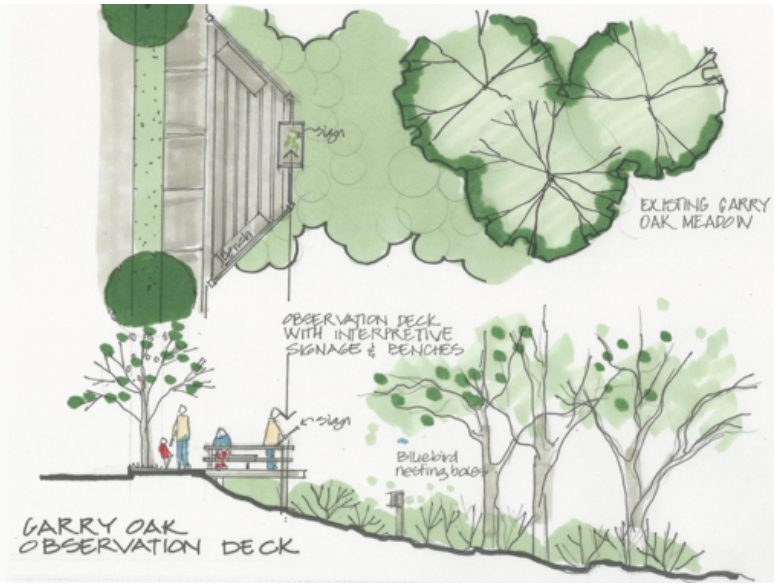
Stormwater ponds will be vegetated with plants that can withstand both wet and dry conditions. Trails will follow the stormwater channels where possible. These features will be incorporated into the landscape, and will eventually become part of the natural landscape.

LANDMARKS

There will be small focal points along the trails, which will include benches, interpretive signage, way finding, and viewpoints.



Typical Interpretive Signage



Typical Viewpoint

PARK TYPE 3: North Park

The main park consists of level areas for parking, a meeting place/gazebo, picnic areas, play equipment, and open areas for throwing a ball around. There are distant views to the west of the Cowichan Valley. Revegetation will consist of replanting with indigenous plants, and interpretive signage will showcase these plantings.

All play equipment and trails will be developed to MNC standards. A conceptual plan for the North Park is provided in Figure 2 (page 11).

View looking west from North Park

Example of a gazebo/pavilion

Example of a playground

PLANTS & REMEDIATION OF PARK SPACE

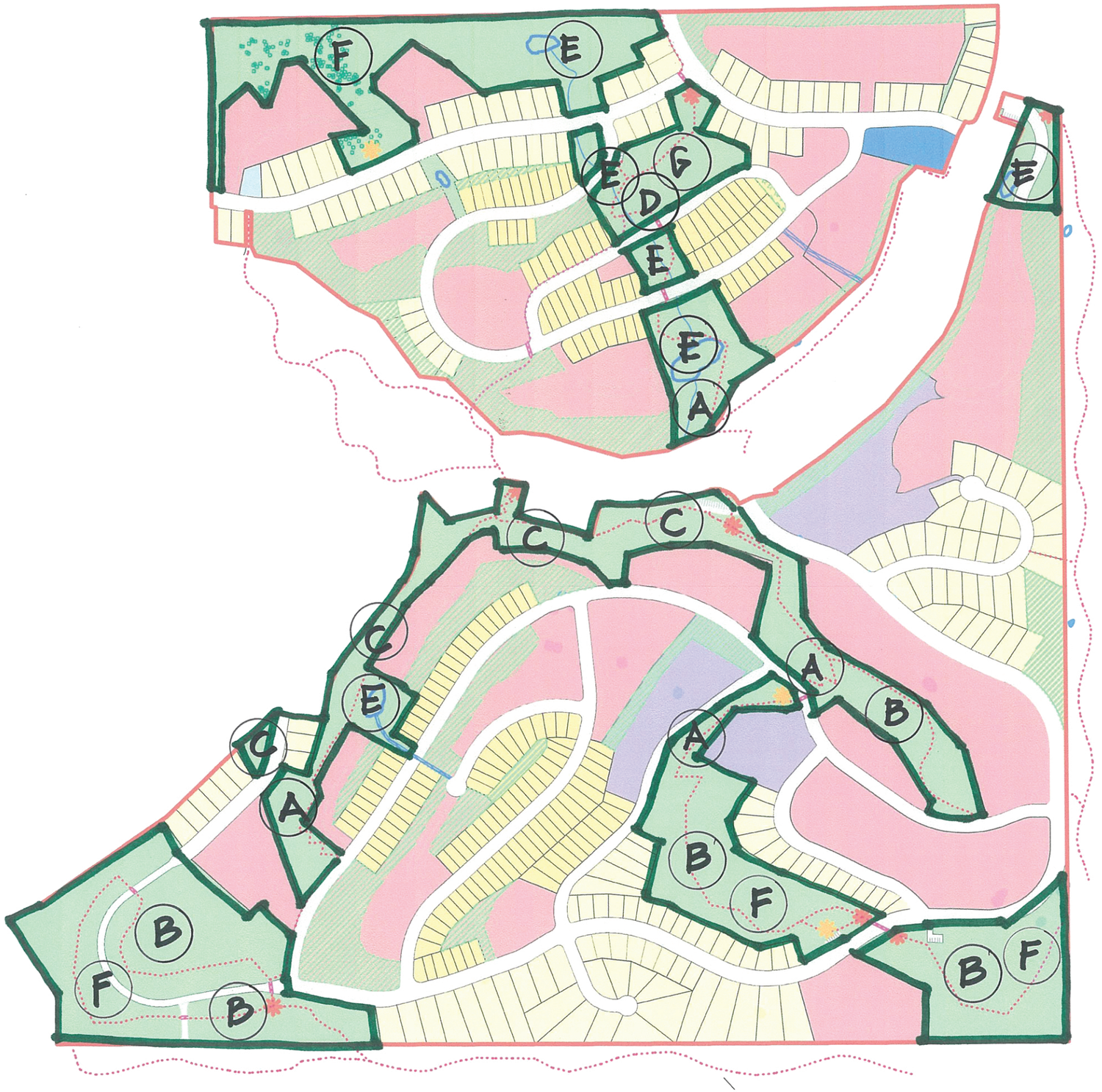
Due to the site variation in aspect, topography, drainage and current conditions, remediation plans tailored to each planned phase of the project will need to be developed. Each remediation and revegetation management plan will outline appropriate strategies.

Plants indigenous to this area will be used to revegetate all spaces, both in the parks and along the trails. Two examples of suitable, native shrubs that could be planted at this site include Saskatoon and salal.

For more information on revegetation procedures and plant communities that will be used on the site, refer to the Vegetation Management Plan (VMP) contained in the CDP application.

Saskatoon (Amelanchier alnifolia)

Salal (Gaulteria shallon)



	PARKS AND REMEDIATION
	Vegetation Assemblages
A	Douglas Fir and Pine with Kinnickinnick
B	Douglas Fir, Pine and Arbutus with shrubs
C	Shrubs only in View corridors
D	Garry Oak woodland and meadows
E	Stormwater channels and ponds
F	Existing woodlands
G	North Park

Park Type 3 – North Park

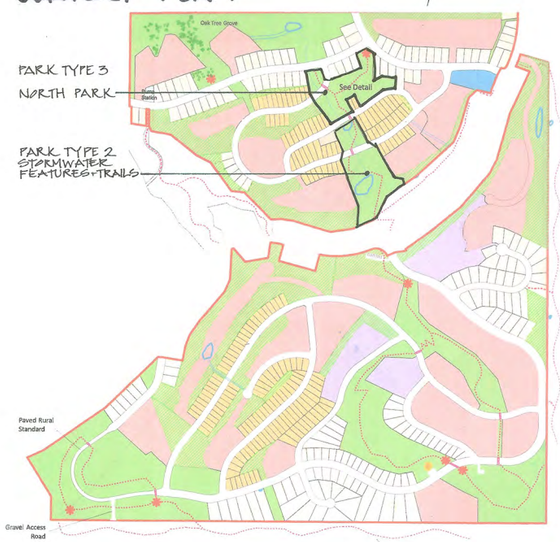
LANDMARK
PLAY GROUND
SIGNAGE
HARD SURFACE TRAILS
PICNIC AREA
OPEN AREA
GAZEBO
HARD SURFACE TRAILS
PARKING
STORMWATER CHANNELS REVEGETATION AREAS
SIGNAGE

Park Type 2 – Stormwater Features and Trails

SOFT SURFACE TRAILS
SIDEWALK/ TRAIL LINK
REVEGETION AREAS
STORMWATER CHANNEL
STORMWATER CHANNEL
SOFT SURFACE TRAILS
STORMWATER POND

0 10 20 30 40 50m

CONTEXT PLAN



DATE	REV.	DESCRIPTION
4.1.16		REVISIONS

CONSULTANT

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PROJECT

KINGSVIEW

MAPLE BAY B.C.

SHEET TITLE

NORTH PARK STORMWATER FEATURE+TRAILS CONCEPT PLAN

SCALE 1:750m DATE 19 11 15

DRAWN VJD CHECKED

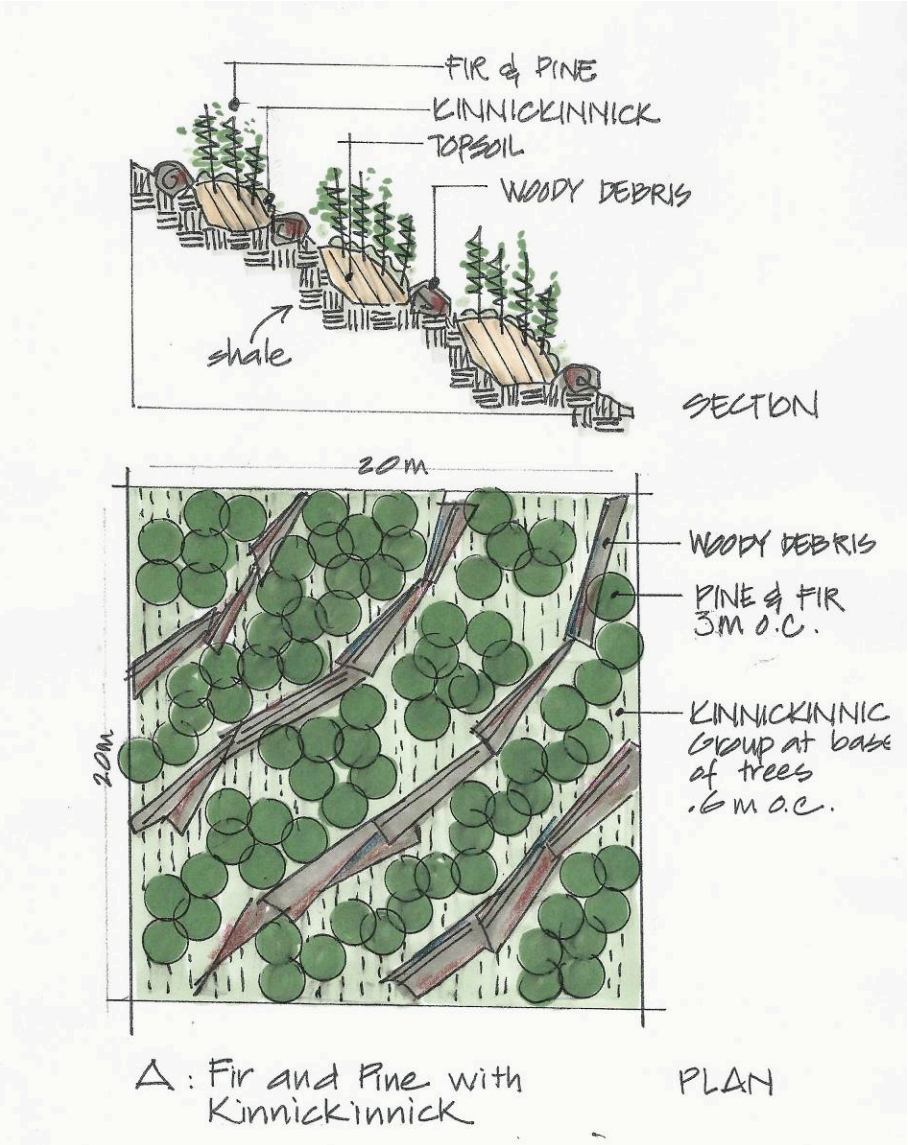
PROJECT NUMBER

DRAWING NUMBER

SCHEDULE F

Vegetation Management Plan Strategy

KingsView at Maple Bay
Vegetation Management Plan Strategy



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TERMINOLOGY & DEFINITIONS

Term	Project Context
Established	A planted area is considered successful when the majority of the plants have survived (established) after year 1; typically a 2 year maintenance period with success measured at the end of that time. Percent of survival will vary based on level of effort of planting. Definitions to be determined and approved by MNC as part of the detailed VMP for each phase of the development.
Free to Grow	The stand is healthy and its further growth to maturity will not be affected by competition from other plants or trees.
Long-term	>10-30 years
Plant Assemblage - Module	Based on site conditions, a series of appropriate plant assemblages (a group of plant species) has been proposed. A variety of modules is proposed in order to provide species suitable to different growing conditions such as dry versus wet sites; as well as for promoting viewscapes (e.g., shrubs instead of trees where visual quality high).
Remediated	Areas that have either reached a free to grow condition (in the case of re-forested areas), or where vegetation has become established. These areas would be considered suitable to the Municipality for transfer.
Remediation	The process of returning the site to a visually pleasing condition for use by the general public and future residents. The focus is on removal of Scotch broom and establishment of non-invasive, preferably native vegetation.
Re-vegetation	The process of planting vegetation where it is not growing at this time, or adding to areas where the current vegetation is not thriving.
Short-term	<5 years

1. INTRODUCTION

The following Vegetation Management Plan Strategy (VMPS) is based on the site topography, existing conditions, natural features, connectivity, and proposed land use designation within the Comprehensive Development Plan (CDP). The VMPS is integrated with environmental, storm water management, and of greatest relevance, the Parks and Open Space Strategy (the focus of vegetation remediation priorities).

The following strategy has been designed in order to guide the significant site remediation efforts required for the property; in the immediate future (1 to 3-year plan on approval of the application), the short-term (5-year plan), and for long term, on-going site remediation (20+ years).

This VMPS will ensure that the site remains in a reasonably managed state for the duration of its development timeframe. The intention is for the MNC to accept the lands (area) shown as proposed parks and open space dedication (refer to the Parks and Open Space Strategy of the CDP). Therefore, the CDP commits to site remediation so that the lands will be in suitable condition at the time of transfer to the MNC.

These lands will continue to be owned and managed by the proponent until such time that they are dedicated with individual phases. This approach serves two key purposes:

a) It will help to address invasive species management and reduce wildfire risk on the majority of the site; and

b) Re-establishes vegetation and creates lands, which, upon dedication to the Municipality in years ahead, will contain a well-established and maturing forest and vegetation cover.

1.1. GOALS

The overall goal of the VMPS is to remediate the open space areas of the KingsView at Maple Bay development. Key objectives identified include:

a) The long term control and management of Scotch broom from KingsView.

b) Remediate and reforest the proposed parks and open space site (the areas anticipated to be provided to the Municipality.

c) The reduction of the fire hazard (to address the Scotch broom infestation of the site with a focus on the fire interface with Municipality forest lands).

d) Maximize the control and reduction of nutrient run-off, and soil erosion from the site.

1.2. STRATEGY

The main strategy to achieve the above goals and objectives includes:

- Completion of detailed, phase-level management plans (to be approved by the MNC prior to the start of construction of any phase of the project).
- Prior to construction of stormwater controls, including detention ponds and any raingarden ditching, a sediment and nutrient control plan specific to the site will be prepared for approval by MNC.
- Excavation of the two detention ponds proposed for the north half of the property will be prepared concurrently, incorporating the erosion control strategies identified above.
- Building scheme covenants will be placed on the subdivided lands, informing home contractors and future owners of the importance of erosion control and nutrient overload.
- Prior to marketing the lots, an information/education piece will be prepared for potential homebuyers that describes the local ecosystem, and the importance of Quamichan Lake. It will also include best practices measures relating to planting, stormwater run-off, and on-site infiltration techniques.

Due to the site variation in aspect, topography, drainage and current conditions, remediation plans tailored to each planned phase of the development will take place. These plans will be submitted to the MNC for approval at the permitting stage of each phase development application. Each remediation and revegetation management plan will outline appropriate strategies with input from registered professionals.

2. CURRENT CONDITIONS

As identified on the site conditions plan, broom covers the majority of the site along with some remnant forest cover of second growth Douglas fir and Garry oak woodlands.

In amongst the broom, there are also (see vegetation map and appended photos):

- Small patches of regenerating native vegetation, mostly Douglas fir.
- Isolated native plants, such as Douglas fir, Black Capped Raspberry.
- Bare shale and very steep slopes that indicate continued eroding and preventing any vegetation from establishment.
- Level areas with a sparse cover of grass.
- Existing water channels, gullies and ponds with some associated wetland native revegetation, such as willow, bull rushes, and hardhack.

2.1. MAPPING CURRENT CONDITIONS

One of the essential baseline components for establishing goals and monitoring the success of the ISVMS is mapping the existing conditions. The map of current environmental conditions provides a means to quantify how much of the area is remediated over time. This exercise was completed in June of 2014, as depicted in Figure 1 and photos below, and indicates the following:

a) The current extent of Scotch broom on the site.

b) The location of existing native vegetation, specifically Garry oak woodlands and stands of fir and arbutus.

c) Areas of regenerating fir and other native species.

d) Soil conditions.

e) Existing water courses, ponds, and channels.

f) Adjacent forests.

It is useful to note possible reasons for the small patches of revegetation:

- Proximity to seed sources. The areas of revegetation are close to existing forests.
- The plants are establishing on areas of looser soil.
- On north and west facing, but not eroding, slopes. This would enable the plants to retain more moisture, and be less exposed to the sun during the hot dry summers.
- In the gullies on the southwest corner.

- Small areas where water is collecting.
    - Willow, bullrush, hardhack.
- Species that are regenerating.
    - Douglas fir.
    - Black Capped Raspberry.
    - Ocean spray.

In addition to mapping of site conditions, a site analysis of soil samples was completed to provide additional baseline data. Results from the soil chemistry analysis were considered in developing the strategies/methods most suitable for the site remediation to ensure the highest level of success over the shortest period of time.

Figure 1: KingsView Current Vegetation Site Conditions

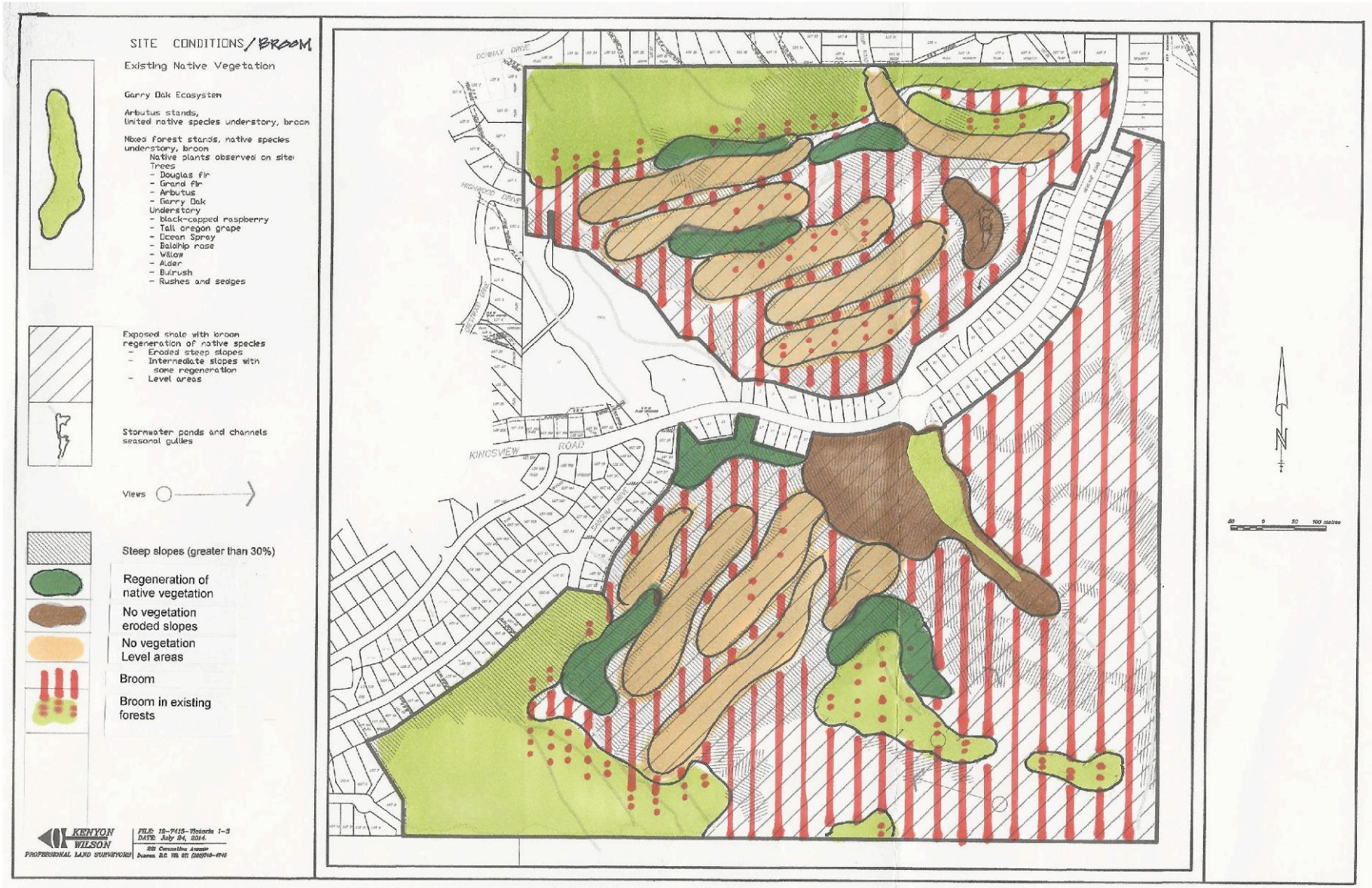


Photo 1: Natural fir regeneration (KingsView North)

Photo 2: Black Capped Raspberry regenerating (KingsView South)

Photo 3: Typical landscape of exposed shale and broom

Photo 4: Sparse grass cover (natural regeneration)

Photo 5: Existing water course south of roundabout

Photo 6: Scotch broom throughout the property

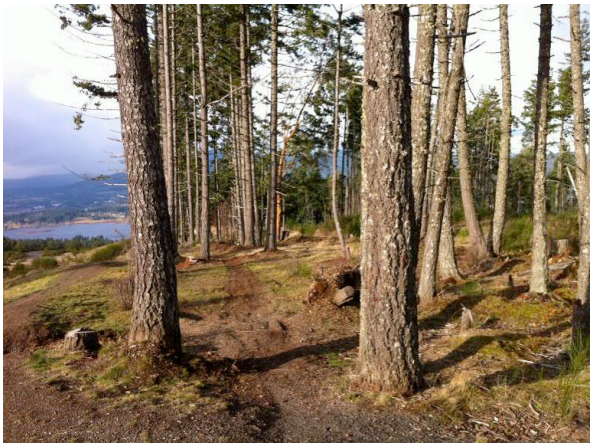


Photo 7: Douglas fir forest (KingsView South)

Photo 8: Shale – predominant parent material

2.2. LIMITING SITE CONDITIONS

There are a number of conditions at the site that are limiting the natural regeneration of native plants on:

- Compaction on the level areas.
- Steep slopes that indicate continued erosion.
- Poor soil structure and fertility.
    - Soil tests show that, in general, the substrate on the site consists of 55-80% particles greater than 2 mm, very low organic matter, nitrogen, potassium and phosphorous.
    - Soil tests of the stripped topsoil consist of 54% particles greater than 2mm with low nitrogen and organic matter.
- Dark substrate. The dark colour of the shale is likely causing extremes in soil temperature that may limit revegetation.
- Limited microclimate conditions. Most of the existing topography is very smooth and lacks varied terrain. Where the terrain is slightly more uneven, moisture can collect in pockets, there is less compaction and some revegetation is taking place.
- Competition from broom. The low fertility and good exposure is an ideal environment for broom. It secretes phytotoxic substances, which prevent other species from colonizing.
- Increased distance from the existing plants and, therefore, seed sources.
- Grazing by rabbits and deer.

