OCEANVIEW
GOLF RESORT & SPA
VANCOUVER ISLAND

# MASTER PLAN APPENDICES

OCTOBER 29, 2009

# APPENDIX A - WILDLAND URBAN INTERFACE FIRE HAZARD ASSESSMENT


# Strathcona Forestry Consulting

# WILDLAND URBAN INTERFACE FIRE HAZARD ASSESSMENT:

**Oceanview Golf Resort and Spa**
**Nanaimo, BC**

*Prepared for:*
Oceanview Golf Resort and Spa Ltd.

*As a requirement for:*
THE CITY OF NANAIMO

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# WILDLAND URBAN INTERFACE FIRE HAZARD ASSESSMENT

## Oceanview Golf Resort and Spa


## Synopsis

1. The wildland urban interface is the zone where structures and other human developments meet and/or intermix with wildland fuels (vegetation). In accordance with guidelines established by the City of Nanaimo for development in the interface zone, Strathcona Forestry Consulting conducted a wildland urban interface assessment of Oceanview Golf Resort and Spa, a development proposed on approximately 200 hectares at Cable Bay, southeast of Nanaimo, BC.

2. Proposed development includes a golf course, estate housing, duplexes, townhouses, multifamily housing, and a hotel. A total of approximately 3,200 units would be phased over two decades. Approximately half the site will be designated "green space" (parks and trails, Environmentally Sensitive Areas, golf course).

3. Methodology used to assess the interface fire hazard at the site was based on standard fire danger and risk-hazard analyses. Key fire behaviour output factors were evaluated in consideration to ignition potential, rate of spread, and potential crown fraction burned. Fuel type characteristics were combined with fuel output factors to determine potential wildfire severity. FireSmart criteria were used to determine the interface fire hazard ranking. Hazard-risk modeling was used to assess risk management.

4. The overall interface fire hazard at the site is rated Extreme. A combination of challenging topography, neighbouring interface, inaccessibility, delayed Fire Department response time, and continuous fuel complexes create an undesirable fire situation.

5. A mitigation plan was formulated to reduce the fire threat to property, people, and adjacent properties and wildlands. Mitigation addresses vegetation management, structural design features, and planning tools. Examples of mitigative measures include fuel reduction along forested boundaries, fire resistant construction, and infrastructure improvements (i.e., access, fireflow).

6. Recommendations provided in this report are designed to facilitate cooperative action by the developer, future property and local government. If the recommended mitigation is carried out, the interface fire hazard can be reduced to acceptable levels (i.e., moderate). Long-term implementation of mitigative measures is essential to ensure protection for life, property, and ecological processes in the wildland urban interface.

## BACKGROUND

### The Wildland Urban Interface Zone

The interface (wildland urban interface) describes any area where combustible wildland fuels are found adjacent to homes or other buildings. Fuels may occur at the interface, where development and wildland fuels (vegetation) meet at a well-defined boundary, or in the intermix, where development and wildland fuels intermingle with no clearly defined boundary (*FireSmart*, Partners in Protection, 2003).

Successful fire suppression over the last fifty years has increased natural fuel loads. The United Nations Intergovernmental Panel on Climate Change (2007) predicts global climate change will extend the duration of fire seasons and increase wildfire frequencies in fire-prone regions with mild climates (i.e., southeast Vancouver Island).

Expanding population density and increased human activity at the interface zone are responsible for a growing number of human-caused wildfires on southeast Vancouver Island (Ministry of Forests and Range, 2009). Wildfire in the interface zone is a cause of deep concern for fire fighting agencies.

Effective hazard mitigation can be incorporated into the design and planning stages of interface development if local government, developers, and property owners are made aware of the dangers inherent in a selected site or in building or infrastructure plans.

Photo. Firefighting in the interface zone.

### Proposed Development: Oceanview Golf Resort and Spa

In accordance with guidelines established by the City of Nanaimo for development in the interface zone, Oceanview Golf Resort and Spa Ltd. retained Strathcona Forestry Consulting to provide a Wildland Urban Interface (WUI) assessment of a golf resort and spa proposed at Cable Bay, southeast of Nanaimo, BC. The project is designed to be phased over approximately twenty-five years.

## Location of Oceanview Golf Resort and Spa

The subject property occupies the northeastern portion of the Cedar peninsula, a short distance east of the Duke Point ferry terminal, approximately 15 km southeast of the City of Nanaimo (Figure 1). Bordered on the west by private industrial lands (including the Harmac pulp mill), and to the south by rural lands in the District of Cedar, the subject property straddles Cable Bay (to the north), and Stuart Channel (to the east). Most of the subject property lies within the boundaries of the City of Nanaimo. The area is contained within the Regional District of Nanaimo (RDN).


Figure 1. The arrow indicates the approximate location of Oceanview Golf Resort and Spa at Cable Bay, southeast of Nanaimo, BC.

## Description of Proposed Development

Oceanview Golf Resort and Spa Ltd. ("the developer") plans to develop the subject site with an 18-hole professional golf course, a variety of housing units (estate, duplex, townhouse, multifamily, and employee housing), and a hotel complex. A total of approximately 3,200 units is proposed.

Photo. The eastern portion of the proposed development property overlooks Dodds Narrows (foreground). The northern portion of the property fronts Cable Bay (background).

The subject property, which is not presently serviced, is to be developed with piped city water, above-ground utilities (power, cable), and looping strata roads. Current road access to the site is limited to abandoned logging roads (secured with gates at property boundaries). New primary access from the north-west (Phoenix Way) will connect the property to Nanaimo. At the southwest, primary new access will be developed at Lindsey Road, while Nicola Road will provide secondary access to Cedar.

Photo. Overgrown logging roads crisscross the subject property.

Much of the development will consist of "green space", including retention of approximately 12 ha of Environmentally Sensitive Areas (ESA's), creation of approximately 30 ha of parkland, and a 60+ ha golf course. The popular Cable Bay Trail, which winds diagonally through the property, will be retained in a 10 m trail envelope, protected by an additional 10 m no-build zone along the western boundary where it fringes proposed residential lots. The trail will continue to be managed by the City of Nanaimo Parks Department.

Photo. A forested buffer will be retained along the popular Cable Bay Trail.

## Field Assessment

Strathcona Forestry Consulting conducted several site visits to the subject property between October 2006 and April 2009.

Zeidler Partnership provided site plan maps.

In the process of conducting my assessment, I consulted the environmental and archaeological assessments being prepared by Madrone Environmental Services Ltd. terrain analysis (Lewkowich Geotechnical Engineering Ltd.), and the golf course design plan (BH Golf Design).

I contacted the Nanaimo Fire Department regarding call history, and existing and future suppression capabilities at the area. The Ministry of Forests and Range (MoFR) Protection Branch (Coastal Fire Zone) provided fire history data and information about fire weather conditions.

Photo. Mixed stand of conifers and bigleaf maple trees at the subject property.

## Regulatory Provisions

Development of Oceanview Golf Resort and Spa is subject to various municipal and provincial regulations. The property falls under several Municipal Development Permit Areas defined by the City of Nanaimo Official Community Plan (Bylaw 6000), including Environmentally Sensitive Areas, Riparian Areas, and Steep Slope Development.

Development plans include the protection of Environmentally Sensitive Areas (ESA's) on approximately 13 ha of the subject property.

The provincial Riparian Area Regulation (RAR) protects streams and wetlands. Under the Riparian Area Regulation (RAR), riparian setback areas are designed to maintain the function of riparian vegetation for fish and wildlife values.

Portions of the subject property lies within DPA 25 (steep slope development), and must adhere to municipal measures regarding slope stability. Limited development will take place in these areas. Where development is permitted in steeper areas, adequate vegetation setbacks should be provided around structures (to reduce potential fire spread).

Photo. Forest canopy at subject property.

## BIOPHYSICAL DESCRIPTION

The subject property is classified in the moist maritime Coastal Douglas-fir Biogeoclimatic Subzone (CDFmm). The CDFmm represents the mildest climate in Canada. Summers are generally warm and dry, while winters are wet and mild. Growing seasons are very long, and feature pronounced water deficits on zonal (average) and drier sites. Long periods of droughts are not uncommon during the fire season (April to October).