3. REMEDIATION METHODS

The focus of the VMPS is to clear out as many of the invasive plants as possible, and allow for replanting activities to work towards remediation of parks and open spaces on the property. This section lays out remediation option that are site specific.

3.1. SITE PREPARATION

- **Grading:** The land grading will consist of modification of the smooth slopes to form "rough and loose" landforms (Polstar, 2013). These landforms have aesthetic value, prevent runoff and retain water, allow formation of microhabitats, and mimic natural landforms.
- **Amend soil:** Soil amendments will be tailored to each site and plant community, and will include fines, organic matter, and fertilizer. Remediate soil according to specific site and plant requirements.
- **Place woody debris:** This provides microhabitats, as well as aids in nutrient cycling.
- **Spread salvaged leaf litter (if available):** This will introduce mycorrhizal fungi into new soil ecosystems.
- **Select plants**: Plants will be selected based on local nitrogen fixing ability and suitability as pioneer species.

3.2. BROOM MANAGEMENT IN PARK TYPE 1

- Minimize soil disturbance. (Broom throws seed up to five metres, waiting for the soil to be disturbed to sprout).
- Remove plants in late spring when the flowers are out, usually May. (The plant is directing its energy into flower and seed production, and is unlikely to have the energy necessary to regenerate).
    a) Small seedlings (less than a pencil width): Pull by hand when the soil is moist. Note that hand-pulling may encourage broom growth due to the unavoidable soil disturbance, so if the plant does not come out easily, see next method.
    b) Larger plants: Cut the plant off just below soil level.
- Prevent the plants from going to seed. (In one season, a mature plant can produce up to 3,500 seed pods, each with 5-12 seeds. These seeds sit in the soil, waiting for the opportunity to sprout).
- Remove all cut/pulled broom from the site. (Burning on site is not effective as burning stimulates the broom seed already in the soil from past growing seasons to germinate. Cuttings should be contained in tarps or garbage bags to prevent seed drop along the exit path, and taken to a composting facility with the ability to grind the debris).
- Repeat every growing season for 3 to 5 years. (The seed bank sprouts and also cut plants try to regenerate).

3.3. REMOVAL & CONTROL OF OTHER INVASIVE PLANT SPECIES

In addition to Scotch broom, other invasive plant species have been identified as occurring at the site. A list of other invasive plant species, and how to remove and dispose of them will be provided in the detailed VMP for each planned phase of the development for approval by the MNC.

3.4. REDUCTION OF FIRE HAZARD

Current and future fire reduction measures are of a high priority at the site. In consultation with MNC, a commitment to annual broom control along the fire interface on the southern property boundary adjacent to MNC forestry lands, is and will continue to be maintained.

Photo 9: Firebreak along the southern property boundary, adjacent to Municipality forest lands.

3.5. REVEGETATION: PLANTING

Detailed planting prescriptions (treatments) should take into account the uses of the park areas, and their view potential. The following table outlines a series of suitable vegetation assemblages, their dominant vegetation type, and associated landform and ecological conditions (i.e., where they would be ideally suited within the landscape and conditions of the site). Native species are preferred, but some non-invasive, non-native, drought tolerant species may also be considered.

Depictions of vegetation remediation treatment types "A" to "E" are provided following Table 1. These illustrations provide a cross-section and aerial perspective, along with the predominant species and associated planting densities of each treatment type. None are provided for the existing natural areas, namely the Garry oak woodland, as no treatment other than some broom removal is planned for that area. Traditional parks (Park Type 3) are described in the Parks & Open Space Design Strategy.

Site specific planting plans will be provided with each phase of development.

Table 1: Proposed Vegetation Assemblages for Use on the KingsView Development for Site Remediation

Vegetation Assemblages		Dominant Plant Species	Suggested Plants to Add (nitrogen fixing)	Site Conditions	Long-term Management
A	**Douglas Fir & Pine with Kinnickinnick**	• Douglas fir • Kinnickinnick	• Lupine	• Steep (>30%), warm slopes	• Self sustaining indigenous plantings • Manage for invasives
B	**Douglas Fir, Pine & Arbutus with shrubs**	• Douglas fir, Grand fir • Arbutus • Tall & dull Oregon grape, • Ocean spray, Salal, Red huckleberry, Sword fern	• Lupine • Red alder	• Designated sites for re-forestation. This is the dominant type of vegetation assemblage that is naturally taking place at the site.	• Self sustaining indigenous plantings • Manage for invasives
C	**Shrubs only in view corridors**	• Tall Oregon grape • Ocean spray • Black capped raspberry • Salal		• Various depending on moisture level & shrub species used. Apply to areas where viewscape & low fire hazard is the priority.	• Self sustaining indigenous plantings • Manage for invasives
D	**Garry oak woodland & meadows**	• Garry oak • Meadow seed mix • Tall Oregon grape • Ocean spray • Baldhip rose	• Lupine	• Well drained sites on shallow soils. Open areas for play & view enjoyment. Some small patches of meadow are present between and amongst the Garry oak. Add more or less trees, depending on views and activity levels of open space.	• Self sustaining indigenous plantings • Manage for invasives
E	**Stormwater channels & ponds**	• Willow • Red alder • Bullrush • Rushes and sedges	• Douglas fir • Bigleaf maple • Lupine • Pacific crab apple	• Wet & seepage sites.	• Self sustaining indigenous plantings • Manage for invasives
F	**Existing woodlands**	• Existing Garry oak, Douglas fir, Arbutus woodlands	• None - some broom removal required	• One area representing this vegetation type (ecosystem) is present at the North end of the property.	• Self sustaining indigenous plantings • Manage for invasives
G	**North Park**	• Open areas & scattered drought resistant native trees	• Native drought resistant grass seed	• Level to near level areas of Park Type 3 North.	• Self sustaining indigenous plantings • Manage for invasives

Figure 2: Proposed Vegetation Remediation Plan Assemblages (modules) (Types A & B)

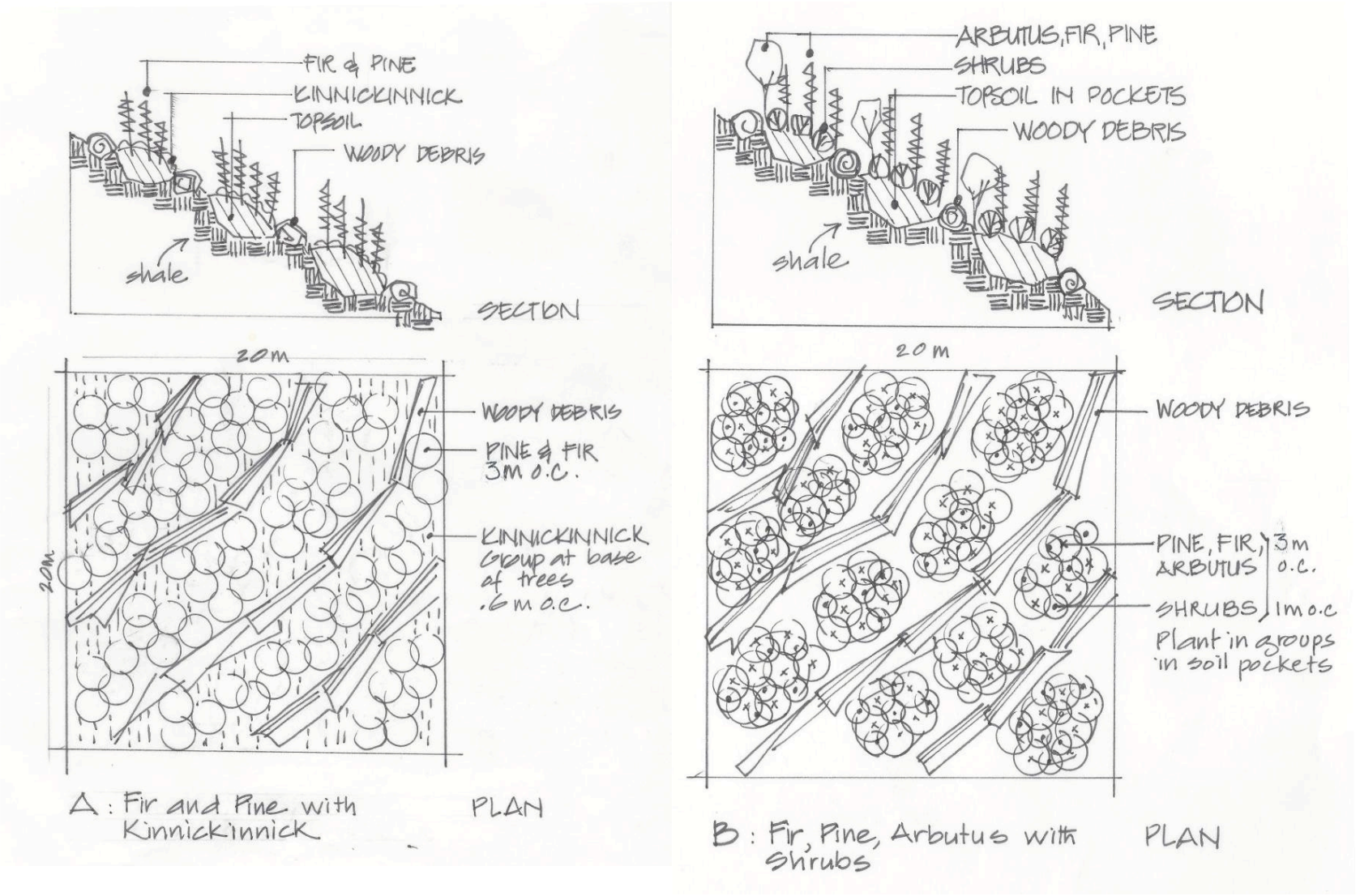


Figure 3: Proposed Vegetation Remediation Plan Assemblages (modules) (Types C & D)

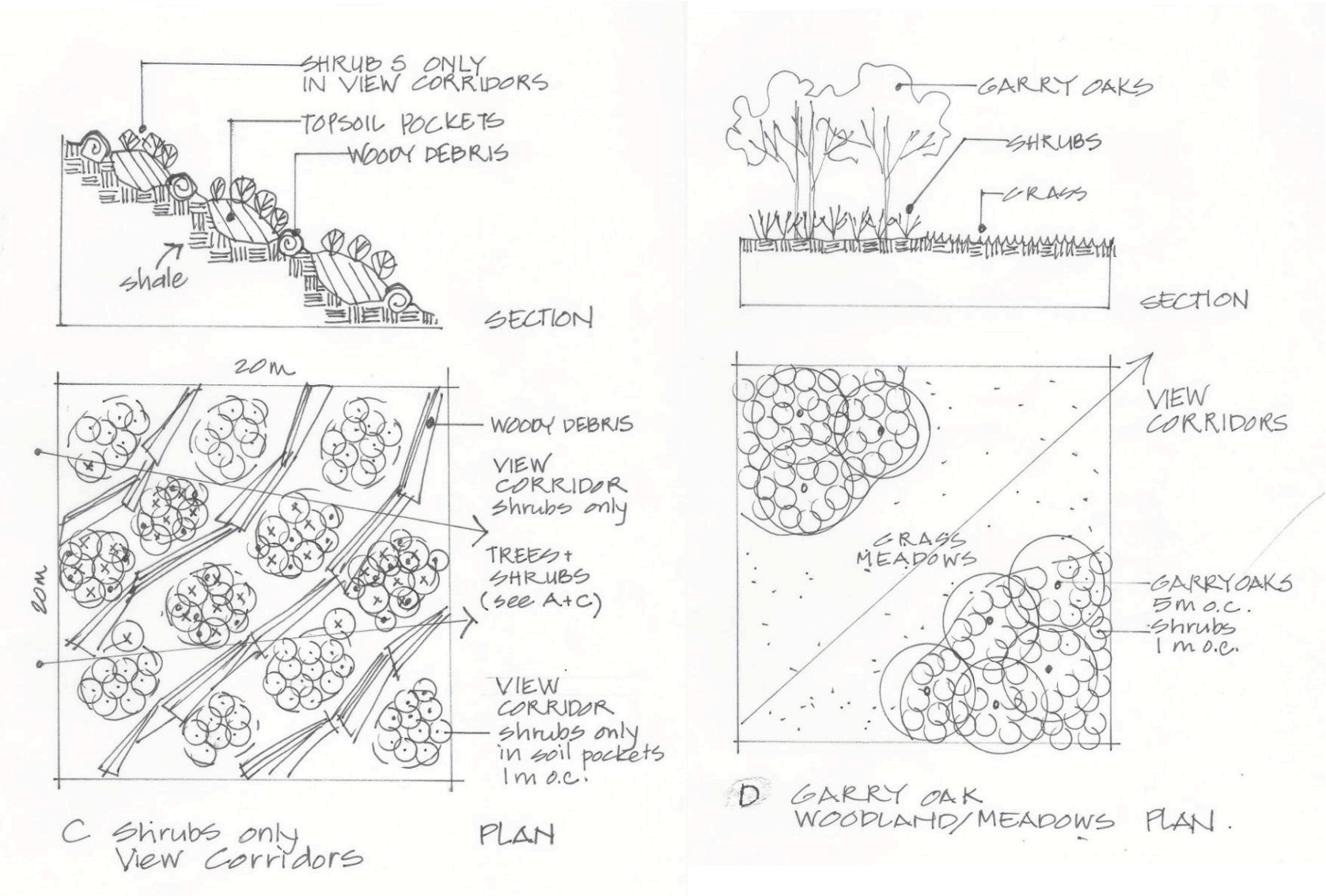
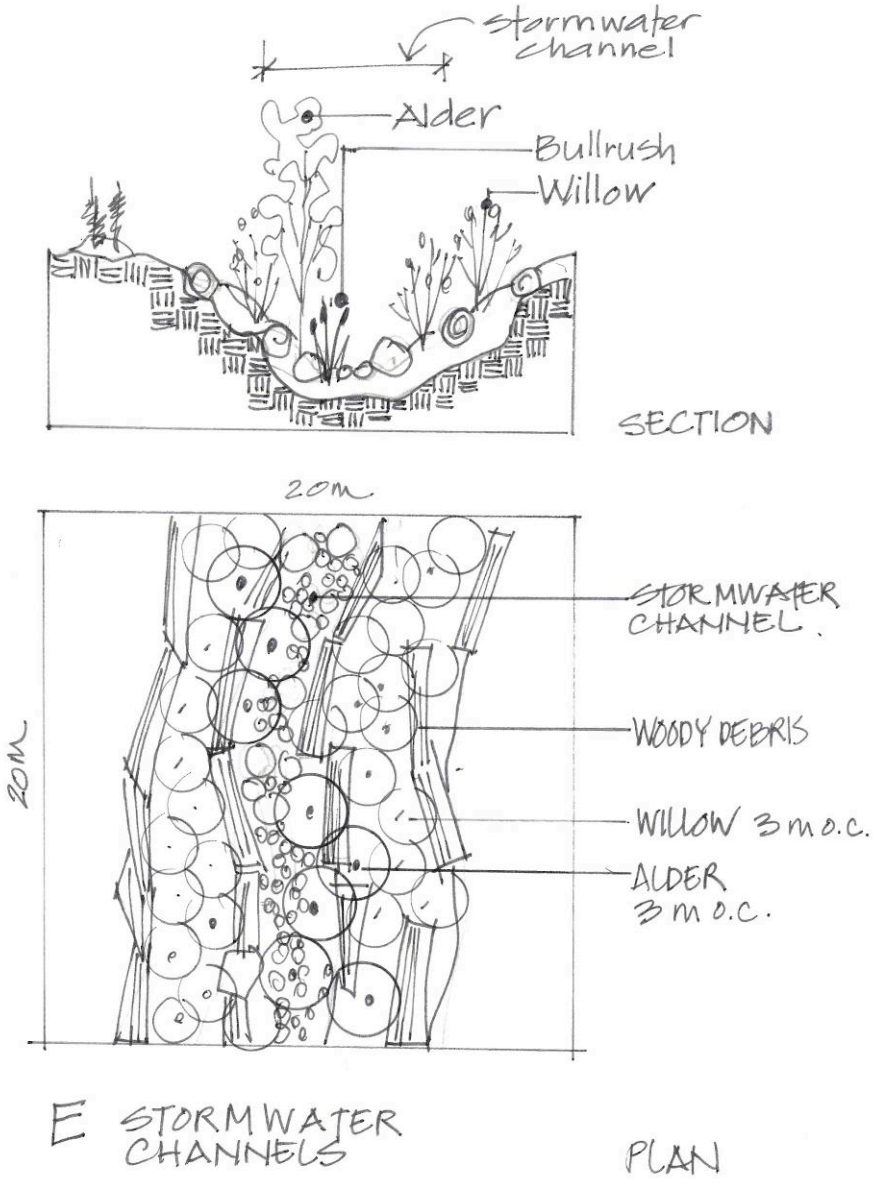


Figure 4: Proposed Vegetation Remediation Assemblages (Modules) (Type E)



A detailed list of the possible plants appropriate for each scenario will include plants selected from the Master Plant list to be provided within Phase-specific management plans (Table 2). The Master Plant list is not definitive, additional species may be considered. It is proposed that the re-vegetation of the site should give priority to native plants. Please refer to Madrone Environmental Services biophysical assessment letter on the ecological benefits of using native plant and grass species.