Prevailing weather systems in summer can vary from moderately moist to windy and excessively dry patterns. Prevailing summer winds are northwesterly. Net radiation values are generally high.

### Physiographic Features

The subject property is gently rolling to very hilly. Aspect is generally northwesterly to northeasterly (with many local variations).

Photo. The subject property is gently rolling to very hilly.

Soils in the area developed in shallow, sandy, gravelly, colluvial, or morainal deposits, between 10 and 50 cm deep, overlying sedimentary (Late Cretaceous Nanaimo Group sandstone or conglomerate) bedrock. Inclusions of soils between 50 and 100 cm also occur. Gravelly loamy sand is the common texture. Drainage is generally rapid (except in small, localised depressions). Coarse fragment varies between 30 and 75%. The usual taxonomic classification of soils in the area is Orthic Dystric Brunisol (shallow lithic phase). A range of humus forms are present. Lignomors and mormoders dominate upland coniferous areas. Mullmoders and rhizomulls are more common at riparian sites.

**Vegetative Features**

Continuous stands of forests once covered southeast Vancouver Island, including much of the Cedar peninsula. Coniferous stands dominated by Douglas-fir were interspersed with mixed-wood stands in wetter areas, and terrestrial herbaceous ecosystems on drier upland sites.

The subject property is characterised by human disturbance. Long before the arrival of Europeans on Vancouver Island, local First Nations peoples developed sustainable harvesting practices (including prescribed fire) to cultivate indigenous plants for food, medicine, tools, and shelter. Coastal middens provide evidence of aboriginal activity at the subject area (archaeological surveys: Madrone Environmental Services Ltd.)

Logging and mining commenced in conjunction with settlement of the lands by Europeans in the late 1800's, continuing into the 21st century. About sixty years ago, the forestry conglomerate, MacMillan Bloedel, purchased the subject property and neighbouring lands (including the site to the west, where a pulp mill was built). Well sites and associated industrial infrastructure were constructed at the subject property. In the last decade, significant areas of second-growth stands at the subject property were logged prior to the acquisition of the site by the present owners. These areas were not re-planted.

Photo. Substantial portions of the subject property were logged prior to acquisition by the current owners.

Moderately dry forest ecosystems dominate much of the subject property. Areas cleared prior to acquisition of the property by the present owners contain discontinuous to continuous growth of native and invasive brush (Structural Stage 3a & 3b – see Appendix 1 for Description of Structural Stages) and scattered trees (Structural Stage 4 & 5). Young (Structural Stage 5) and mature second-growth stands (Structural Stage 6) occupying the site are dominated by Douglas-fir, with lesser amounts of western red cedar and grand fir. Mixed stands of mature forest are found in the riparian gully along lower portions of the Cable Bay trail. Small wetlands border portions of the trail.

Photo. Terrestrial herbaceous ecosystem at subject property.

Several sensitive ecosystems occupy the subject property. Moss-covered rock outcrops support terrestrial herbaceous ecosystems with shallow soils and scattered trees and shrubs.

Riparian ecosystems border streams and small wetlands, where soil moisture and light conditions favour nitrophytic and shade-tolerant plants distinct from surrounding land areas. Riparian ecosystems provide critical habitat for wildlife: food, cover, and water. Additionally, riparian vegetation helps to maintain the water quality and health of streams and rivers, and reduces erosion.

Terrestrial herbaceous ecosystems and riparian ecosystems present low fire hazards. Sparse tree cover at terrestrial herbaceous ecosystems negatively affects fire behaviour. Shaded, moist conditions at riparian ecosystems reduce the potential for fire start and spread.