Table 2: Master Plant List for Remediation at KingsView Development

Botanical Name	Common Name	Habitat Requirements
EVERGREEN TREES		
Abies grandis	Grand Fir	Dry/Sun
Arbutus menziesii	Arbutus	Dry/Sun
Pseudotsuga menziesii	Douglas Fir	Dry/Sun
Taxus brevifolia	Western Yew	Dry/shade
Thuja plicata	Western Red Cedar	moist
Tsuga heterophylla	Western Hemlock	moist
DECIDUOUS TREES		
Acer glabrum	Douglas Maple	moist
Acer macrophyllum	Big-leaf Maple	moist
Alnus rubra	Red Alder	Moist - pioneer
Cornus nuttallii	Pacific Dogwood	Moist/Shade
Corylus cornuta	Beaked Hazelnut	Dry/Sun
Crataegus douglasii	Douglas Hawthorn	Moist
Malus fusca	Pacific Crabapple	Moist
Prunus emarginata	Bitter Cherry	Moist
Quercus garryana	Garry Oak	Dry
Salix lucida	Pacific Willow	Wet
EVERGREEN SHRUBS		
Gaultheria shallon	Salal	Dry/Shade
Mahonia aquifolium	Tall Oregon Grape	Dry/Sun
Mahonia nervosa	Dull Oregon Grape	Dry/Shade
Vaccinium ovatum	Evergreen Huckleberry	Dry/Shade

Botanical Name	Common Name	Habitat Requirements
DECIDUOUS SHRUBS		
Amelanchier alnifolia	Saskatoon	Dry/Sun
Cornus sericea	Red Osier Dogwood	Wet/Sun/Shade
Holodiscus discolor	Ocean Spray	Dry/Sun
Oemleria cerasiformis	Indian Plum	Dry/moist/sun/shade
Philadelphus lewisii 'Gordianus'	Mock Orange (Coastal)	Dry/Sun
Ribes divaricatum	Coastal Black Gooseberry	Moist/dry
Ribes sanguineum	Red Flowering Currant	Dry/Sun
Rosa gymnocarpa	Baldhip Rose	Dry/shade
Rosa nutkana	Nootka Rose	Dry sun
Rosa pisocarpa	Clustered Wild Rose	Dry/Sun/Shade
Rubus leucodermis	Black-cap Raspberry	Dry/Sun - pioneer
Rubus parviflorus	Thimbleberry	Moist
Salix hookeriana	Hookers Willow	Moist
Sambucus cerulea	Blue Elderberry	Moist
Sambucus racemosa	Red Elderberry	Moist
Spirea douglasii	Hardhack	Moist
Symphoricarpos albus	Snowberry	Dry/Sun
Vaccinium parvifolium	Red Huckleberry	Dry/dappled shade
Viburnum edule	Highbush cranberry	Moist
GROUND COVER		
Arctostaphylos uva-ursi	Kinnikinnick	Dry/Sun
Asarum caudatum	Wild Ginger	Moist/Shade
Frageria vesca	Wild Strawberry	Moist/Sun
Linnaea borealis	Twinflower	Dry/Shade
Oxalis oregana	Oxalis	Moist shade
VINES		
Lonicera ciliosa	Western Trumpet Honeysuckle	Dry/Shade
Lonicera hispidula	Hairy Honeysuckle	Dry/Sun
FERNS		
Dryopteris expansa	Spiny Wood Fern	Dry/Shade
Polypodium glycyrrhiza	Licorice Fern	Moist/Shade
Polystichum munitum	Sword Fern	Dry/shade/dappled shade

Botanical Name	Common Name	Habitat Requirements
PLANTS FOR STORMWATER BIOSWALES		
Aquilegia formosa	Red columbine	Moist
Carex obnupta	Slough Sedge	Moist
Carex rostrata	Beaked Sedge	Moist
Iris missouriensis	Western Blue Flag Iris	Moist
Juncus effusus	Common Rush	Moist
Scirpus microcarpus	Small-flowered Bulrush	Moist
PERENNIALS		
Achillea millefolium	Yarrow	Dry/Sun
Achyls triphylla	Vanilla Leaf	Dry/Shade
Allium acuminatum	Hooker's Onion	Dry/Sun
Allium cernuum	Nodding Onion	Dry/Sun
Anaphalis margaritacea	Pearly Everlasting	Dry/Sun
Antenaria microphylla	Small-leaved Pussytoes	Dry/Sun
Aquilegia formosa	Red Columbine	Moist/Shade
Armeria maritima	Thrift	Dry/Sun
Aster douglasii	Douglas' Aster	Dry/Sun
Brodiaea hyacinthina	Fool's Onion	Dry/Sun
Camassia leichtlinii	Great Camas	Spring moisture/sun
Camassia quamash	Common Camas	Spring moisture/sun
Dicentra formosa	Bleeding Heart	Spring moisture/sun/shade
Dodecatheon hendersonii	Broad-leaved Shooting Star	Spring moisture/sun
Erigeron speciosus	Showy Fleabane	Dry/Sun
Eriophyllum lanatum	Woolly sunflower	Dry/Sun
Erythronium oreganum	White Fawn Lily	Spring moisture/dappled shade
Heuchera micrantha	Alumroot	Dry/Sun
Potentilla anserina	Silverweed	Moist/Sun
Sedum lanceolatum	Lance-leaved Stonecrop	Dry/Sun
Sedum oreganum	Oregon Stonecrop	Dry/Sun
Sedum spathufolium	Broad-leaved Stonecrop	Dry/Sun
Trillium ovatum	Western Trillium	Dry/Shade
Viola adunca	Early Blue Violet	Dry/Shade

3.6. STANDARD PRACTICES

As part of the revegetation/remediation strategy, apply standard horticultural practices (BCSLA Landscape Standards, 2012) best forestry practices:

- Plant in the fall to allow plants to establish themselves as much as possible prior to summer drought.
- Protect all plants from browsing by deer.
- Use large woody debris and boulders to create microhabitats to capture moisture and create shade.
- Plant in groups to mimic natural growing patterns with a mix of trees, shrubs and groundcovers.
- Interpretive signage to be located in prominent places to outline re-vegetation procedures.

4. PHASING & TIMING

One of the essential components of a vegetation management plan is the phasing and timing of the efforts and targets. A phased approach with detailed VMPs tailored to each phase (phase-specific) will maximize the likelihood of success. Overall principles for site remediation should be consistent through all phases.

4.1. PARKS & OPEN SPACE

The focus of site remediation (revegetation) efforts will be on the sections of the property that are proposed for parks.

We propose to use an Adaptive Management process, in combination with a priority treatment classification system, to the VMPs that will consist of a series of plant prescriptions (treatment types) suitable for different site conditions. The treatment types will be set up in the initial stages of the development, and will then be monitored to gauge their success in achieving the goal of “free to grow” (for trees) or "successfully established" (for shrubs and herbaceous vegetation). The successful treatments will be used as models for the rest of the site. hese planting prescriptions will be created in harmony with the park plan, and will be showcased with interpretive signs.

It is anticipated that the section of the property located north of Kingsview Road will contain the first few phases of the project. A detailed VMP has been initiated for that area, and will serve as the template on which other VMPs for future phases are based and measured. All VMPs will be submitted to the MNC for approval as part of the subdivision application.

It is proposed that once 50% completion has been reached for the last phase north of KingsView, initiation of Priority 1 areas south of KingsView will be triggered. For example, broom removal within areas adjacent to Park Types 2 and 3.

4.2. REMAINING AREA (DEVELOPMENT)

For the remaining area to be developed, the focus will be on vegetation management; the removal and control of invasive plant species, namely Scotch broom.

There is a continued commitment for ongoing maintenance of the property south of Kingsview Road that is adjacent to MNC Forest Lands. Maintenance will consist of removing the broom annually, or until such time that the area is developed in order to manage invasive species, reduce wildfire risk, and minimize public trespass.

Extensive broom removal will also take place on a phase-specific basis as part of the site preparations for development as well as remediation.

4.3. PRIORITY VEGETATION MANAGEMENT AREAS

To help guide the timing and phasing of the VMP, a classification system reflective of the level of priority has been developed, and ties in with the Parks and Open Spaces Strategy (Table 2). Each Park Type has been assigned a priority on a scale of 1 to 4 ,with 1 indicating areas of highest priority (also reflective of level of effort) and "4" indicating lowest priority (little to no remediation is planned for these sites). A reasonable timeframe has also been assigned to each treatment priority.

Table 3: Vegetation Remediation & Broom Control Priorities by Park Type for Phases North & South of KingsView

Park Type	Vegetation Remediation Treatment	Broom Control	Phasing & Timing	Comments
North of KingsView				
Park Type 3	Priority 1 (high)	Priority 1 (high)	Triggered by PLA of Phase 1; Short-term (1-3 years)	Key focal feature and amenity of the CDP. Initiation of remediation is highest priority for Park Type A
Park Type 2	Priority 2 (moderate)	Priority 2 (moderate)	Varies - some component of Park Type B will be present within most development phases	Focal points; areas of interest; highly visible
Park Type 1	Priority 2 (moderate)	Priority 2 (moderate)	Varies - some component of Park Type C will be present within most development phases	Highly visible green space between and amongst development
Development Sites	Priority 4 (very low) due to planned development	Priority 3 (low)	As needed and determined by associated fire hazard	No vegetation remediation is planned due to future development
South of KingsView				
Park Type 3	Priority 1 (high)	Priority 1 (high)	Initiated by 50% of the final phase North of KingsView	Key focal feature and amenity of the CDP.
Park Type 2	Priority 2 (moderate)	Priority 2 (moderate)	Future phases - long-term horizon of >15 years	Focal points; areas of interest; highly visible
Park Type 1	Priority 2 (moderate)	Priority 2 (moderate)	Future phases - long-term horizon of >15 years	Highly visible green space between and amongst development
Park Type D	No applicable Park Type D identified south of KingsView at this time			
Fire Interface	Priority 3 (moderate)	Priority 1 (high)	Annual broom control efforts will be maintained along the fire interface	Vegetation remediation associated with future development phases

NOTE: Please refer to the Parks & Open Space Strategy for corresponding figures depicting Park Types.

5. MONITORING

In order to determine whether-or-not the VMPS is successful, monitoring will be required for the short-term and long-term goals. Monitoring will focus on two aspects of the strategy:

- Removal and control of invasive species (namely Scotch broom), and
- Successful establishment of non-invasive vegetation (with the effort focused on remediation of parks and open spaces reaching "establishment" and "free to grow" conditions for transfer of lands to the Municipality).

An acceptable survival rate (measure of successful vegetation remediation efforts) may vary by phase, dependent on how much is planted in a given area and which plant assemblage is applied. A higher survival rate (>90%), two years following initial planting, would be expected for a smaller area that is planted with predominately shrubs. For plant assemblages focused on growing future forests, a lower survival of 60-70% may be acceptable (e.g., if 1,000 fir tree plugs were planted within a Park Type 3 area).

As part of the monitoring, an adaptive management approach will be applied to determine which plant assemblages have the highest success during vegetation remediation efforts applied during Phases 1 and 2 of the development. This feedback process is anticipated to take 3-5 years, and will help to determine the best methods for future phases.

These details will be provided within the VMPS produced for each phase of the development, and will be submitted to MNC for approval as part of the development permit application.

6. REFERENCES

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SCHEDULE G

Site Services

KINGSVIEW AT MAPLE BAY

PRELIMINARY SITE SERVICING REPORT

TRANSTIDE KINGSVIEW LIMITED PARTNERSHIP

Project no: 141-13463-00
Date: March, 2016

WSP Canada Inc.
400, 401 Garbally Road
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1 BACKGROUND

1.1 INTRODUCTION

The Kingsview at Maple Bay (Kingsview) development lies on the northern face of Mount Tzouhalem in the District of North Cowichan, east of Quamichan Lake, and totals 106.5 hectares. The original development plan of what was then known as The Cliffs Over Maple Bay (COMB) included approximately 360 single family units, 5.54 Ha of multi-family development, a hotel, and an 18-hole golf course, expected to total approximately 700 residential equivalent units. Phase 1 for the extension of Kingsview Road and Nevilane Drive has been completed. Some of the infrastructure for extensions to Highwood Drive and Viewtop Road has been installed, however, the roads remain unfinished as at the date of this report. A new layout of the property without the originally planned golf course has been completed; the revised concept plan includes a mix of single family and multi-family units, totalling at least 1280 units, depending on the addition of legal suites.

A Site Servicing Pre-design Report was completed in September 2013 by WSP (formerly Genivar). Since then the proposed land use and lot layout for Kingsview has been changed, and as a result some of the material and conclusions of the 2013 report are no longer valid. The report in hand serves to revise the 2013 report, some sections of which have been copied herein.

WSP has been retained to review the impact of the increased density and revised lot layout on existing infrastructure. On-site utility layout is examined, including sanitary sewer, water, and storm drain. Off-site impacts for water and sanitary sewer has been determined by the District's engineering consultant using computer model software. Commentary from shallow utilities, including Fortis, Telus, BC Hydro, and Shaw, is included to determine the extent of improvements needed to support the revised lot configuration.

For the original development plan, WSP prepared a detailed stormwater management plan (SWMP), dated February 2008. This report builds on that SWMP, incorporating the revised lot layout and earthworks completed during Phases 1 and 2 of COMB. The primary goal is to identify potential issues with servicing the new lot configuration, including pipe/culvert capacity and stormwater detention. Once detailed design commences, the SWMP will be updated to include additional details such as groundwater flows and recharge, sediment and erosion control, and maintenance issues.

Stormwater detention systems for Kingsview will be designed to manage stormwater runoff such that during a 1:2 year storm event, post-development flows match pre-development rates. Total catchments contributing to each site discharge will remain relatively consistent between pre- and post-development to avoid unbalancing stormwater flows during high-intensity (overflow) events.

2 STORMWATER ANALYSIS

2.1 EXISTING CONDITIONS

The site has 14 existing stormwater outfalls to various channels, culverts, and drainage systems, often located in statutory right-of-ways (SRW) between single family lots. Much of the development site was cleared and stripped during the preliminary golf course grading work. Stormwater flows are managed with existing and recently created water courses with large culverts crossing Kingsview Road and Highwood Drive. Some temporary settling ponds have been created to improve stormwater quality and reduce the peak flows discharged from the site.

As stated in the 2007 geotechnical report prepared by Levelton Consultants, the steep mountain face consists of rapidly drained shale, siltstone, sandstone, and conglomerate soils with little overburden and visible rock outcrops. Upon working the existing soils with heavy machinery, the material breaks down and forms an impermeable crust. To avoid surface pooling, the native fill material should be scarified prior to placing sand or topsoil and avoid tracking heavy equipment over fill areas once grading is complete.

Despite the free-draining base material, the underlying bedrock can lead to trapped groundwater or heavy discharge at interface locations. Groundwater flows can lead to slope instability which can be exasperated with excessive stormwater infiltration. Refer to Figure 1 for pre-development stormwater catchments.

2.2 STORMWATER MODEL DETAILS

A hydrologic model of the development, including Phases 1 and 2 of the Cliffs was created using EPA SWMM v5.1. Catchments were created for both pre and post-development conditions based on existing topography, land use, and lot layout; refer to Figures 1 and 2. Large culverts crossing Kingsview Road and Highview Drive are included with the stormwater model.

Rainfall information is based on data collected from the Atmospheric Environment Service's weather North Cowichan weather station, fit to a 24-hour SCS Type 1A storm distribution. Other model parameters are generally unchanged from the previous SWMP, with the exception of the SCS runoff curve number, which is now standardized at 39 for both pre- and post-development due to the removal of the golf course. All pre-development and greenspace catchments have been assigned an impervious percentage of 5%, based on rock outcrops and to account for channelized flow. Developed areas have impervious percentages of 50% for single family lots, 60% for small SF lots, 70% for multi-family sites and 80% for the commercial site.

The previous SWMP included a detailed analysis of groundwater conditions by EBA Engineering. We found that while groundwater contributed a considerable base-flow, it was relatively unchanged from pre- to post-development. Groundwater flows must be considered during detailed design for proper pipe and control structure sizing, building foundation stability, and downstream capacity calculations. However, since groundwater flows do not increase once the site is developed, they have not been considered for the purposes of this report.

2.3 STORMWATER DETENTION FACILITIES

To meet the District's requirement of zero increase in post-development flow rates during the 1:2 year storm event, detention ponds have been modelled to temporarily impound stormwater with release at

a controlled rate. For the purposes of the model, the ponds are assumed to be dry (no permanent storage) with 3:1 side slopes. Pond locations have been determined based on the catchment boundaries and lot layout.

While large detention ponds at the downstream end of catchments tend to be the easiest method to provide zero increase in flows, they also provide little stormwater treatment in the way of pollutant and sediment removal. Additionally, the topography of the site is such that pond grading is difficult and extensive earthworks / retaining structures may be required to obtain a moderate volume of stormwater detention. The results below are based upon on-site stormwater detention on all multi-family sites, and some single-family lots. Completion of the SWMP will determine final detention requirements.

Reduction of post-development flows during this exercise has been attained solely by use of detention ponds and residential detention tanks. It is important to note that further flow reduction, or smaller ponds can be achieved through use of a number of alternate stormwater management methods such as use of pervious surface treatments and roadside rain gardens.

2.4 RESULTS

2.4.1 OUTFALL FLOWS

The table below summarizes the pre- and post-development flows at each of the site's 14 outfalls during the 1:2 year storm. The Post-Development condition includes detention on all multi-family and commercial sites, and on selected single-family sites. Refer to Figures 2 and 3 for catchment boundaries, stormwater outfalls, and pond locations.

OUTFALL	1:2 YEAR RETURN MAXIMUM FLOW, L/S		% VARIANCE
	Pre-Development	Post-Development	
Out 1	13.7	15.8	15%
Out 2	87.4	83.6	-4%
Out 3	37.1	28.8	-22%
Out 4	31.9	31.9	0%
Out 5	26.8	18.7	-30%
Out 6	35.6	44.0	24%
Out 7	20.2	18.0	-11%
Out 8	24.6	24.6	0%
Out 9	35.5	30.5	-14%
Out 10	56.5	57.6	2%
Out 11	10.2	5.6	-45%
Out 12	25.4	24.5	-4%
Out 13	12.1	0	-100%
Out 14	14.6	12.4	-15%
Total:	**431.5**	**396.1**	**-8%**

No post-development flows are directed to outfall 13, which is a poorly defined channel to the east of the site. The predevelopment catchment for outfall 13 is relatively small. To mitigate downstream impacts, flows from this area will be directed to outfall 12 where there is a defined channel and downstream culverts.

Attenuation for the small amount of excess flow to Outfall 1 can be done by constructing a small pond at the bottom of that catchment. Similarly, a small pond or underground tank constructed at the south side of Highwood Road at the western boundary can be used to attenuate the additional flow to Outfall 6.

2.4.2 DETENTION POND SIZING

As noted previously, stormwater detention ponds have been designed to provide zero increase in post-development flows during a 1:2 year storm event. Below is a table summarizing the pond volumes and maximum discharge rate during the 1:2 year storm for the five major ponds. Pond numbers relate to outflows to which they are connected (Figure 3).

POND	MAX VOLUME	MAX OUTFLOW
	cu.m	**l/s**
Pond 4	533	31.9
Pond 8	32	24.6
Pond 10a	750	17.8
Pond 10b	3,401	40.4
Pond 12	343	24.5

2.4.3 CULVERT CAPACITY

Included in the stormwater model are culverts crossing both Kingsview Road and Highwood Drive, which are mostly 900mm diameter and are installed in existing ravines. Upstream catchment areas will discharge to these culverts rather than the municipal stormwater network within road right-of-ways to preserve capacity in existing pipes. To meet the DNC specifications, however, the capacity must be verified using the rational method, which will be completed during detailed design. We do not anticipate any upgrades will be required to increase culvert capacity with the new lot layout.

2.5 STORMWATER RECOMMENDATIONS

2.5.1 ENVIRONMENTAL

With some ponds proposed on existing watercourses, notification and/or approval from the Ministry of Environment will be required. A Qualified Environmental Professional (QEP) will be required to assess the site and provide documentation to the Ministry. The QEP will also advise on what mitigation measures, which may need to be undertaken during the late summer Fisheries window, would be necessary during construction

2.5.2 ON-LOT DETENTION

To reduce the size of the stormwater management ponds, or where detention ponds cannot be built, on-lot detention can be utilized. In some cases it will be necessary that these be constructed on

single family lots. This is generally the case for single-family lots at the most downstream extents of a catchment, and where there is little or no room for detention between those lots and the downstream drainage channel. Also, small efforts such as disconnecting roof leaders, creation of rain gardens, and rainwater harvesting are encouraged and can have a significant impact on stormwater rate, quantity, and quality; however, these methods have not been included in this analysis.

On multi-family sites, formal stormwater detention structures are more feasible due to the availability of larger treatment areas, and maintenance which can be provided by the strata. Methods to reduce stormwater peak flow from multi-family sites can include pervious pavement, underground tanks, green roofs, rain gardens, or reduction in impervious areas. The criterion for this property has been set so that all multi-family sites are to include a stormwater management system which will limit post-development 1:2 year flows to pre-development rates. Once stormwater management guidelines are developed during detailed design for individual multi-family sites, the downstream detention requirements can be revaluated. The requirement for design and construction of all such facilities would need to be covered under a covenant registered on the property.

2.5.3 PIPE ROUTING

A conceptual pipe network has been completed for the revised lot layout at Kingsview based on the post-development catchment areas; refer to Figure 3. Due to the topography, some pipe routes will be outside the road right-of-way, which will require SRWs in favour of the District for access and maintenance. With some roads constructed on steep sideslopes, the elevation difference from front yards down to rear yards can be significant, necessitating servicing along the backs of some lower lots.

To avoid costly replacement of infrastructure, all new storm pipes should be designed to discharge to culverts, rather than to existing pipes on Kingsview Road and Highview Drive. By doing so the capacity of these existing systems is preserved, despite the increase in upstream density. An extensive amount of re-grading will be required to accommodate the new lot layout, including overland stormwater flow in ditches.

2.5.4 CULVERTS

Four culverts have been constructed on Kingsview Road, and 4 on Highview Drive. These culverts will receive stormwater flows from upstream development. Additional road crossing culverts will be required in future phases. As noted, the existing culverts have capacity for the proposed development; however, two culverts on Highwood Drive require reconfiguration: The first culvert crosses Highview Road and discharges to Pond 8. Depending on the final alignment of access to the multi-family site on the north side of Highwood Drive, this culvert may need to be extended. Secondly, the inlet of the easternmost 900 mm culvert on Highwood Drive is located in the centre of a proposed road. This culvert should be extended southward to clear the new road.

2.6 SUMMARY

Based on the findings of the stormwater model, the District's requirement for zero increase in runoff during the 1:2 year storm event can be achieved with a combination of on-lot detention, and detention ponds. Further stormwater management techniques can be used to both reduce the load on the ponds and improve water quality. The majority of existing stormwater infrastructure can remain in place.

Moving forward in the planning and design stage of the project, we recommend a hydrogeologist and a Qualified Environmental Professional be retained to review the possible implications of groundwater

flows and work in existing streams. A comprehensive landscaping and vegetation management plan. Managing vegetation should be developed to aid in controlling stormwater runoff rate and quality.

3 SANITARY SEWER NETWORK

The proposed sanitary sewer network will follow roadways, with some interconnections through SRW's registered on private properties. Flows will be directed to existing downstream manholes at a number of locations, shown on Figure 4. Pipes have been constructed on Viewtop Raod and Highwood Road, which drain to the existing 'Highwood' pump station. These pipes and the pump station currently serve the existing units on Kingsview Road and Nevilane Drive. The Kingsview station pumps through a forcemain which discharges to the sewer system on Crestwood Drive. No new pump stations will be needed.

WSP provided the District with the proposed sanitary network layout for Kingsview for modelling by their engineering consultant, Parsons. Preliminary results of the modeling has identified the need for upgrading downstream infrastructure, including a number of pipes and three pump stations. The requirement for downstream upgrades has been made necessary by the proposed Kingsview development, other proposed developments that would be contributing to the same downstream system, and existing units already connected to the system. Further study is required to verify the model's results and to determine mutually-agreeable cost sharing for funding the improvements.

4 WATER NETWORK

The overall watermain network remains relatively unchanged from the previous conceptual design. The site will include 6 pressure zones, 9 new pressure reducing valve (PRV) stations, a booster pump station, and a new reservoir. Watermains will be looped where possible to provide redundancy and improved fire flow; refer to Figure 5 for a conceptual pipe layout.

Pressure zones are dictated by the existing connections to neighbouring properties and fix the location of pressure reducing valves. Some lots will require individual pressure reducing valves as the watermain line pressure will exceed the recommended maximum pressure in the District of North Cowichan specifications (580 kPa / 84 psi). Watermains will be sized based on results of an updated water model during detailed design. Generally, fire flows dictate watermain diameters

4.1 RESERVOIRS

As with the original plan, the existing reservoir with a top water level (TWL) of 258m will be supplemented by a new reservoir with a TWL of 376.6 m. A new booster pump station and dedicated feed line will be required to supply the new reservoir. Sizing is based on the maximum daily demand of the development, plus the required fire flow. The new reservoir will need to be constructed prior to development of any lots in zones 5, 6, or 7, located south of Kingsview Road. Development of Kingsview, including the new reservoir, PRV stations, and watermain loops will provide increased fire protection to existing properties.

4.2 OFF-SITE IMPROVEMENTS

WSP provided the District with the proposed water network layout for Kingsview for modelling by their engineering consultant, Parsons. Preliminary results of the modeling has identified the need for upgrading two pump stations. The requirement for these upgrades has been made necessary by the proposed Kingsview development, other proposed developments that would be feeding from the same system, and existing units already connected to the system. Further study is required to verify the model's results and to determine mutually-agreeable cost sharing for funding the improvements. Upgrades to the existing pipe network, if required, have not been identified.

5 POPULATION DENSITY ASSUMPTIONS

The portion of the Kingsview catchment containing 'The Properties', that is that area generally west of the western boundary of Kingsview as far as Maple Bay Road, had been modeled with a population density of 3.1 persons per unit (ppu). The population density for these existing units remains unchanged in the current model. In the earlier 2013 study undertaken by Parsons (then Delcan), a population density of 3.1 ppu was assigned to the proposed Cliffs Over Maple Bay development. Since the time that study was completed it has been recognized and accepted by MNC that a density of 2.5 ppu, which is being used for the neighbouring Stone Hill proposed development, can also be used for Kingsview. As it relates to the water system and sanitary sewer models, establishing existing and future population densities is under review as at this report. Final decisions on assignment of densities in the models may affect the results, with corresponding implications to the amount of downstream improvements that will be required.

6 SHALLOW UTILITIES

Representatives from Fortis, BC Hydro, Telus, and Shaw were contacted to determine the extent of improvements that would be required to support the proposed additional density at Kingsview. A summary of their initial findings are below.

6.1 FORTIS

Nevilane Drive was constructed with a 114 mm PE gas main, which is oversized for the original development and, according to Fortis, has 'abundant gas capacity' for the planned project. This Nevilane Drive gas main will become the backbone of the gas network for servicing future phases.

6.2 BC HYDRO

BC Hydro has indicated that major feeder upgrades will be required to support the full build-out density proposed at Kingsview. We are awaiting further details of these upgrades, including magnitude of cost and the number of developable lots before the upgrades are required.

6.3 TELUS

Generally, the existing Telus infrastructure can be extended to service the proposed units at Kingsview. A new cabinet for fibre optic facilities will be required in one of the future phases.

6.4 SHAW

An initial review of the existing infrastructure by Shaw shows no areas of concern. Generally, the existing facilities can support the increased density. Future phases will include multiple above ground pedestals, which is typical of developments this size.

7 CONCLUSIONS

The additional density proposed at Kingsview can be supported with some upgrades to existing infrastructure. With appropriate phasing, a significant number of units can be developed before offsite improvements are required. Stormwater management ponds will be required to attenuate peak flows to pre-development levels, as required by the District. The model indicates this target is achievable; however, implementation of on-lot best management practices (rain gardens, pervious pavement, infiltration galleries, etc.) can reduce the size and visual impact of the ponds. Significant grading efforts are anticipated to accommodate the proposed lot layout due to the steep slopes, stormwater ponds, and grading already completed on the unfinished golf course.

The requirements for water and sanitary sewer servicing remain generally unchanged from the original Cliffs plan. A new water reservoir is needed as well as a number PRVs. Upgrades to all three sewage pump stations (Highwood, Kingsview and Maple Bay) may be required at different milestones of development within both the Kingsview property and the region as a whole (although the Maple Bay station is already undersized, without additional development).

Initial review of the increased density by the shallow utilities indicates no capacity issues with the exception of BC Hydro. The existing hydro system can support some development before significant feeder upgrades are required. We are awaiting further information to determine when the upgrades will be required.

The neighbouring 300-unit Stone Hill development will have an impact on utilities in the area, so cost sharing of infrastructure upgrades common to both projects should be expected. The District of North Cowichan has identified some of the required downstream improvements as Development Cost Charge (DCC) projects. DCC projects are eligible for funding from the District using monies collected from other lot sales. This could reduce the capital cost of off-site improvements for Kingsview. The upgrades eligible for DCC funding include a number of pipe replacements, and upgrades to the Maple Bay Road Pump station.

Based on the results of our review and the Parsons sanitary and water feasibility studies, the infrastructure upgrades required to support Kingsview development do not extend far beyond those originally required for The Cliffs. However further consideration is required to confirm population densities assigned to the models, and the results of the model output require verification. The precise scope of the upgrades and associated costs will be determined as preliminary and detailed design progress.

Appendix A

FIGURES

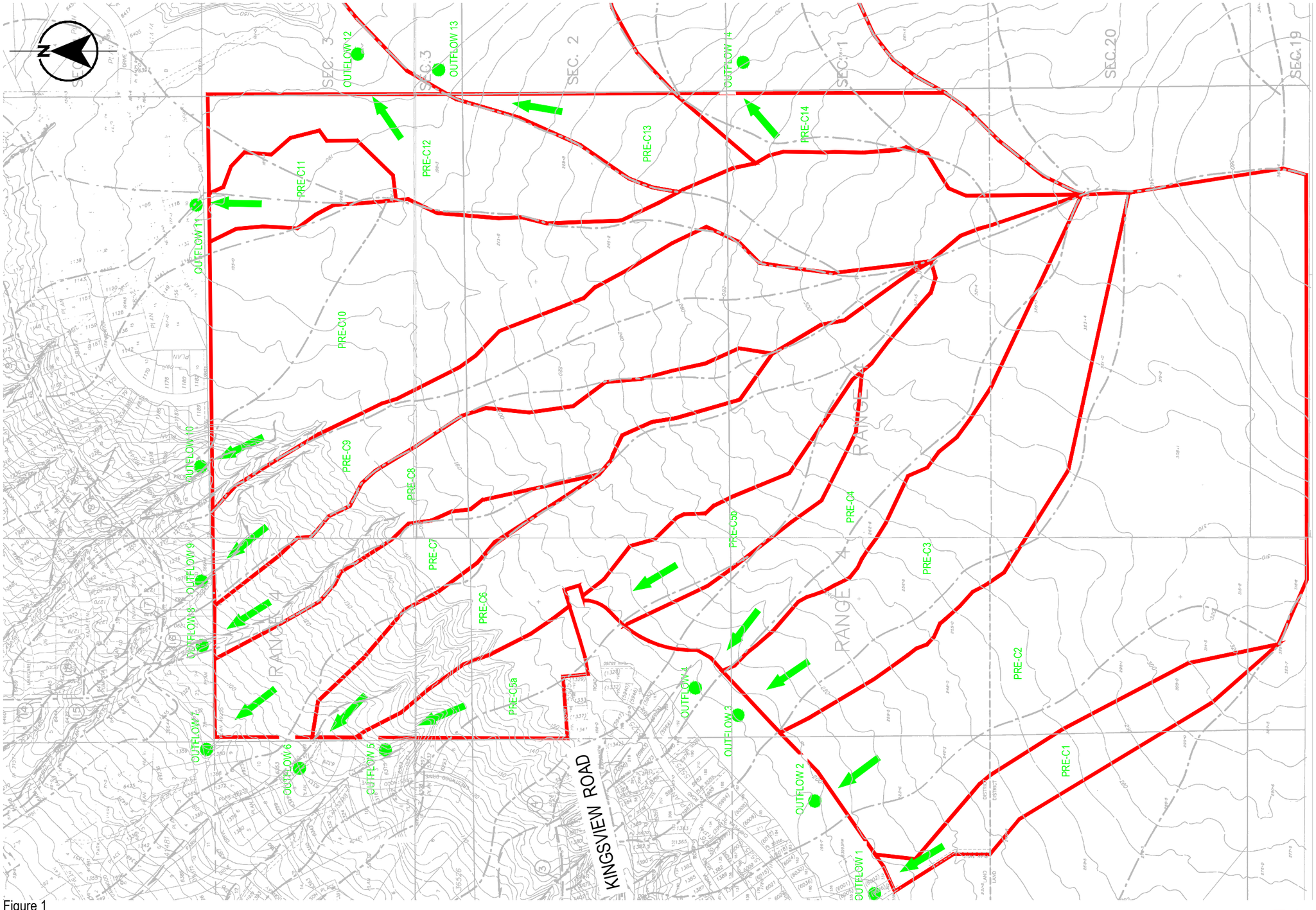


Figure 1
Pre-Development Subcatchment Areas
Kingsview at Maple Bay
1:6000

LEGEND

C10f Catchment ID

Catchment Boundary

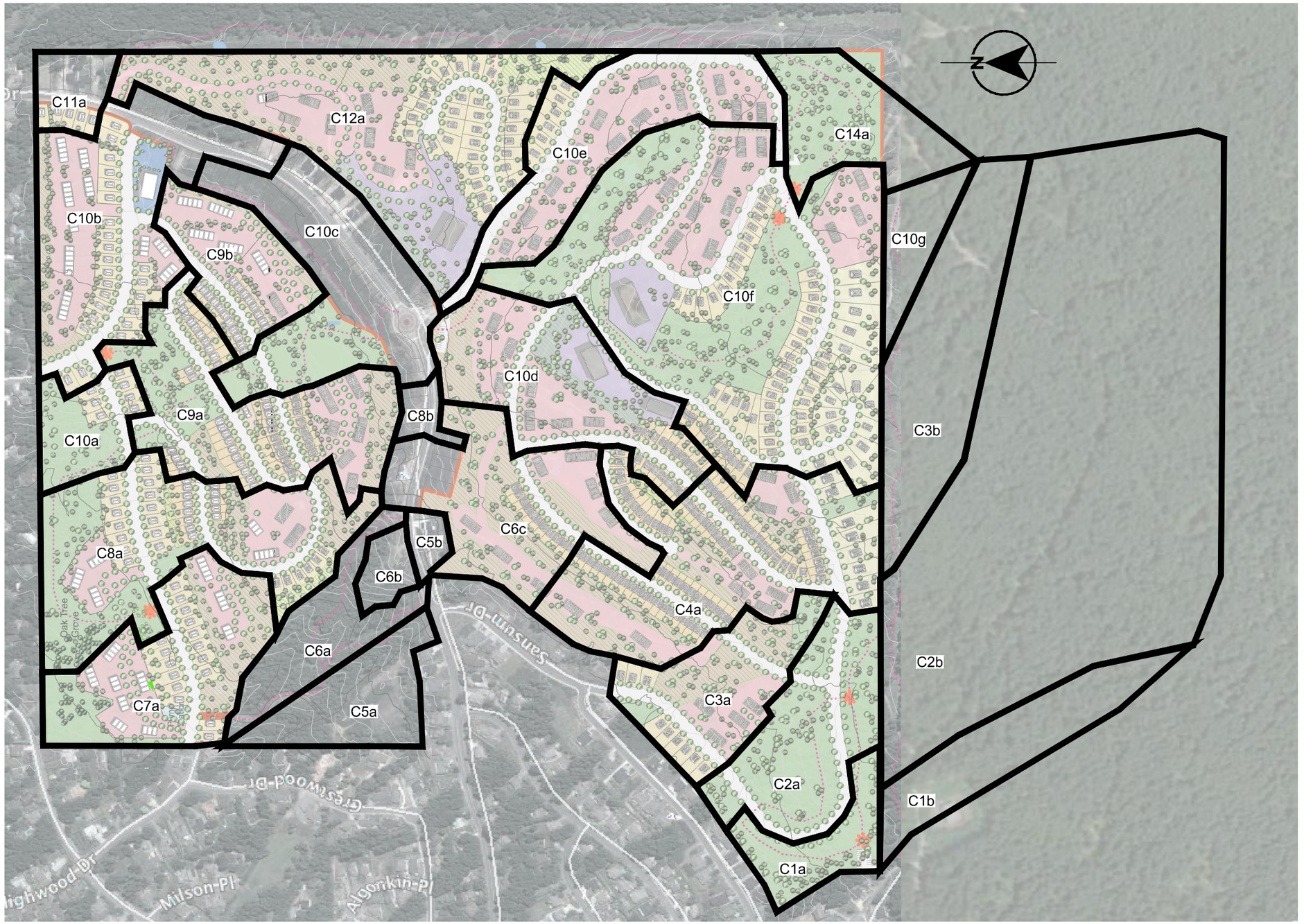


Figure 2
Drainage Catchments
Kingsview at Maple Bay
1:6000

FILE NO: V:\Projects\201\141-13463-00 The Properties - CDP Application\DWG\Civil\Production\Figs\141-13463-00_ServicingFigs

LEGEND

- Existing Drain Main
- Proposed Drain Main
- (11) Outfall ID
- Pond
- Single Family, On-Lot Detention

Figure 3
Drain Network Schematic
Kingsview at Maple Bay
1:6000

LEGEND

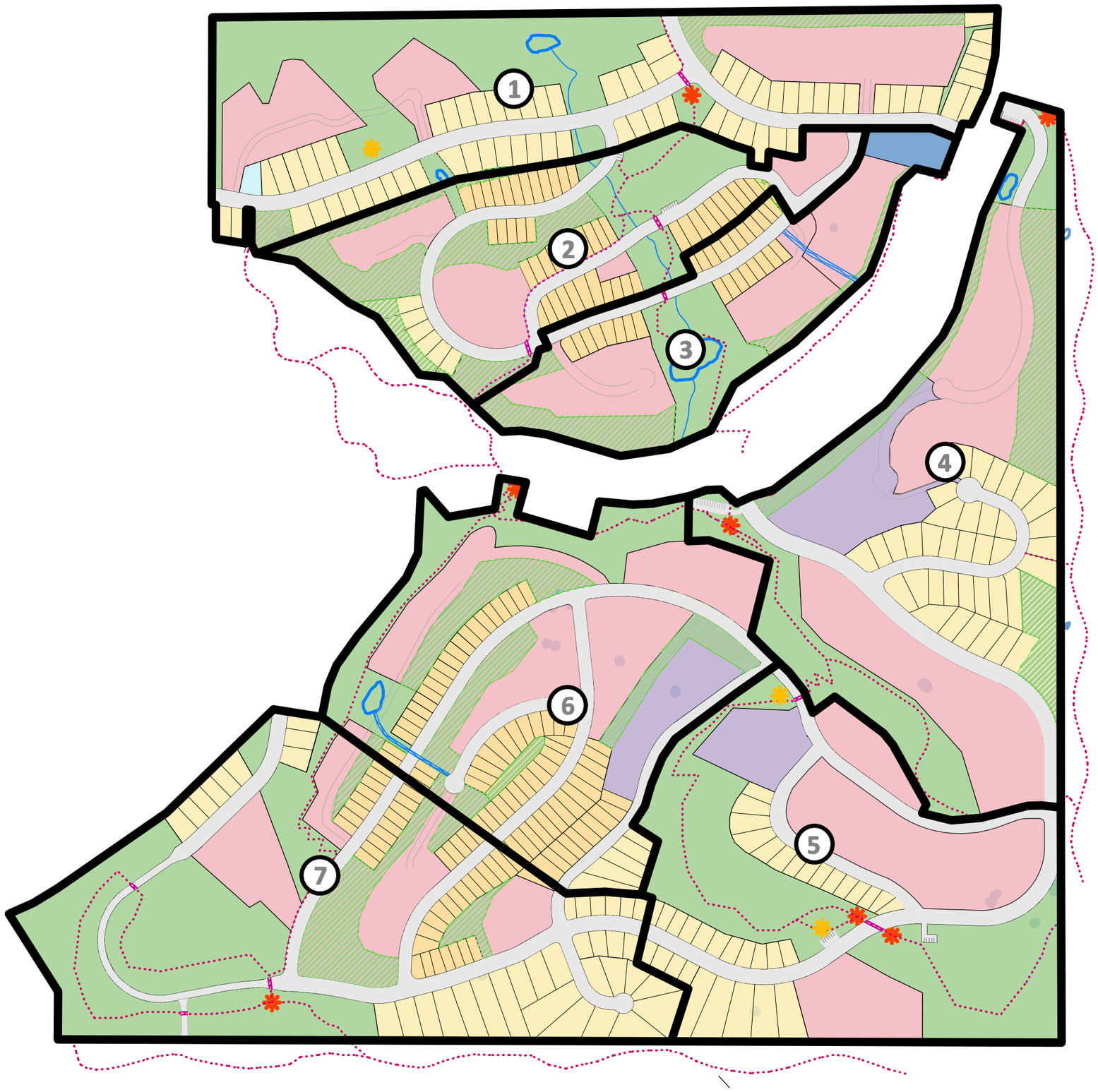
- Existing Sanitary Main
- Proposed Sanitary Main
- LS Lift Station

Figure 4
Sanitary Network Schematic
Kingsview at Maple Bay
1:6000

SCHEDULE H

Phasing Plan

Schedule H
Phasing Plan
KingsView



Boundary of Site

Development Phase

Land Use Area

- Area 1 – Standard Lot
- Area 2 – Small Lot Comprehensive
- Area 3 – Townhouse
- Area 4 – Multifamily
- Area 5 – Multfamily w/ commercial
- Area 6 – Parks
- Open & Covenanted Green Space
- Road ROWs
- Other (dedicated for servicing)

N

0 25 100 200

Scale 1:5,000

March 23, 2016

SCHEDULE I

Transportation

Boulevard Transportation
a division of Watt Consulting Group

KINGSVIEW DEVELOPMENT

Traffic Impact Assessment

Prepared for:	**Strandlund Investments Ltd.**
Prepared by:	**Boulevard Transportation, a division of Watt Consulting Group**
Our File:	**1900**
Date:	**November 1, 2015**

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1.0 INTRODUCTION

Boulevard Transportation Group, a division of Watt Consulting Group, was retained by Strandlund Investments Ltd. to conduct a traffic impact assessment for the proposed KingsView development in North Cowichan, BC. This study reflects the proposed development plan from September 8, 2015.

An analysis of post-development conditions was undertaken in order to provide a clear view of the impacts on the adjacent roadways after full build-out and occupancy. The study assessed traffic impacts of the development, reviewed the site access roads, and assessed the need for any mitigation measures. Study recommendations and conclusions are to provide safe and efficient movement of pedestrians, bicycles and vehicular traffic for the proposed development while minimizing the impact to non-site trips. The study area includes Maple Bay Road, Kingsview Road, Nevilane Drive, Highwood Drive and the site accesses. There are two key intersections in the study area from a traffic conditions / capacity perspective: Maple Bay Road & Kingsview Road and Maple Bay Road & Highwood Dr. See **Figure 1** for the study area and site location.

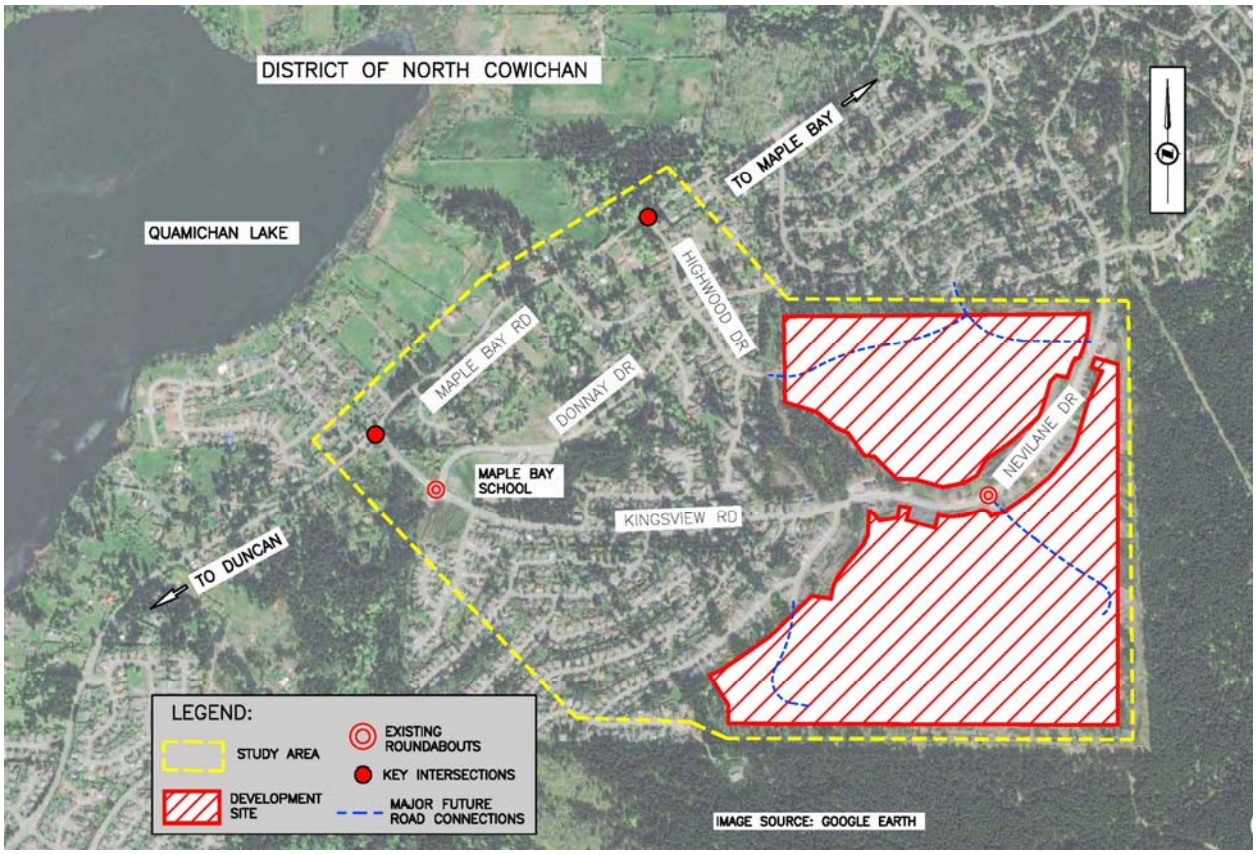


Figure 1: Study Area and Site Location

2.0 EXISTING CONDITIONS

2.1 Road Network

The development site is located in the District of North Cowichan to the east of Duncan. Maple Bay Road serves as a rural arterial road connecting the community of Maple Bay with Duncan. Kingsview Road is a two-lane collector road that runs east-west, connecting several residential neighbourhoods in the east (and becomes Nevilane Drive at the roundabout on the hillside 400m east of Sunsum Drive) and Maple Bay Road to the west, where it terminates at a T-intersection. Kingsview Road is a major access road to the development as this road passes through the development area, and would serve the south portion of the site. There are two existing roundabouts on Kingsview Road, one at Donnay Drive (adjacent to Maple Bay School) and one at the proposed development site (east end of Kingsview Road). Note that due to the site topography and proposed on-site road network, the south portion of the site (south of Kingsview Road) would use Kingsview Road to access / egress the site, while the north portion of the site would use Highwood Drive. Note that in the future, Donnay Drive will be extended to the south, providing a parallel and alternative route to Maple Bay Road. This was not, however, considered in the analysis due to the uncertainty of when the extension may occur, as well as since it is not expected to be a major alternative route since Maple Bay Road is a more direct roadway to/from Duncan.