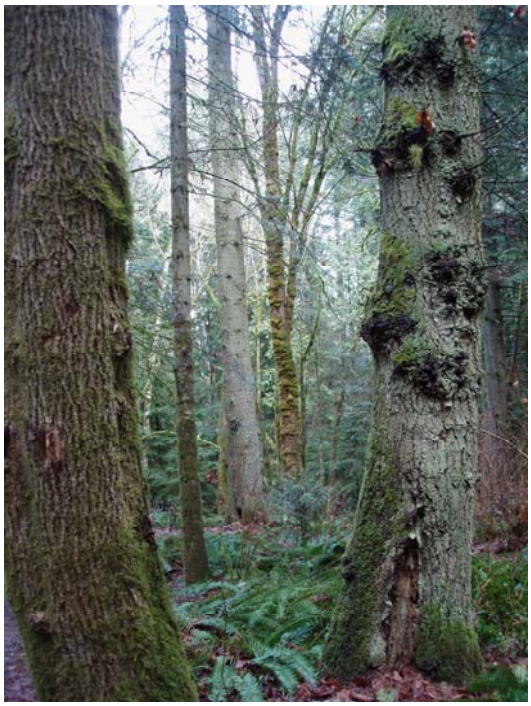


Photo. Mixed deciduous stands prevail in riparian areas.

On its southwestern boundary, the subject property borders an undeveloped block of private forested land. Stand structure here consists of young and mature forest, with dense, well developed understoreys. Fuel loading (combustible natural fuels) is high.

Photo. Second-growth forest occupies private land at the southwest corner of the subject property.

Root rot diseases, which are endemic to the forests of British Columbia, have a moderate (to high) incidence at the site. Root rot infection pockets (pockets of toppled trees, often with no apparent orientation) occur throughout the property. In areas where there is a high incidence of root rot, diseased and dying timber can pose a fire threat.

Photo. Root rot infection pocket, with windthrown coniferous trees, at the subject property.

Moderate to major encroachment of invasive species (i.e., broom, holly, daphne, blackberry, ivy) has occurred at the site. Newly cleared construction areas will be vulnerable to ingress of invasive weed species, and should be promptly landscaped with native, fire-resistive species. Broom is a noxious and combustible invasive brush species.

Photo. Broom, an undesirable invasive brush species, is prevalent on the southwest border of the property.

## FIRE: PAST AND PRESENT

### Natural Disturbance History

For thousands of years prior to European settlement, infrequent fires swept through the forests of southeastern Vancouver Island (Table 1). Lightning ignited most fires. As noted earlier, aboriginal people set fires to cultivate plants for food, medicine, and other uses. The resulting landscape was a varied mosaic of forest stands and habitats. Periodic low intensity surface fires reduced natural fuel loading and recycled nutrients.

Photo. Fire-scarred stump and surrounding second-growth forest.

**Table 1. Mean forest fire return interval and fire size**

| Biogeoclimatic Unit | Mean Historical Wildfire Fire Return Interval (Years) | | | Fire Size (ha) | | |
|---|---|---|---|---|---|---|
| | Minimum | Average | Maximum | Minimum | Average | Maximum |
| CDFmm | 50-100 | 100-300 | 300-400 | 0.1-5 | 5-50 | 150-550 |

**(BC Ministry of Forests and Range)**

In the last century, the demise of traditional aboriginal cultural land management practices, and the advance of modern fire suppression have produced a significant increase in fuel loading (vegetation).

### Recent Fire History

The Ministry of Forests and Range Protection Branch maintains a database of wildfires that have occurred in the area over the last fifty years (Ministry of Forests and Range, Coastal Fire Centre, 2009). Both human-caused and lightening-caused fires are recorded. Lightening typically accounts for very few wildfires on the coast. Nearly 100% of wildland fires in the South Island Coastal Fire Zone are human-caused. In the last two decades, the Ministry of Forests and Range has suppressed several small (generally < 1 ha) wildfires in the Duke Point-Cedar area.

Over the last decade, fire weather data from the Ministry of Forests and Range indicate an average of over 15% of total days in Fire Class Hazard 3 (moderate danger class).

## Fire Protection

The Nanaimo Fire Department (NFD) provides service to the Duke Point/Cable Bay area. The Nanaimo Fire Department has expressed concerns about fire protection at the Oceanview Golf Resort and Spa development (discussion with NFD Fire Chief R. Lambert, 2006, 2009). According to the Fire Department, response time to the site is 15 minutes (considered a "lengthy" response time).