Highwood Drive provides another site access route from Maple Bay Road, and is one kilometre north of the Kingsview Road intersection. Highwood Drive is currently a two-lane local road with a dead end to the east, but a connection and extension to the site would be made to serve the north portion of the development site (north of Kingsview Road).

The intersection of Maple Bay Road & Kingsview Road is currently stop-controlled on Kingsview Road. At the intersection, Kingsview Road is divided with a wide landscaped median (8m wide 70m long) and a raised island to channelize westbound right turns. On Maple Bay Road there is a southbound left-turn lane and a northbound right-turn lane. The intersection of Maple Bay Road & Highwood Drive is stop-controlled on Highwood Dr, and there are no dedicated turn lanes.

The posted speed limit on Maple Bay Road is 60km/h. The speed limits on Kingsview Road and Highwood Drive are 50 km/h, except for the school frontage on Kingsview Road (between Donnay Drive and Algonkin Road) where there are playground zone warning signs with 30 km/h posted speed limit signs.

2.2 Traffic Volumes

Manual counts were undertaken at the two intersections of Kingsview Road/Maple Bay Road and Highwood Drive/Maple Bay Road during the AM and PM peak hours on March 25, 2014. At both intersections, the overall intersection volumes (i.e. entering the intersection) were found to

be almost same for the AM peak hour and the PM peak hour, with significant differences in directional flow. Overall the volumes at the Highwood Drive intersection were found to be much lower than at Kingsview Road, with less than half the volume. See **Figures 2 and 3** for existing AM and PM peak hour turning movement counts at Maple Bay Road & Kingsview Road and at Maple Bay Road & Highwood Dr.

In June 2004, peak hour traffic volumes were measured at the same location (Kingsview Road/Maple Bay Road) for a previous study. The 2014 through volumes on Maple Bay Road were actually lower than the 2004 volumes. The AM peak hour through volume (both directions total) was measured at 323 vehicles in 2014 and 352 vehicles in 2004. The PM peak hour through volume was measured at 337 vehicles in 2014 and 407 vehicles in 2004. As there has been a negative traffic growth trend in the area, the 2014 counts were considered to be reflective of 2015 volumes, and were used for background conditions without application of a growth factor.

2.3 Traffic Modelling – Background Information

Analysis of the traffic conditions at the intersections within the study area were undertaken using Synchro software (for stop-controlled intersections) and SIDRA (for roundabout intersections).

Synchro / SimTraffic is a two-part traffic modelling software that provides analysis of traffic conditions based on traffic control, geometry, volumes and traffic operations. Synchro software (Synchro 9) is used because of its ability to provide analysis using the Highway Capacity Manual (2010) methodology, while SimTraffic integrates established driver behaviours and characteristics to simulate actual conditions by randomly "seeding" or positioning vehicles travelling throughout the network. SIDRA provides results using HCM 2010 methodology as well. SIDRA and Synchro uses measures of effectiveness to return the results of the analysis. These measures of effectiveness include level of service (LOS), delay and 95th percentile queue length. The delays and type of traffic control are used to determine the level of service. The level of services are broken down into six letter grades with LOS A being excellent operations and LOS F being unstable/failure operations. Level of service C is generally considered to be an acceptable LOS by most municipalities. Level of service D is generally considered to be on the threshold between acceptable and unacceptable operations.

2.4 Existing Traffic - Results

Existing traffic conditions were analysed during the AM and PM peak hours for the two key intersections (Kingsview Road/Maple Bay Road and Highwood/Maple Bay Road).

At the intersection of Kingsview Road/Maple Bay Road, the westbound left turn movement (from Kingsview Road onto Maple Bay Road) is operating at a LOS C during the AM peak hour and LOS B during the PM peak hour. All other movements are operating at a LOS A during the AM

and PM peak hours. The westbound left 95th percentile queue length is 4.0 vehicles during the AM peak hour and 0.6 vehicles during the PM.

The westbound turn movement (from Highwood Drive onto Maple Bay Road) is operating at a LOS B during both AM and PM peak hours. On Maple Bay Road, all movements are operating at LOS A during both AM and PM peak hours.

Tables 1 and **2** summarize 2015 existing traffic conditions at the two key intersections: Kingsview Road/Maple Bay Road and Highwood/Maple Bay Road respectively. Analysis results include delays, LOS and queue lengths. The 2015 existing AM/PM peak hour volumes and levels of service are shown in **Figure 2** and **3**. See *Appendix C* for existing condition Synchro reports.

TABLE 1: 2015 EXISTING PEAK HOUR CONDITIONS AT KINGSVIEW ROAD/MAPLE BAY ROAD

	Southbound (On Maple Bay Rd) Left	Westbound (On Kingsview Rd) Left	Westbound (On Kingsview Rd) Right
Average Delay (s)	7.5 (7.8)	20.6 (13.4)	8.9 (9.7)
LOS	A (A)	C (B)	A (A)
95th Queue (veh)	0.0 (0.1)	4.0 (0.6)	0.0 (0.0)

*Note: ## indicates AM; (##) indicates (PM)

TABLE 2: 2015 EXISTING PEAK HOUR CONDITIONS AT HIGHWOOD DR/MAPLE BAY RD

	Southbound (On Maple Bay Rd) Left	Westbound (On Highwood Dr) Left	Westbound (On Highwood Dr) Right
Average Delay (s)	7.5 (7.7)	11.2 (11.2)	11.2 (11.2)
LOS	A (A)	B (B)	B (B)
95th Queue (veh)	0.0 (0.0)	0.3 (0.1)	0.3 (0.1)

*Note: ## indicates AM; (##) indicates (PM)

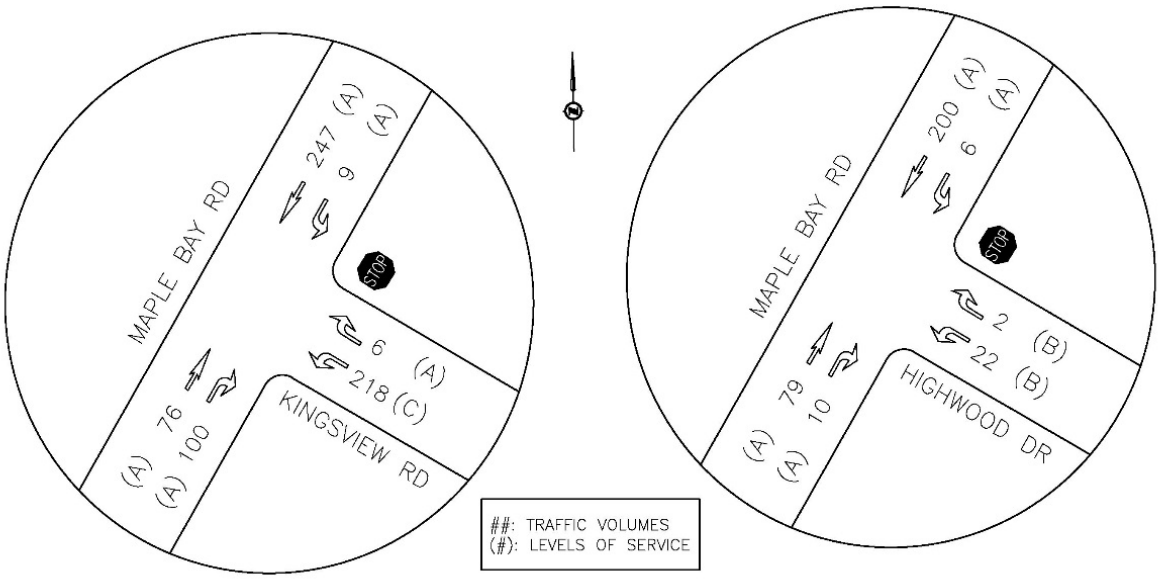


Figure 2: 2015 Existing AM Peak Hour Conditions

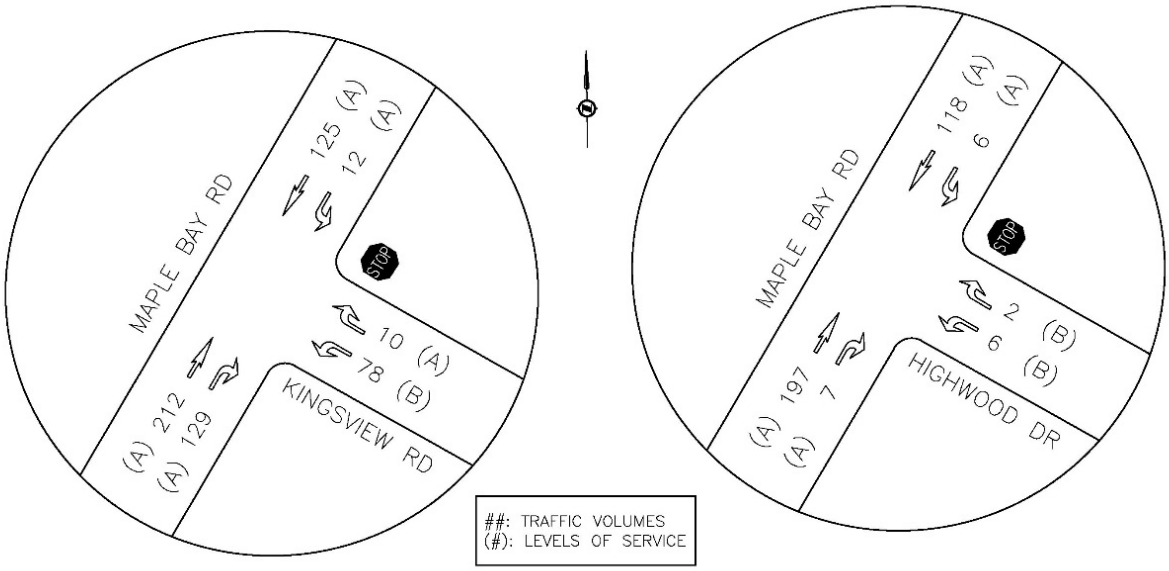


Figure 3: 2015 Existing PM Peak Hour Conditions

3.0 POST DEVELOPMENT

3.1 Land Use

The site is currently undeveloped although the major access road (Kingsview Road extension) is already constructed or upgraded. The KingsView development proposes a total of 1,280 residential units, comprising a mix of single family, single family small lot, townhouses/multi-

family and duplex lot. **Table 3** summarizes the dwelling units by type and location for the proposed development.

TABLE 3: BUILD-OUT PLAN

Land Use Type	North Side	South Side	Total
Single Family (Detached)	**151 Units**	**230 Units**	**381 Units**
Townhouse / Multi-family	**250 Units**	**649 Units**	**899 Units**
Total:	**401 Units**	**879 Units**	**1,280 Units**

3.2 Site Access

Kingsview Road and Highwood Drive are the main access roads to/from the site, and connect to Maple Bay Road. (Although it will be possible to travel to/from Maple Bay via Nevilane Drive, this would be used by a small number of site trips only.) The site is effectively divided into two portions (one north and one south of Kingsview Road) due to the elevation and topography characteristics. Trips to/from the south portion of the development would use Kingsview Road to access to/from Maple Bay Road, and trips to/from the north portion of the development would use Highwood Drive, based on route length and travel times. See **Figure 4** for the site accesses and site plan.

Figure 4: Access Roads and Site Plan (surrounded by red border)

3.3 Trip Generation

Site trips were estimated from the *ITE Trip Generation Manual (9th Edition)*. The *Trip Generation Manual* provides trip rates for a wide variety of land uses gathered from actual sites across North America over the past 35 years. The ITE manual does not provides trip generation rates specifically for single family small lot and duplex lots, and therefore the single family trip rates were used as a worst case estimate. The trip generation rates are shown for the AM and PM peak hours in **Table 4Error! Reference source not found.**.

TABLE 4: TRIP GENERATION RATES

AM Peak Hour					
Land Use Type	**Code**	**ITE Land Use**	**Trip Rate / unit**	**In**	**Out**
Multi-Family	**230**	**Condo / Townhouse**	**0.44**	**17%**	**83%**
Single Family	**210**	**Single Family Detached**	**0.75**	**25%**	**75%**
Single Family Small Lot	**210**	**Single Family Detached**	**0.75**	**25%**	**75%**
Duplex Lot	**210**	**Single Family Detached**	**0.75**	**25%**	**75%**
PM Peak Hour					
Multi-Family	**230**	**Condo / Townhouse**	**0.52**	**67%**	**33%**
Single Family	**210**	**Single Family Detached**	**1.00**	**63%**	**37%**
Single Family Small Lot	**210**	**Single Family Detached**	**1.00**	**63%**	**37%**
Duplex Lot	**210**	**Single Family Detached**	**1.00**	**63%**	**37%**

Tables 5 to **8** summarize the generated site trips by location with full build-out during the AM and PM peak hours. Note that the development will likely be constructed in phases, but phasing details have yet to be determined.

TABLE 5: AM PEAK HOUR TRIP GENERATION (NORTH SIDE)

Land Use	ITE Code	Units	Rate	In	Out	Total Trips
Multi-Family	230	250	0.44 / unit	19	91	110
Single Family	210	151	0.75 / unit	28	85	113
Total				**47**	**176**	**223**

TABLE 6: AM PEAK HOUR TRIP GENERATION (SOUTH SIDE)

Land Use	ITE Code	Units	Rate	In	Out	Total Trips
Multi-Family	230	649	0.44 / unit	49	237	286
Single Family	210	230	0.75 / unit	43	130	173
Total				**92**	**367**	**459**

TABLE 7: PM PEAK HOUR TRIP GENERATION (NORTH SIDE)

Land Use	ITE Code	Units	Rate	In	Out	Total Trips
Multi-Family	230	250	0.52 / unit	87	43	130
Single Family	210	151	1.00 / unit	95	56	151
Total				**182**	**99**	**281**

TABLE 8: PM PEAK HOUR TRIP GENERATION (SOUTH SIDE)

Land Use	ITE Code	Units	Rate	In	Out	Total Trips
Multi-Family	230	649	0.52 / unit	226	111	337
Single Family	210	230	1.00 / unit	145	85	230
Total				**371**	**196**	**567**

Typically a residential development does not generate pass-by trips and the generated development trips are considered all primary trips. Therefore, the generated trips are directly used for the analysis without any trip modifications.

3.4 Trip Assignment

The generated total site trips are 682 vehicles during the AM peak hour and 848 vehicles during the PM peak hour. The generated site trips were assigned based on the existing trip distributions at the two key intersections on Maple Bay Road. The future site traffic patterns are

assumed to match the existing trip distributions at the two key access intersections. Directional splits for the site trips are as follows:

AM Peak Hour

Trips In

- 88% of the trips total from Maple Bay Road South (Duncan)
- 12% of the trips total from Maple Bay Road North (Maple Bay)

Trips Out

- 97% of the trips total to Maple Bay Road South (Duncan)
- 3% of the trips total to Maple Bay Road North (Maple Bay)

PM Peak Hour

Trips In

- 95% of the trips total from Maple Bay Road South (Duncan)
- 5% of the trips total from Maple Bay Road North (Maple Bay)

Trips Out

- 91% of the trips total to Maple Bay Road South (Duncan)
- 9% of the trips total to Maple Bay Road North (Maple Bay)

Figures 5 and **6** outline the site trips assigned during the AM and PM peak hours at the two key intersections: Kingsview Road/Maple Bay Road and Highwood Drive/Maple Bay Road.

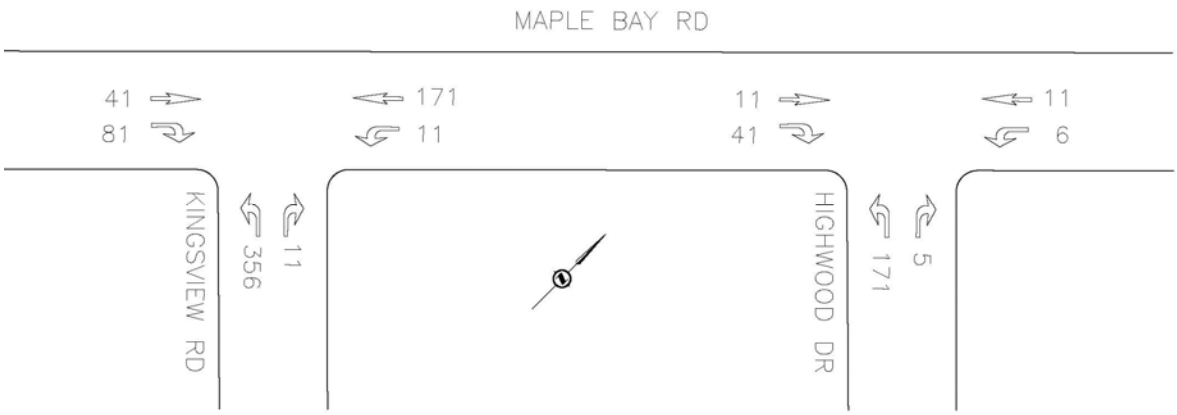


Figure 5: Site Trips Assigned during AM Peak Hour

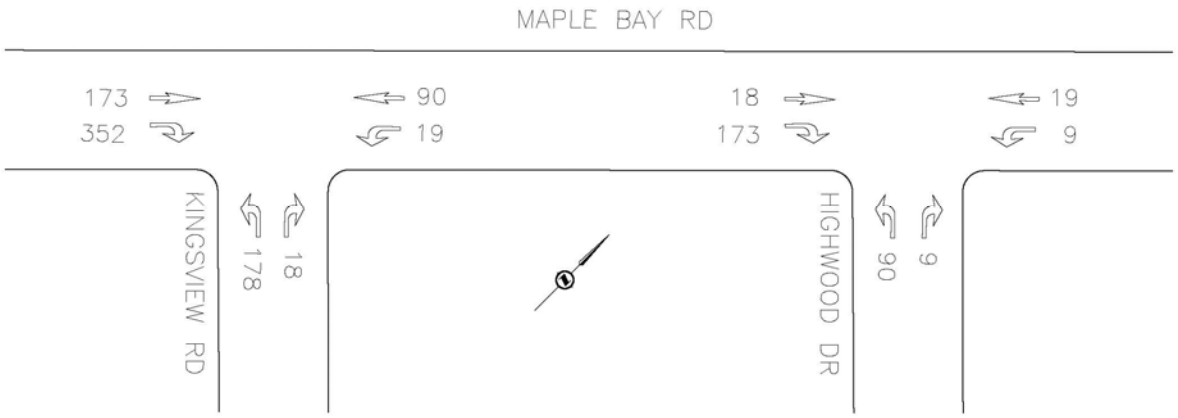


Figure 6: Site Trips Assigned during PM Peak Hour

3.5 Post-development Analysis Results - Full Buildout

The post development traffic volumes were entered into Synchro to determine the post development traffic conditions, in consideration of full buildout of the site, to establish ultimate traffic implications for the site (even though the site will be built out in phases over a number of years).

At the stop-controlled intersection of Kingsview Road/Maple Bay Road with full build-out, the westbound left turn movement will experience a failing level of service (LOS F) during the AM and PM peak hours (although with significantly longer delays in the AM peak). Other movements will operate at good levels of service (LOS A/B) during the AM and PM peak hours. The westbound left movement will have a 95th percentile queue length of 41.5 vehicles during the post development AM peak hour. Alternative traffic control would be required at the intersection to improve the failing level of service.

However, no mitigations would be required at the intersection of Highwood Drive/Maple Bay Road since all movements will continue to operate at acceptable levels of service (LOS C or better) with full build-out.

Tables 9 and **10** summarize post development traffic conditions (short term) at the two key intersections: Kingsview Road/Maple Bay Road and Highwood/Maple Bay Road. The post development peak hour volumes and levels of service are shown in **Figures 7** and **8**. See *Appendix D* for the Synchro post-development summary reports.

TABLE 9: POST DEVELOPMENT PEAK HOUR CONDITIONS AT KINGSVIEW ROAD/MAPLE BAY ROAD

	Southbound (On Maple Bay Rd) Left	Westbound (On Kingsview Rd) Left	Westbound (On Kingsview Rd) Right
Average Delay (s)	7.6 (8.4)	360 (69.5)	9.2 (11.2)
LOS	A (A)	F (F)	A (B)
95th Queue (veh)	0.1 (0.1)	41.5 (9.2)	0.1 (0.2)

*Note: ## indicates AM; (##) indicates (PM)

TABLE 10: POST DEVELOPMENT PEAK HOUR CONDITIONS AT HIGHWOOD DRIVE/MAPLE BAY ROAD

	Southbound (On Maple Bay Rd) Left	Westbound (On Highwood Dr) Left	Westbound (On Highwood Dr) Right
Average Delay (s)	7.7 (8.6)	17.6 (22.1)	17.6 (22.1)
LOS	A (A)	C (C)	C (C)
95th Queue (veh)	0.1 (0.1)	2.7 (2.8)	2.7 (2.8)

*Note: ## indicates AM; (##) indicates (PM)

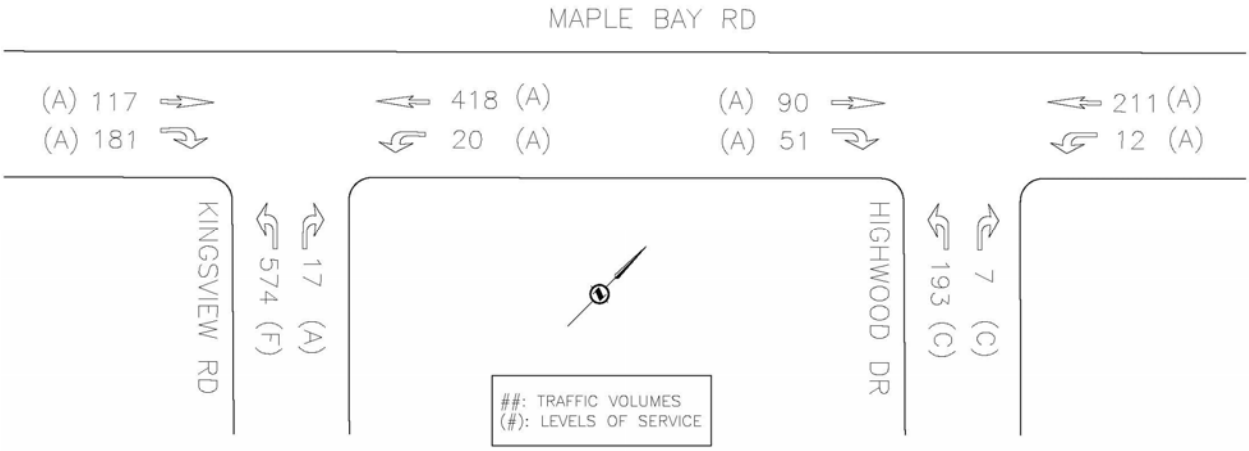


Figure 7: Post Development Conditions during AM Peak Hour, Existing Traffic Control

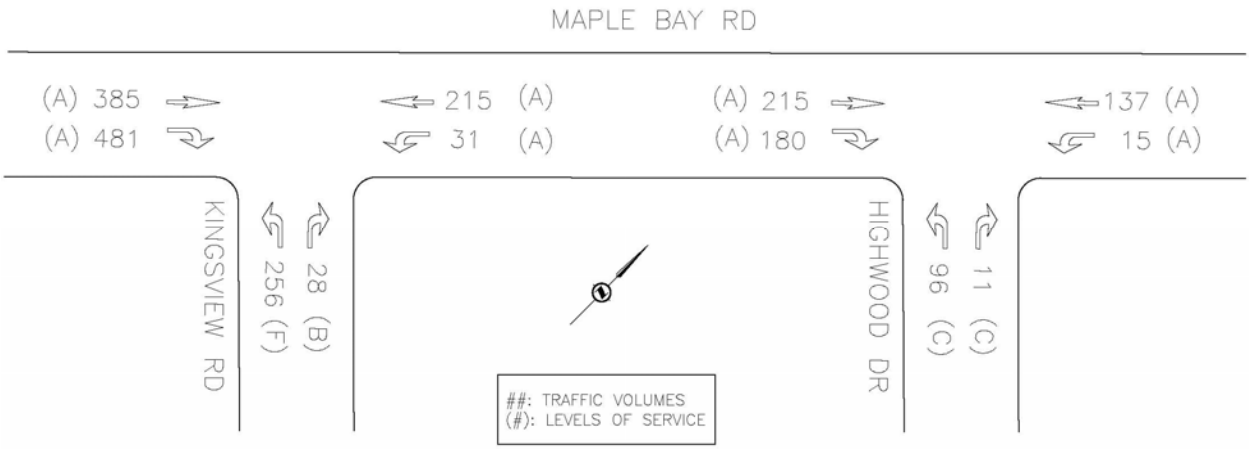


Figure 8: Post Development Conditions during PM Peak Hour, Existing Traffic Control

3.6 Mitigation for Kingsview Road/Maple Bay Road (full buildout)

The current stop control and geometry at Kingsview Road/Maple Bay Road will result in the westbound left turn movement having an LOS F during the AM and PM peak hours with the development at full buildout. Alternative traffic control will be required to improve this failing level of service. Three options that were considered were: (1) all-way stop, (2) roundabout, and (3) traffic signal. The future intersection conditions were reviewed for each traffic control option.

All-way stop control was found to be ineffective, as the westbound movement would remain at LOS F in the AM peak hour. Either a one-lane roundabout or a signal would however provide a good level of operation. A roundabout would have better levels of service, with all movements at LOS A, while a signal would have some movements at LOS B/C. A roundabout may therefore be preferable, and would fit with North Cowichan's approach to using roundabout traffic control on roads with capacity considerations. **Table 11** summarizes the analysis result of AM peak hour traffic conditions with a roundabout/signal at the Kingsview Road/Maple Bay Road.

TABLE 11: COMPARISON BETWEEN ROUNDABOUT AND SIGNAL AT KINGSVIEW ROAD/MAPLE BAY ROAD – AM PEAK HOUR

Movement	LOS		Delay (Sec)		95th Queue Length (m)	
	RA*	Signal	RA*	Signal	RA*	Signal
Northbound through	A	B	0.1	15.2	9.1	17.9
Northbound right	A	A	0.5	4.2	9.1	6.6
Southbound left	A	B	8.9	13.7	28.1	4.3
Southbound through	A	C	4.6	26.8	28.1	78.1
Westbound left	A	C	5.1	23.4	21.2	85.6
Westbound right	A	A	1.1	3.5	21.2	1.5

* RA indicates a roundabout with single lane

3.7 Trigger for Mitigation at Kingsview Road & Maple Bay Road

A review was conducted to establish the number of units for which traffic control improvements would be triggered due to excessive vehicle delays for westbound Kingsview Road at Maple Bay Road. The point at which the westbound left turn movement, in the AM peak hour, would drop from LOS D to LOS E is at 238 new site trips (161 trips for the south side development and 77 trips for the north side).

This trigger point can be achieved by different unit totals depending upon the type of units built first, since single family homes generate more vehicle trips than multi-family units. Three development scenario triggers were considered, ranging from all single family units (least number of units), to all multi-family units (most units), to a mix of them. Each scenario will generate the same site trips. This trigger point review took into account potential added trips (77 trips based on a 35% buildout of the north side) on Maple Bay Road travelling to/from the north portion of the development via Highwood Drive (which can add delay to westbound left turning vehicles on Kingsview Road at Maple Bay Road). **Table 12** summarizes residential unit numbers by scenario for the 238-trip trigger point.

TABLE 12: TRIGGER POINT UNIT TOTAL SCENARIOS, THAT GENERATE 238 TRIPS

Land Use Type	South Side Development Units
Scenario 1: Single Family	215 units
Scenario 2: Multi-family	366 units
Scenario 3: Mixed*	Single Family 81 units and Multi-family 227 units (Total 308 units)

*The mixed ratio is based on the total south-side proposed ratio of single family to multi-family units

3.8 Roadway Corridor Volumes, Post Development

Both Kingsview Road and Highwood Drive will, with full buildout, have a significant increase in the number of vehicles along their length. Kingsview Road will have approximately double the existing peak hour volumes, and Highwood Drive will have an approximate 5-fold increase in traffic (but would still be approximately half of current pre-development Kingsview Road volumes). Although these added volumes can be accommodated on the existing two-lane roads and are not expected to require specific traffic control or capacity mitigation at any intersections (outside of Maple Bay Road), existing residents will likely notice a change in the roadway volumes of these specific roads.

4.0 LONG TERM CONDITIONS

A long-term analysis for the 15-year horizon after the opening day (2015 base) with full build-out was conducted. A 15-year horizon was selected as it was indicated by the proponent as a likely minimum build-out timeframe. To obtain 2030 background traffic volumes, a growth rate of 1.0% was applied to the existing 2015 through volumes on Maple Bay Road. Note that this is considered a conservative estimate, since it was determined that there has actually been a decrease in volume on Maple Bay Road over the last 10 years. The proposed development traffic was then added to the 2030 background traffic to obtain the 2030 post development conditions. The long term conditions were analyzed in Synchro and SIDRA software. The long term volumes are shown in **Figures 9 & 10**.

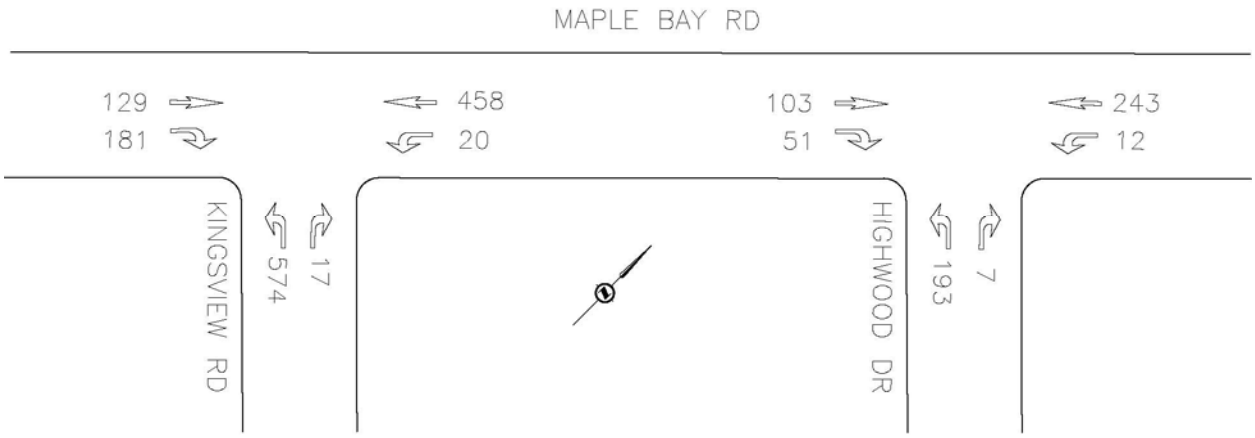


Figure 9: Long-term Post-Development Traffic Volumes, AM Peak Hour

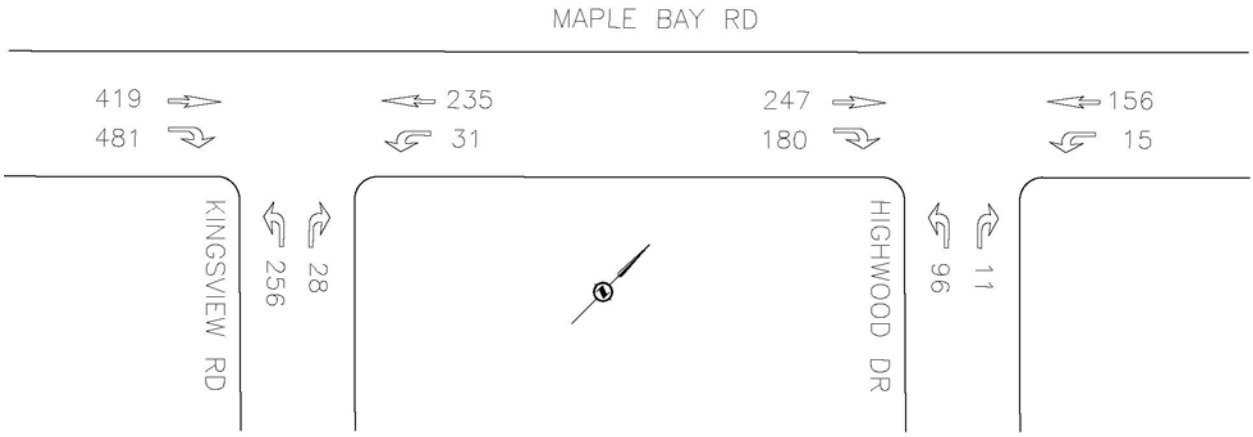


Figure 10: Long-term Post-Development Traffic Volumes, PM Peak Hour

4.1 2030 Background Conditions

In 2030 without the development, the intersection of Kingsview Road/Maple Bay Road will continue to operate at the same levels of service as 2015 existing (LOS C or better) during the peak hours. The westbound left movement will be a 24.1 second of delay (LOS B) per vehicle. The intersection of Highwood Drive/Maple Bay Road will continue to operate at the same levels of service as 2015 existing (LOS A/B) during the peak hours.

4.2 2030 Post Development Conditions

In 2030 with the development but without traffic control mitigation, at the intersection of Kingsview Road/Maple Bay Road the westbound left movement (from Kingsview onto Maple Bay) will experience a failing level of service (LOS F; delay 429 seconds per vehicle) during the AM peak hour and will also drop to LOS F (delay: 128 seconds) in the PM peak hour. Highwood Drive/Maple Bay Road will continue to operate at acceptable levels of service (LOS C or better) for all movements during the peak hours.

With a roundabout, the intersection would operate at LOS A for all movements (AM and PM peak hours) and with a signal all movements would operate at LOS C or better (AM and PM peak hours). Therefore a roundabout would continue to be an effective traffic control measure into the future.

5.0 SAFETY AND GEOMETRICS

5.1 Turn Lanes

Although improvements at Highwood Drive and Maple Bay Road are not triggered by capacity concerns, turn lanes on Maple Bay Road could be a consideration from a safety and flow perspective. The BC Ministry of Transportation and Infrastructure's left and right turn lane warrants were therefore considered.

At the intersection of Highwood Drive/Maple Bay Road, a southbound left turn lane is not warranted based on the MoTI left turn lane warrant review (based on the warrant chart for a design speed of 60km/h and a percentage of left turns in advancing volume of 10%), for long term (2030) post development volumes (AM and PM peak hours). Therefore, no left turn lane is required on Maple Bay Road at Highwood Drive. The warrant chart review can be found in Appendix F.

There is no similar MoTI warrant for right turn lanes at intersections, when considering the potential need for a right turn lane on Maple Bay Road onto Highwood Drive. Warrants from other jurisdictions are varied in nature, and are based on a combination of the total advancing volume (through plus right turn volume) vs the right turning volume. Based on Minnesota DOT's right turn warrant, a right turn lane would be required once there are 115 right turning vehicles in a design hour, whereas 130 right turning vehicles would be the trigger if using Ohio DOT's right turn lane warrant. The estimated right turn volume at full buildout (of 401 units) of the north portion of the KingsView site is 173 vehicles, which exceeds both of these right-turn lane warrant thresholds. The Minnesota right-turn lane warrant would be met at 68% buildout (268 units) whereas the Ohio warrant would be triggered at 75% buildout of the north side (301 units). Note that this volume of northbound right turning vehicles is very similar to existing peak hour northbound right turn volumes on Maple Bay Road at Kingsview Road (which has up to 129 peak hour right turning vehicles), where there is an existing right turn lane. Therefore a northbound right turn lane on Maple Bay Road at Highwood Drive is a consideration once the north-side development exceeds 268 units, to maintain safety, traffic flow, and intersection design consistency. See Appendix F for the right turn lane warrant chart reviews.

5.2 Cross Sections

Kingsview Road and Nevilane Drive (extension) have been constructed to serve the development area. On the road adjacent to the site, the typical cross section has a 3.5m lane (for each direction), a 1.5m bike lane (uphill direction only), a 2m parking lane (for both sides),

and a concrete sidewalk one side of the road. This meets the Municipal typical cross section standards for a rural collector road.

Looking to Nevilane Drive North

Highwood Drive ranges from 8.7m to 11.5m paved width, with limited unpaved shoulders and no paint markings, which is typical of local roads in the Municipality. Highwood Drive will continue to serve as a local road with the development (albeit with a higher volume). New roadway sections should be constructed to meet the District's roadway specifications.

6.0 OTHER MODES

6.1 Pedestrian and Bicycle Facilities

There is sidewalk along one side of Kingsview Road but no sidewalk along Highwood Drive. There is a bike lane (1.5m) along one side (uphill side) of Kingsview Road east of Donnay Drive. On Highwood Drive, it was observed that there were not significant pedestrian/cyclist activity, but this could increase with the development. The provision of sidewalks and bicycle facilities should either adhere to Municipal specifications or meet agreements between the developer and the Municipality if alternative cross-sections are pursued for on-site roads.

6.2 Transit

There is one transit bus route (#4) along Kingsview Road (from Maple Bay Road to Chippewa Road) and Donnay Drive (see Figure 11). This bus route connects Duncan to Maple Bay eight times a day on weekdays. In the future the bus route could be extended along Kingsview Road and Nevilane Drive if the transit demand increases around the development area. Based on the current route, the closest bus station is at Chippewa Road/Kingsview Road.

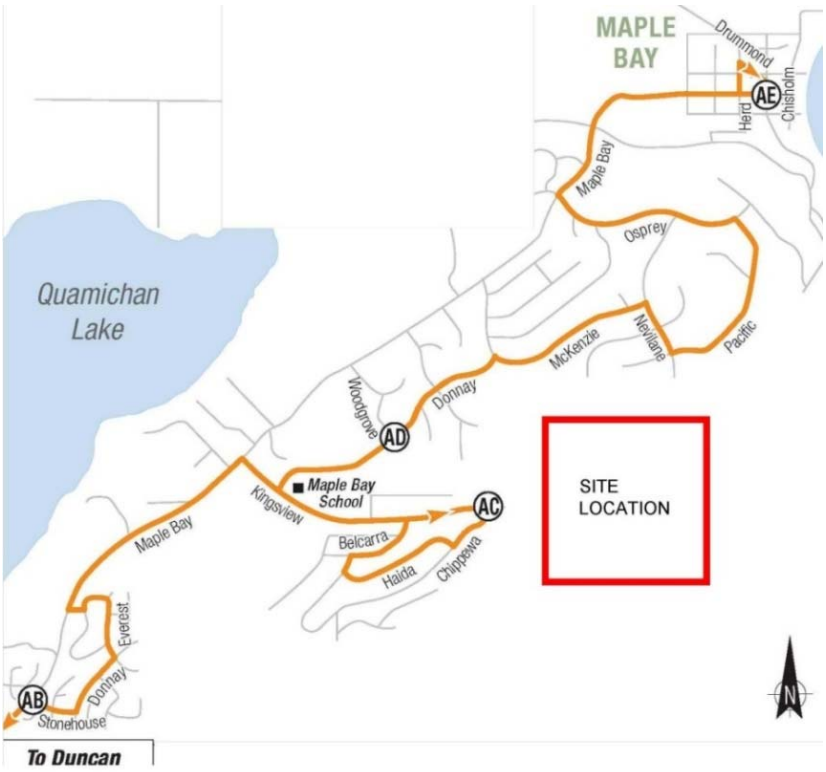


Figure 11: Transit Bus Route #4

7.0 CONCLUSIONS

The following conclusions are made regarding the traffic study for the proposed 808-unit KingsView development.

The existing intersection of Kingsview Road/Maple Bay Road operates at LOS C or better for all movements in the AM and PM peak hours (with the AM peak hour being the worst-case traffic condition period due to left turns onto Maple Bay Road). With development at full buildout, the westbound left turn movement (from Kingsview Road onto Maple Bay Road) will drop to LOS F (failing level of service) in the AM and PM peak hours, and traffic control improvements would be required (either a one-lane roundabout or intersection signalization). The point at which a traffic control improvement at this intersection is triggered is 238 site trips, which is equivalent to 308 units on the south side of Kingsview Road (for a mix of multi-family and single family in proportion to the full-buildout percentage), and slightly higher or lower unit numbers if more multi-family or single family units are initially developed.

The roadway corridors of Kingsview Road and Highwood Drive can accommodate the increased volume and will not require added traffic control at other intersections, but the total volume will

increase noticeably on these roads (approximately double on Kingsview Road and a 5-fold increase on Highwood Drive).

A review of 15-year horizon conditions found that a roundabout or signal would continue to operate with good levels of service at Kingsview Road & Maple Bay Road.

The existing intersection of Highwood Drive /Maple Bay Road will operate at a LOS C or better for all movements in the long term with the development. Therefore, no mitigation would be required at Highwood Drive /Maple Bay Road from a capacity perspective. A southbound left turn lane is not warranted in the long term, but a northbound right turn lane would be warranted at the 67% buildout stage of the north portion of the site (268 units), and would be beneficial for safety and traffic flow due to the added right turn volumes from the development.

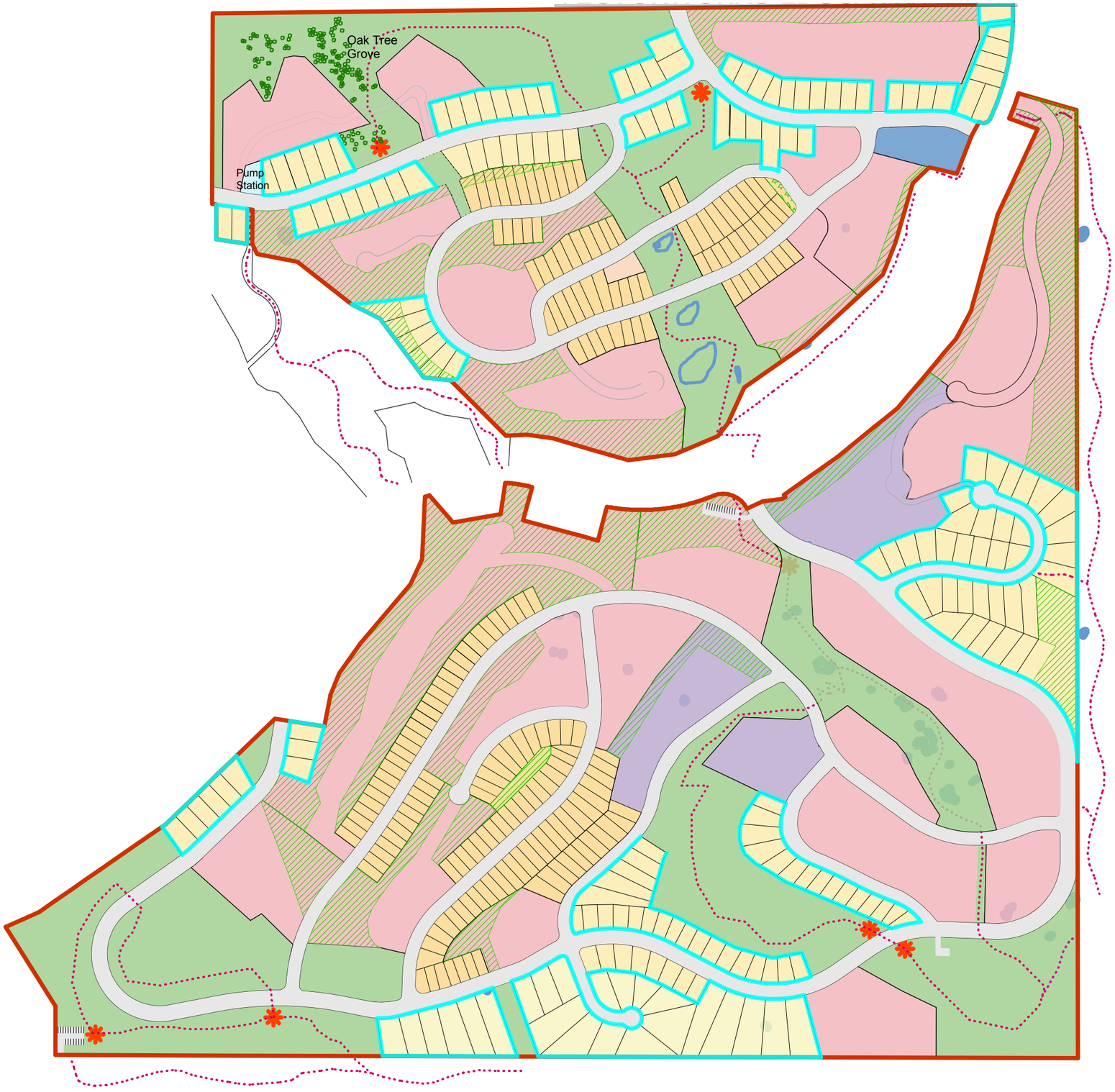
On Kingsview Road there are currently bike facilities (uphill bike lane) and a sidewalk on one side, but no facilities on Highwood Drive. Site road cross sections should either conform to the Municipality's specifications or meet agreements between the developer and the Municipality if alternative cross-sections are pursued for on-site roads. There is a bus route with service near to the site, which could be expanded to directly serve the development once demand is established in the future.

8.0 RECOMMENDATIONS

The following measures are recommended:

- Install a single lane roundabout at Kingsview Road & Maple Bay Road once the 238 site trip trigger point is exceeded (e.g. 308 south-side units for mixed initial development (81 single family and 227 multi-family units), or 215 south-side single family units only or 366 south-side multi-family units only).
- Install a northbound right turn lane on Maple Bay Road at Highwood Drive once 268 units are exceeded for the north portion of the site (out of 401 total units).
- Design the development roads should either meet the Municipal standards (in terms of bike facilities and sidewalks) or meet agreements between the developer and the Municipality if alternative cross-sections are pursued for on-site roads.

APPENDIX A: SITE PLAN



Schedule B
Land Use Plan
KingsView

- Boundary of Site
- Proposed Trail Network
- Trail / Street Crossing
- Lots Permiting Secondary Suites

Land Use Area	**Total Area**	**Buildable Area**
Area 1 – Large Lot	8.9 acres	8.9 acres
Area 2 – Standard Lot	31.4 acres	29.2 acres
Area 3 – Standard Lot (Duplex)	0.2 acres	0.2 acres
Area 4 – Small Lot Comprehensive	20.0 acres	19.3 acres
Area 5 – Townhouse	98.5 acres	66.4 acres
Area 6 – Multifamily	11.2 acres	8.7 acres
Area 7 – Multfamily w/ commercial	1.1 acres	1.1 acres
Area 8 – Parks & Open Space	59.0 acres	
Covenanted Green Space	(35.7 acres)	
Road ROWs	32.1 acres	
Totals	**263 acres**	**134 acres**

Note: Secondary suites permitted in Areas 1 & 2.

North Side

Detached	151 units
TH/Multifamily	250 units

South Side

Detached	230 units
TH/Multifamily	649 units
Total:	**1,280 units***

*Based on 11 units/ac for THs and 22 units/ac for Multifamily.

N

0 25 100 200

Scale 1:5,000

September 8, 2015

APPENDIX B: SYNCHRO BACKGROUND

SYNCHRO MODELLING SOFTWARE DESCRIPTION

The traffic analysis was completed using Synchro and SimTraffic traffic modeling software. Results were measured in delay, level of service (LOS) and 95th percentile queue length. Synchro is based on the Highway Capacity Manual (HCM) methodology. SimTraffic integrates established driver behaviours and characteristics to simulate actual conditions by randomly "seeding" or positioning vehicles travelling throughout the network. The simulation is run five times (five different random seedings of vehicle types, behaviours and arrivals) to obtain statistical significance of the results.

Levels of Service

Traffic operations are typically described in terms of levels of service, which rates the amount of delay per vehicle for each movement and the entire intersection. Levels of service range from LOS A (representing best operations) to LOS E/F (LOS E being poor operations and LOS F being unpredictable/disruptive operations). LOS E/F are generally unacceptable levels of service under normal everyday conditions.

The hierarchy of criteria for grading an intersection or movement not only includes delay times, but also takes into account traffic control type (stop signs or traffic signal). For example, if a vehicle is delayed for 19 seconds at an unsignalized intersection, it is considered to have an average operation, and would therefore be graded as an LOS C. However, at a signalized intersection, a 19 second delay would be considered a good operation and therefore it would be given an LOS B. The table below indicates the range of delay for LOS for signalized and unsignalized intersections.

Table A1: LOS Criteria, by Intersection Traffic Control

Level of Service	Unsignalized Intersection Average Vehicle Delay (sec/veh)	Signalized Intersection Average Vehicle Delay (sec/veh)
A	Less than 10	Less than 10
B	10 to 15	11 to 20
C	15 to 25	20 to 35
D	25 to 35	35 to 55
E	35 to 50	55 to 80
F	More than 50	More than 80

APPENDIX C: 2015 EXISTING CONDITIONS

Intersection	
Int Delay, s/veh	8.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	218	6	76	100	9	247
Future Vol, veh/h	218	6	76	100	9	247
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	500	-	300	150	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	63	50	68	68	38	91
Heavy Vehicles, %	3	0	5	2	0	1
Mvmt Flow	346	12	112	147	24	271

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	431	112	0	0	112	0
Stage 1	112	-	-	-	-	-
Stage 2	319	-	-	-	-	-
Critical Hdwy	6.43	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	579	947	-	-	1490	-
Stage 1	910	-	-	-	-	-
Stage 2	735	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	570	947	-	-	1490	-
Mov Cap-2 Maneuver	570	-	-	-	-	-
Stage 1	910	-	-	-	-	-
Stage 2	723	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	20.2	0	0.6
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	570	947	1490	-
HCM Lane V/C Ratio	-	-	0.607	0.013	0.016	-
HCM Control Delay (s)	-	-	20.6	8.9	7.5	-
HCM Lane LOS	-	-	C	A	A	-
HCM 95th %tile Q(veh)	-	-	4	0	0	-

Intersection	
Int Delay, s/veh	1.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	22	2	79	10	6	200
Future Vol, veh/h	22	2	79	10	6	200
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	46	50	71	50	38	91
Heavy Vehicles, %	5	50	6	20	0	1
Mvmt Flow	48	4	111	20	16	220

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	372	121	0	0	131	0
Stage 1	121	-	-	-	-	-
Stage 2	251	-	-	-	-	-
Critical Hdwy	6.45	6.7	-	-	4.1	-
Critical Hdwy Stg 1	5.45	-	-	-	-	-
Critical Hdwy Stg 2	5.45	-	-	-	-	-
Follow-up Hdwy	3.545	3.75	-	-	2.2	-
Pot Cap-1 Maneuver	623	816	-	-	1467	-
Stage 1	897	-	-	-	-	-
Stage 2	784	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	616	816	-	-	1467	-
Mov Cap-2 Maneuver	616	-	-	-	-	-
Stage 1	897	-	-	-	-	-
Stage 2	775	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.2	0	0.5
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	628	1467	-
HCM Lane V/C Ratio	-	-	0.083	0.011	-
HCM Control Delay (s)	-	-	11.2	7.5	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.3	0	-

Intersection	
Int Delay, s/veh	2.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	78	10	212	129	12	125
Future Vol, veh/h	78	10	212	129	12	125
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	500	-	300	150	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	85	83	80	75	38	76
Heavy Vehicles, %	3	0	5	2	0	1
Mvmt Flow	92	12	265	172	32	164

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	493	265	0	0	265	0
Stage 1	265	-	-	-	-	-
Stage 2	228	-	-	-	-	-
Critical Hdwy	6.43	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	534	779	-	-	1311	-
Stage 1	777	-	-	-	-	-
Stage 2	808	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	521	779	-	-	1311	-
Mov Cap-2 Maneuver	521	-	-	-	-	-
Stage 1	777	-	-	-	-	-
Stage 2	788	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	13	0	1.3
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	521	779	1311	-
HCM Lane V/C Ratio	-	-	0.176	0.015	0.024	-
HCM Control Delay (s)	-	-	13.4	9.7	7.8	-
HCM Lane LOS	-	-	B	A	A	-
HCM 95th %tile Q(veh)	-	-	0.6	0	0.1	-

Intersection	
Int Delay, s/veh	0.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	6	2	197	7	6	118
Future Vol, veh/h	6	2	197	7	6	118
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	50	50	85	58	50	72
Heavy Vehicles, %	5	50	6	20	0	1
Mvmt Flow	12	4	232	12	12	164

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	426	238	0	0	244	0
Stage 1	238	-	-	-	-	-
Stage 2	188	-	-	-	-	-
Critical Hdwy	6.45	6.7	-	-	4.1	-
Critical Hdwy Stg 1	5.45	-	-	-	-	-
Critical Hdwy Stg 2	5.45	-	-	-	-	-
Follow-up Hdwy	3.545	3.75	-	-	2.2	-
Pot Cap-1 Maneuver	580	696	-	-	1334	-
Stage 1	795	-	-	-	-	-
Stage 2	837	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	574	696	-	-	1334	-
Mov Cap-2 Maneuver	574	-	-	-	-	-
Stage 1	795	-	-	-	-	-
Stage 2	829	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.2	0	0.5
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	600	1334	-
HCM Lane V/C Ratio	-	-	0.027	0.009	-
HCM Control Delay (s)	-	-	11.2	7.7	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0	-

APPENDIX D: 2015 POST DEVELOPMENT CONDITIONS

Intersection	
Int Delay, s/veh	151.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	574	17	117	181	20	418
Future Vol, veh/h	574	17	117	181	20	418
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	500	-	300	150	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	85	60	70	75	50	92
Heavy Vehicles, %	3	0	5	2	0	1
Mvmt Flow	675	28	167	241	40	454

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	701	167	0	0	167	0
Stage 1	167	-	-	-	-	-
Stage 2	534	-	-	-	-	-
Critical Hdwy	6.43	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	~ 403	882	-	-	1423	-
Stage 1	860	-	-	-	-	-
Stage 2	~ 586	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	~ 392	882	-	-	1423	-
Mov Cap-2 Maneuver	~ 392	-	-	-	-	-
Stage 1	860	-	-	-	-	-
Stage 2	~ 570	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	$ 345.9	0	0.6
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	392	882	1423	-
HCM Lane V/C Ratio	-	-	1.723	0.032	0.028	-
HCM Control Delay (s)	-	-	$ 360	9.2	7.6	-
HCM Lane LOS	-	-	F	A	A	-
HCM 95th %tile Q(veh)	-	-	41.5	0.1	0.1	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	6.8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	193	7	90	51	12	211
Future Vol, veh/h	193	7	90	51	12	211
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	75	50	75	60	40	92
Heavy Vehicles, %	5	50	6	20	0	1
Mvmt Flow	257	14	120	85	30	229

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	452	163	0	0	205	0
Stage 1	163	-	-	-	-	-
Stage 2	289	-	-	-	-	-
Critical Hdwy	6.45	6.7	-	-	4.1	-
Critical Hdwy Stg 1	5.45	-	-	-	-	-
Critical Hdwy Stg 2	5.45	-	-	-	-	-
Follow-up Hdwy	3.545	3.75	-	-	2.2	-
Pot Cap-1 Maneuver	560	771	-	-	1378	-
Stage 1	859	-	-	-	-	-
Stage 2	753	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	546	771	-	-	1378	-
Mov Cap-2 Maneuver	546	-	-	-	-	-
Stage 1	859	-	-	-	-	-
Stage 2	734	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	17.6	0	0.9
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	554	1378	-
HCM Lane V/C Ratio	-	-	0.49	0.022	-
HCM Control Delay (s)	-	-	17.6	7.7	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	2.7	0.1	-

Intersection	
Int Delay, s/veh	13

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	256	28	385	481	31	215
Future Vol, veh/h	256	28	385	481	31	215
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	500	-	300	150	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	85	85	85	85	60	80
Heavy Vehicles, %	3	0	5	2	0	1
Mvmt Flow	301	33	453	566	52	269

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	825	453	0	0	453	0
Stage 1	453	-	-	-	-	-
Stage 2	372	-	-	-	-	-
Critical Hdwy	6.43	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	341	611	-	-	1118	-
Stage 1	638	-	-	-	-	-
Stage 2	695	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	325	611	-	-	1118	-
Mov Cap-2 Maneuver	325	-	-	-	-	-
Stage 1	638	-	-	-	-	-
Stage 2	663	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	63.8	0	1.4
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	325	611	1118	-
HCM Lane V/C Ratio	-	-	0.927	0.054	0.046	-
HCM Control Delay (s)	-	-	69.5	11.2	8.4	-
HCM Lane LOS	-	-	F	B	A	-
HCM 95th %tile Q(veh)	-	-	9.2	0.2	0.1	-

Intersection	
Int Delay, s/veh	5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	96	11	215	180	15	137
Future Vol, veh/h	96	11	215	180	15	137
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	50	50	85	58	50	72
Heavy Vehicles, %	5	50	6	20	0	1
Mvmt Flow	192	22	253	310	30	190

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	658	408	0	0	563	0
Stage 1	408	-	-	-	-	-
Stage 2	250	-	-	-	-	-
Critical Hdwy	6.45	6.7	-	-	4.1	-
Critical Hdwy Stg 1	5.45	-	-	-	-	-
Critical Hdwy Stg 2	5.45	-	-	-	-	-
Follow-up Hdwy	3.545	3.75	-	-	2.2	-
Pot Cap-1 Maneuver	424	551	-	-	1019	-
Stage 1	665	-	-	-	-	-
Stage 2	785	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	410	551	-	-	1019	-
Mov Cap-2 Maneuver	410	-	-	-	-	-
Stage 1	665	-	-	-	-	-
Stage 2	759	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	22.1	0	1.2
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	421	1019	-
HCM Lane V/C Ratio	-	-	0.508	0.029	-
HCM Control Delay (s)	-	-	22.1	8.6	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	2.8	0.1	-

APPENDIX E:2030 LONG TERM CONDITIONS

Intersection	
Int Delay, s/veh	8.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	218	6	88	100	9	287
Future Vol, veh/h	218	6	88	100	9	287
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	500	-	300	150	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	63	50	68	68	38	91
Heavy Vehicles, %	3	0	5	2	0	1
Mvmt Flow	346	12	129	147	24	315

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	492	129	0	0	129	0
Stage 1	129	-	-	-	-	-
Stage 2	363	-	-	-	-	-
Critical Hdwy	6.43	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	534	926	-	-	1469	-
Stage 1	894	-	-	-	-	-
Stage 2	702	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	525	926	-	-	1469	-
Mov Cap-2 Maneuver	525	-	-	-	-	-
Stage 1	894	-	-	-	-	-
Stage 2	691	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	23.6	0	0.5
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	525	926	1469	-
HCM Lane V/C Ratio	-	-	0.659	0.013	0.016	-
HCM Control Delay (s)	-	-	24.1	8.9	7.5	-
HCM Lane LOS	-	-	C	A	A	-
HCM 95th %tile Q(veh)	-	-	4.8	0	0	-

Intersection	
Int Delay, s/veh	1.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	22	2	92	10	6	232
Future Vol, veh/h	22	2	92	10	6	232
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	46	50	71	50	38	91
Heavy Vehicles, %	5	50	6	20	0	1
Mvmt Flow	48	4	130	20	16	255

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	427	140	0	0	150	0
Stage 1	140	-	-	-	-	-
Stage 2	287	-	-	-	-	-
Critical Hdwy	6.45	6.7	-	-	4.1	-
Critical Hdwy Stg 1	5.45	-	-	-	-	-
Critical Hdwy Stg 2	5.45	-	-	-	-	-
Follow-up Hdwy	3.545	3.75	-	-	2.2	-
Pot Cap-1 Maneuver	579	795	-	-	1444	-
Stage 1	879	-	-	-	-	-
Stage 2	755	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	571	795	-	-	1444	-
Mov Cap-2 Maneuver	571	-	-	-	-	-
Stage 1	879	-	-	-	-	-
Stage 2	745	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.8	0	0.4
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	584	1444	-
HCM Lane V/C Ratio	-	-	0.089	0.011	-
HCM Control Delay (s)	-	-	11.8	7.5	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.3	0	-

Intersection	
Int Delay, s/veh	2.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	78	10	246	129	12	145
Future Vol, veh/h	78	10	246	129	12	145
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	500	-	300	150	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	85	83	80	75	38	76
Heavy Vehicles, %	3	0	5	2	0	1
Mvmt Flow	92	12	308	172	32	191

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	562	308	0	0	308	0
Stage 1	308	-	-	-	-	-
Stage 2	254	-	-	-	-	-
Critical Hdwy	6.43	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	486	737	-	-	1264	-
Stage 1	743	-	-	-	-	-
Stage 2	786	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	474	737	-	-	1264	-
Mov Cap-2 Maneuver	474	-	-	-	-	-
Stage 1	743	-	-	-	-	-
Stage 2	766	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	13.9	0	1.1
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	474	737	1264	-
HCM Lane V/C Ratio	-	-	0.194	0.016	0.025	-
HCM Control Delay (s)	-	-	14.4	10	7.9	-
HCM Lane LOS	-	-	B	B	A	-
HCM 95th %tile Q(veh)	-	-	0.7	0.1	0.1	-

Intersection	
Int Delay, s/veh	0.6

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	6	2	229	7	6	137
Future Vol, veh/h	6	2	229	7	6	137
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	50	50	85	58	50	72
Heavy Vehicles, %	5	50	6	20	0	1
Mvmt Flow	12	4	269	12	12	190

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	489	275	0	0	281	0
Stage 1	275	-	-	-	-	-
Stage 2	214	-	-	-	-	-
Critical Hdwy	6.45	6.7	-	-	4.1	-
Critical Hdwy Stg 1	5.45	-	-	-	-	-
Critical Hdwy Stg 2	5.45	-	-	-	-	-
Follow-up Hdwy	3.545	3.75	-	-	2.2	-
Pot Cap-1 Maneuver	533	662	-	-	1293	-
Stage 1	764	-	-	-	-	-
Stage 2	815	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	528	662	-	-	1293	-
Mov Cap-2 Maneuver	528	-	-	-	-	-
Stage 1	764	-	-	-	-	-
Stage 2	807	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.7	0	0.5
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	556	1293	-
HCM Lane V/C Ratio	-	-	0.029	0.009	-
HCM Control Delay (s)	-	-	11.7	7.8	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0	-

Intersection	
Int Delay, s/veh	174.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	574	17	129	181	20	458
Future Vol, veh/h	574	17	129	181	20	458
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	500	-	300	150	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	85	60	70	75	50	92
Heavy Vehicles, %	3	0	5	2	0	1
Mvmt Flow	675	28	184	241	40	498

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	762	184	0	0	184	0
Stage 1	184	-	-	-	-	-
Stage 2	578	-	-	-	-	-
Critical Hdwy	6.43	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	~ 371	864	-	-	1403	-
Stage 1	845	-	-	-	-	-
Stage 2	~ 559	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	~ 360	864	-	-	1403	-
Mov Cap-2 Maneuver	~ 360	-	-	-	-	-
Stage 1	845	-	-	-	-	-
Stage 2	~ 543	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	$ 412.6	0	0.6
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	360	864	1403	-
HCM Lane V/C Ratio	-	-	1.876	0.033	0.029	-
HCM Control Delay (s)	-	-	$ 429.5	9.3	7.6	-
HCM Lane LOS	-	-	F	A	A	-
HCM 95th %tile Q(veh)	-	-	45	0.1	0.1	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	193	7	103	51	12	243
Future Vol, veh/h	193	7	103	51	12	243
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	75	50	75	60	40	92
Heavy Vehicles, %	5	50	6	20	0	1
Mvmt Flow	257	14	137	85	30	264

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	504	180	0	0	222	0
Stage 1	180	-	-	-	-	-
Stage 2	324	-	-	-	-	-
Critical Hdwy	6.45	6.7	-	-	4.1	-
Critical Hdwy Stg 1	5.45	-	-	-	-	-
Critical Hdwy Stg 2	5.45	-	-	-	-	-
Follow-up Hdwy	3.545	3.75	-	-	2.2	-
Pot Cap-1 Maneuver	522	753	-	-	1359	-
Stage 1	844	-	-	-	-	-
Stage 2	726	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	508	753	-	-	1359	-
Mov Cap-2 Maneuver	508	-	-	-	-	-
Stage 1	844	-	-	-	-	-
Stage 2	707	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	19.4	0	0.8
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	517	1359	-
HCM Lane V/C Ratio	-	-	0.525	0.022	-
HCM Control Delay (s)	-	-	19.4	7.7	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	3	0.1	-

Intersection	
Int Delay, s/veh	21.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	256	28	419	481	31	235
Future Vol, veh/h	256	28	419	481	31	235
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	500	-	300	150	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	83	82	85	38	80
Heavy Vehicles, %	3	0	5	2	0	1
Mvmt Flow	284	34	511	566	82	294

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	968	511	0	0	511	0
Stage 1	511	-	-	-	-	-
Stage 2	457	-	-	-	-	-
Critical Hdwy	6.43	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	~ 280	567	-	-	1065	-
Stage 1	600	-	-	-	-	-
Stage 2	636	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	~ 258	567	-	-	1065	-
Mov Cap-2 Maneuver	~ 258	-	-	-	-	-
Stage 1	600	-	-	-	-	-
Stage 2	587	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	116	0	1.9
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	258	567	1065	-
HCM Lane V/C Ratio	-	-	1.102	0.059	0.077	-
HCM Control Delay (s)	-	-	128.4	11.8	8.7	-
HCM Lane LOS	-	-	F	B	A	-
HCM 95th %tile Q(veh)	-	-	12.1	0.2	0.2	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Intersection	
Int Delay, s/veh	3.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	96	11	247	180	15	156
Future Vol, veh/h	96	11	247	180	15	156
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	70	60	87	70	60	75
Heavy Vehicles, %	5	50	6	20	0	1
Mvmt Flow	137	18	284	257	25	208

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	670	412	0	0	541	0
Stage 1	412	-	-	-	-	-
Stage 2	258	-	-	-	-	-
Critical Hdwy	6.45	6.7	-	-	4.1	-
Critical Hdwy Stg 1	5.45	-	-	-	-	-
Critical Hdwy Stg 2	5.45	-	-	-	-	-
Follow-up Hdwy	3.545	3.75	-	-	2.2	-
Pot Cap-1 Maneuver	418	548	-	-	1038	-
Stage 1	662	-	-	-	-	-
Stage 2	778	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	407	548	-	-	1038	-
Mov Cap-2 Maneuver	407	-	-	-	-	-
Stage 1	662	-	-	-	-	-
Stage 2	757	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	18.5	0	0.9
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	420	1038	-
HCM Lane V/C Ratio	-	-	0.37	0.024	-
HCM Control Delay (s)	-	-	18.5	8.6	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	1.7	0.1	-

Intersection	
Int Delay, s/veh	14.8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Traffic Vol, veh/h	343	9	90	128	13	307
Future Vol, veh/h	343	9	90	128	13	307
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Stop	-	None	-	None
Storage Length	0	500	-	300	150	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	83	50	75	80	38	92
Heavy Vehicles, %	3	0	5	2	0	1
Mvmt Flow	413	18	120	160	34	334

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	522	120	0	0	120	0
Stage 1	120	-	-	-	-	-
Stage 2	402	-	-	-	-	-
Critical Hdwy	6.43	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	513	937	-	-	1480	-
Stage 1	903	-	-	-	-	-
Stage 2	673	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	501	937	-	-	1480	-
Mov Cap-2 Maneuver	501	-	-	-	-	-
Stage 1	903	-	-	-	-	-
Stage 2	658	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	36.5	0	0.7
HCM LOS	E		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	WBLn2	SBL	SBT
Capacity (veh/h)	-	-	501	937	1480	-
HCM Lane V/C Ratio	-	-	0.825	0.019	0.023	-
HCM Control Delay (s)	-	-	37.7	8.9	7.5	-
HCM Lane LOS	-	-	E	A	A	-
HCM 95th %tile Q(veh)	-	-	8.1	0.1	0.1	-

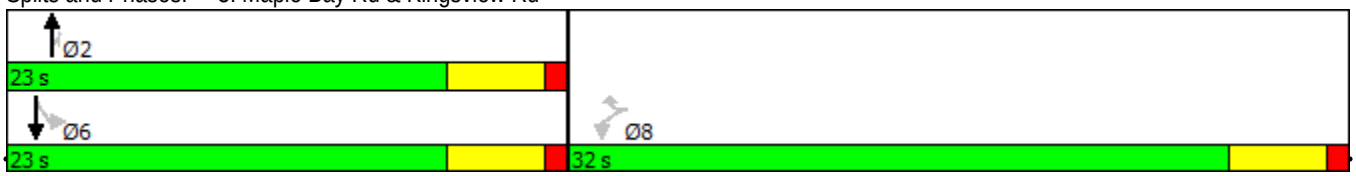
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	574	17	117	181	20	418
Future Volume (vph)	574	17	117	181	20	418
Ideal Flow (vphpl)	1890	1890	1890	1890	1890	1890
Storage Length (m)	0.0	50.0		30.0	15.0	
Storage Lanes	1	1		1	1	
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt		0.850		0.850		
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1724	1589	1780	1557	1776	1843
Flt Permitted	0.950				0.651	
Satd. Flow (perm)	1724	1589	1780	1557	1217	1843
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		28		241		
Link Speed (k/h)	50		60			60
Link Distance (m)	369.2		485.6			120.0
Travel Time (s)	26.6		29.1			7.2
Confl. Bikes (#/hr)					3	
Peak Hour Factor	0.85	0.60	0.70	0.75	0.50	0.92
Heavy Vehicles (%)	3%	0%	5%	2%	0%	1%
Bus Blockages (#/hr)	0	0	0	0	0	1
Adj. Flow (vph)	675	28	167	241	40	454
Shared Lane Traffic (%)						
Lane Group Flow (vph)	675	28	167	241	40	454
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.5		3.5			3.5
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	1.02	1.02	1.02	1.02	1.02	1.03
Turning Speed (k/h)	24	14		14	24	
Number of Detectors	1	1	1	1	1	1
Detector Template						
Leading Detector (m)	15.2	15.2	15.2	15.2	15.2	15.2
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	15.2	15.2	15.2	15.2	15.2	15.2
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Turn Type	Perm	Perm	NA	Perm	Perm	NA
Protected Phases			2			6
Permitted Phases	8	8		2	6	
Detector Phase	8	8	2	2	6	6

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	21.0	21.0	21.0	21.0	21.0	21.0
Total Split (s)	32.0	32.0	23.0	23.0	23.0	23.0
Total Split (%)	58.2%	58.2%	41.8%	41.8%	41.8%	41.8%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	Min	Min	Min	Min
Act Effct Green (s)	22.8	22.8	15.6	15.6	15.6	15.6
Actuated g/C Ratio	0.47	0.47	0.32	0.32	0.32	0.32
v/c Ratio	0.84	0.04	0.29	0.36	0.10	0.77
Control Delay	23.4	3.5	15.2	4.2	13.7	26.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.4	3.5	15.2	4.2	13.7	26.8
LOS	C	A	B	A	B	C
Approach Delay	22.6		8.7			25.7
Approach LOS	C		A			C
Queue Length 50th (m)	51.7	0.0	12.1	0.0	2.7	39.4
Queue Length 95th (m)	#85.6	1.5	17.9	6.6	4.3	#78.1
Internal Link Dist (m)	345.2		461.6			96.0
Turn Bay Length (m)		50.0		30.0	15.0	
Base Capacity (vph)	987	922	679	743	464	703
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.68	0.03	0.25	0.32	0.09	0.65

Intersection Summary			
Area Type:	Other		
Cycle Length: 55			
Actuated Cycle Length: 48.8			
Natural Cycle: 55			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.84			
Intersection Signal Delay: 20.1		Intersection LOS: C	
Intersection Capacity Utilization 62.4%		ICU Level of Service B	
Analysis Period (min) 15			

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Maple Bay Rd & Kingsview Rd



MOVEMENT SUMMARY

Site: Kingsview-Maple Bay Rd AM

Kingsview Rd and Maple Bay Rd RA_AM Peak Hr w Kingsview Development
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Maple Bay Rd											
2	T	123	4.0	0.191	0.1	LOS A	1.3	9.1	0.12	0.03	30.1
3	R	191	2.0	0.191	0.5	LOS A	1.3	9.1	0.12	0.08	30.1
Approach		314	2.8	0.191	0.4	LOS A	1.3	9.1	0.12	0.06	30.1
East: Kingsview Rd											
4	L	604	1.0	0.428	5.1	LOS A	3.0	21.2	0.36	0.50	28.7
6	R	18	0.0	0.428	1.1	LOS A	3.0	21.2	0.36	0.22	29.2
Approach		622	1.0	0.428	5.0	LOS A	3.0	21.2	0.36	0.49	28.7
North: Maple Bay Rd											
7	L	21	0.0	0.490	8.9	LOS A	3.9	28.1	0.80	0.98	28.5
8	T	440	2.0	0.490	4.6	LOS A	3.9	28.1	0.80	0.76	28.4
Approach		461	1.9	0.490	4.8	LOS A	3.9	28.1	0.80	0.77	28.4
All Vehicles		1397	1.7	0.490	3.9	LOS A	3.9	28.1	0.45	0.49	28.9

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Kingsview-Maple Bay Rd PM

Kingsview Rd and Maple Bay Rd RA_PM Peak Hr w Kingsview Development
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Maple Bay Rd											
2	T	405	2.0	0.547	0.3	LOS A	5.2	37.2	0.22	0.06	29.9
3	R	506	1.0	0.547	0.6	LOS A	5.2	37.2	0.22	0.09	29.8
Approach		912	1.4	0.547	0.5	LOS A	5.2	37.2	0.22	0.07	29.8
East: Kingsview Rd											
4	L	269	1.0	0.268	6.5	LOS A	1.6	11.5	0.56	0.64	28.4
6	R	29	0.0	0.268	2.5	LOS A	1.6	11.5	0.56	0.43	28.6
Approach		299	0.9	0.268	6.1	LOS A	1.6	11.5	0.56	0.62	28.4
North: Maple Bay Rd											
7	L	33	0.0	0.216	5.7	LOS A	1.3	9.4	0.48	0.85	29.3
8	T	226	2.0	0.216	1.3	LOS A	1.3	9.4	0.48	0.22	29.2
Approach		259	1.7	0.216	1.9	LOS A	1.3	9.4	0.48	0.30	29.2
All Vehicles		1469	1.4	0.547	1.9	LOS A	5.2	37.2	0.34	0.23	29.4

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: 2030 Kingsview-Maple Bay Rd AM

Kingsview Rd and Maple Bay Rd RA_AM Peak Hr w Kingsview Development
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Maple Bay Rd											
2	T	136	4.0	0.199	0.1	LOS A	1.3	9.6	0.12	0.03	30.1
3	R	191	2.0	0.199	0.5	LOS A	1.3	9.6	0.12	0.08	30.0
Approach		326	2.8	0.199	0.4	LOS A	1.3	9.6	0.12	0.06	30.1
East: Kingsview Rd											
4	L	604	1.0	0.434	5.2	LOS A	3.1	21.6	0.38	0.51	28.6
6	R	18	0.0	0.434	1.2	LOS A	3.1	21.6	0.38	0.23	29.1
Approach		622	1.0	0.434	5.1	LOS A	3.1	21.6	0.38	0.50	28.7
North: Maple Bay Rd											
7	L	21	0.0	0.537	9.6	LOS A	4.8	33.8	0.83	1.03	28.3
8	T	482	2.0	0.537	5.2	LOS A	4.8	33.8	0.83	0.83	28.3
Approach		503	1.9	0.537	5.4	LOS A	4.8	33.8	0.83	0.84	28.3
All Vehicles		1452	1.7	0.537	4.1	LOS A	4.8	33.8	0.48	0.52	28.8

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: 2030 Kingsview-Maple Bay Rd PM

Kingsview Rd and Maple Bay Rd RA_PM Peak Hr w Kingsview Development
Roundabout

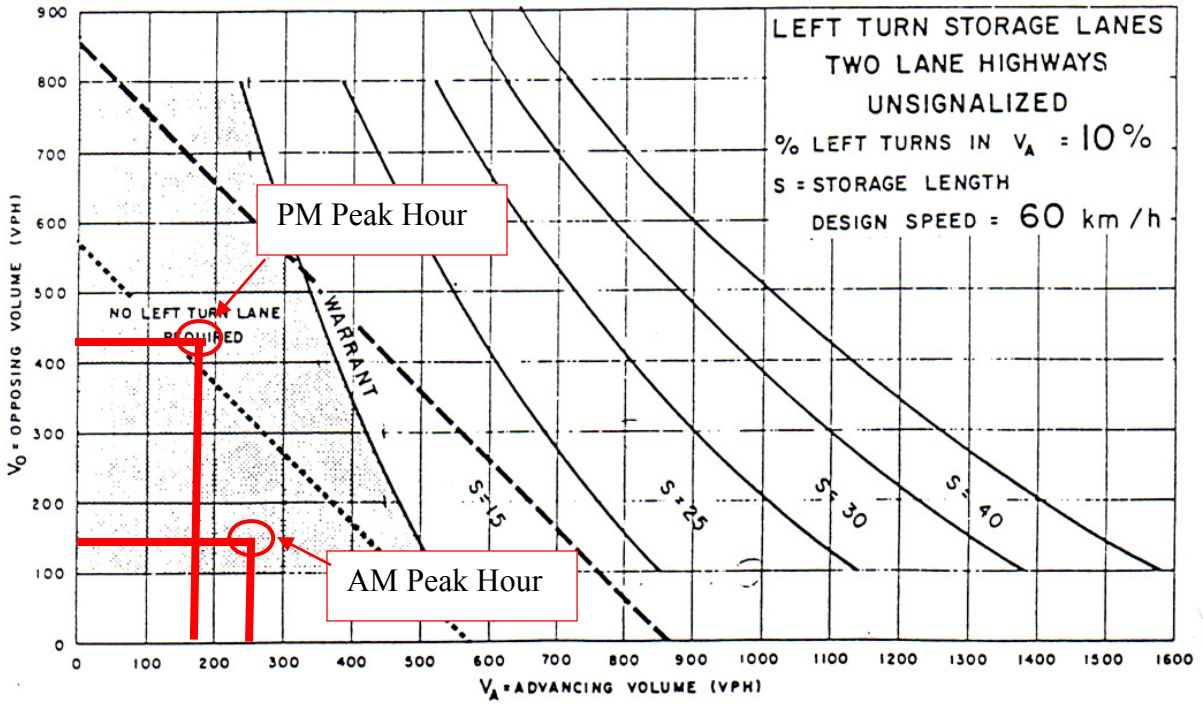
Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Maple Bay Rd											
2	T	441	2.0	0.568	0.3	LOS A	5.7	40.1	0.23	0.06	29.8
3	R	506	1.0	0.568	0.6	LOS A	5.7	40.1	0.23	0.09	29.8
Approach		947	1.5	0.568	0.5	LOS A	5.7	40.1	0.23	0.07	29.8
East: Kingsview Rd											
4	L	269	1.0	0.275	6.7	LOS A	1.7	11.9	0.59	0.66	28.3
6	R	29	0.0	0.275	2.7	LOS A	1.7	11.9	0.59	0.47	28.5
Approach		299	0.9	0.275	6.3	LOS A	1.7	11.9	0.59	0.64	28.3
North: Maple Bay Rd											
7	L	33	0.0	0.234	5.7	LOS A	1.5	10.4	0.49	0.85	29.3
8	T	247	2.0	0.234	1.3	LOS A	1.5	10.4	0.49	0.22	29.2
Approach		280	1.8	0.234	1.8	LOS A	1.5	10.4	0.49	0.30	29.2
All Vehicles		1526	1.4	0.568	1.9	LOS A	5.7	40.1	0.35	0.23	29.4

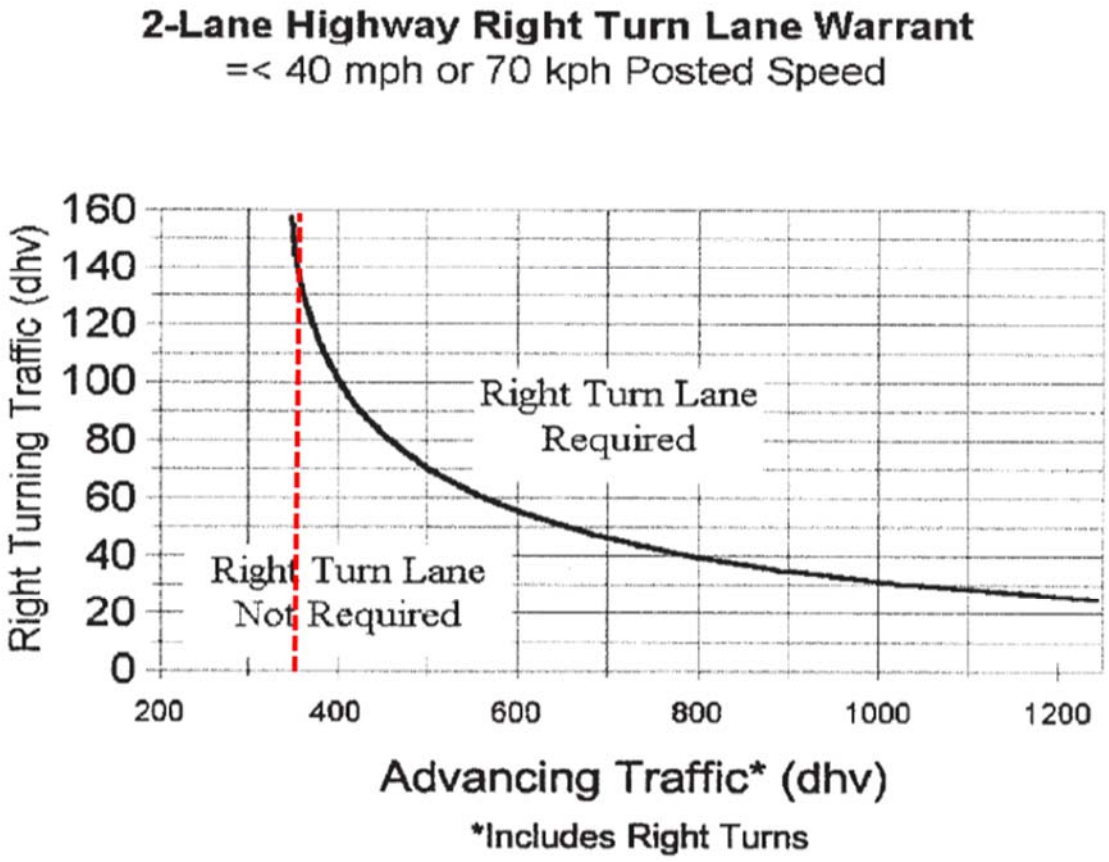
Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

APPENDIX F: TURN LANE WARRANT REVIEW

BC MoTI Left Turn Lane Warrant, 2030 Post-Development, Maple Bay Road at Highwood Drive

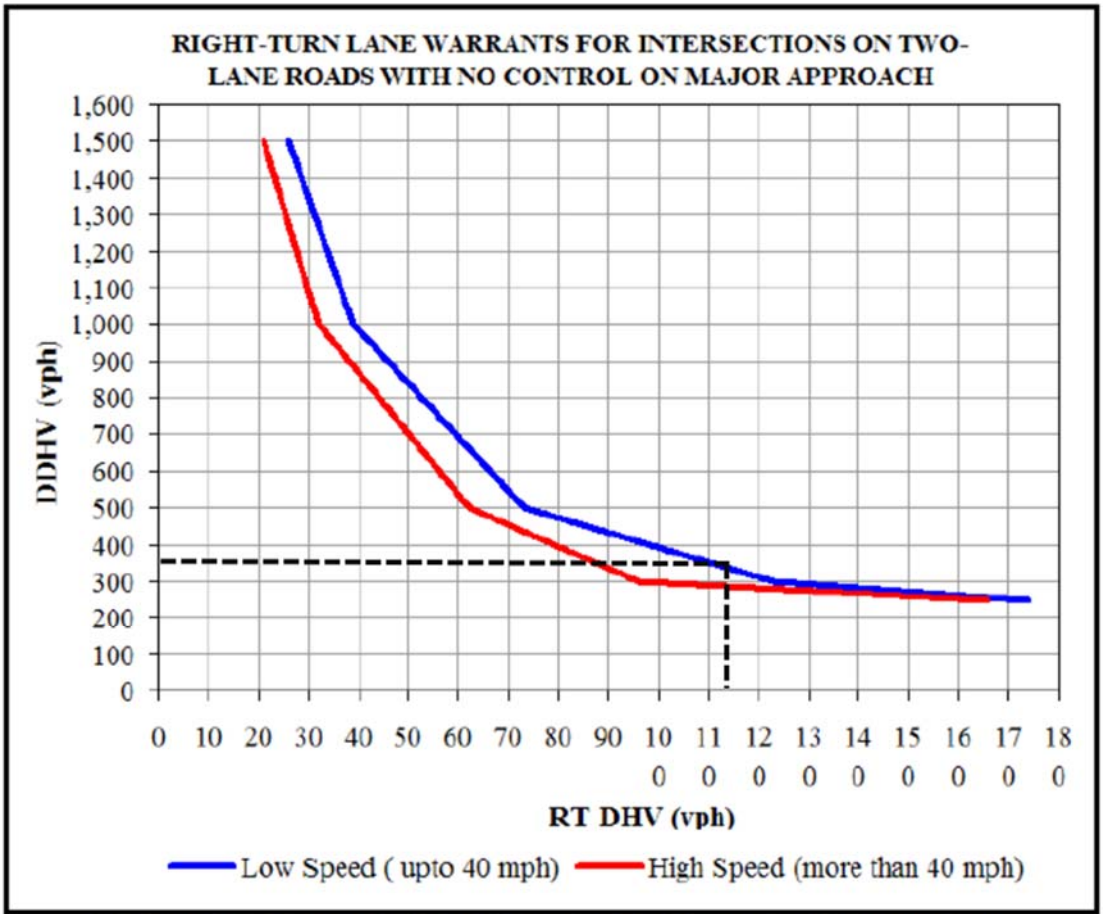


Ohio DOT Right Turn Lane Warrant for Maple Bay Rd at Highwood Dr, 2030 Horizon (not warranted until 130 right turning vehicles plus future traffic growth)



Source:
http://www.dot.state.oh.us/Divisions/Engineering/Roadway/DesignStandards/roadway/Location%20and%20Design%20Manual/Section_400_July_2013.pdf

Minnesota DOT Right Turn Lane Warrant for Maple Bay Rd at Highwood Dr, 2030 Horizon (not warranted until 115 right turning vehicles plus future traffic growth)



Minimum Right-turn DHV (vph) Required to Warrant a Right-turn Lane
(Right-turn Lane Cost = $50,000 / Cost of Fuel = $3)

Speed (mph)	DDHV (vph)							
	100	150	200	250	300	500	1,000	1,500
≤ 40	NA	NA	NA	174	123	73	39	26
> 40	NA	NA	NA	166	96	62	32	21

Figure 6.10. Right-turn lane warrants for intersections (fuel cost $3/gallon, delay cost $13/hr, right-turn lane cost $50,000).

Source: http://www.lrrb.org/media/reports/200825.pdf