Fire department response time is the elapsed time, in minutes, from when the first fire fighting unit is dispatched to when the first fire fighting unit arrives at the emergency scene. Response time is inclusive of alarm processing, member turnout, and travel time for the apparatus. Standards for the deployment of fire suppression operations (i.e., response times) are maintained by the National Fire Protection Association (NFPA).

Fire department intervention time is crucial in determining the consequences of a fire in terms of deaths, injuries, and loss of property and damage to the environment. An early aggressive and offensive primary interior attack on a working fire is usually the most effective strategy to reduce the loss of lives and property damage. In the graph in Figure 2, the line represents a rate of fire propagation, which combines temperature rise and time. The line roughly represents the percentage of property destruction. In less than 10 minutes, a structural fire generally progresses to the point of flashover (very rapid spreading of fire due to the superheating of room contents and other combustibles). Data generated by NFPA provides empirical data that rapid and aggressive attack can substantially reduce the human and property losses associated with structural fires (NFPA 1710).

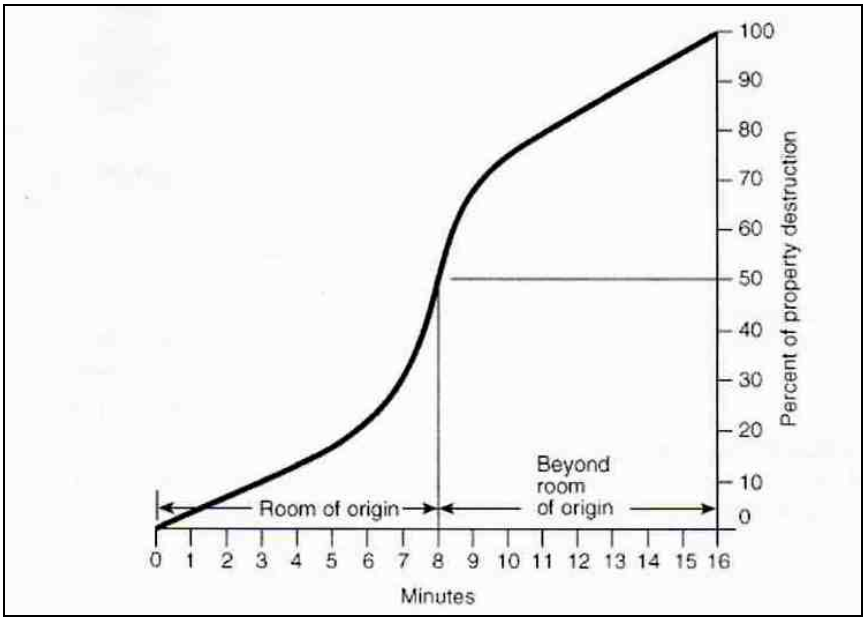



Figure 2. Fire Propagation Curve.

The Nanaimo Fire Department automatically responds to structure fires and small, easily accessible bush fires. Assistance from the Ministry of Forests and Range is requested when larger brush fires occur within the jurisdiction.

The Nanaimo Fire Department operates under a mutual aid agreement with fire departments from neighbouring jurisdictions (including North Cedar – south of the proposed development site). In the case of a serious fire in the area, mutual aid from adjoining fire departments would benefit fire suppression by pooling manpower and resources (water supply, water tenders, etc.). North Cedar's Station 4 on Cranberry Avenue is staffed daytime only with career members. During the night, response would be an aggregation of career engine from Station 1 downtown and the on-call engine ("volunteer" firefighters) from Station 4. Presently, Station 4 is planned to be staffed 24/7 in July 2010. The Fire Department notes that current response time from Station 4 may be within 10-12 minutes, provided it is from the Duke Point Highway side. Response time to the southern portion of the site, via the Holden Courso route, would add significant time. Turnout time of volunteers increases response time.

Development plans for Oceanview Golf Resort and Spa include a fire station in the northeast portion of the property. From the perspective of the Nanaimo Fire Department, it would be desirable to view the proposed firehall on a larger community scale if it is to be considered a publicly operated function (discussion with NFD Fire Chief, 2009). Several years ago the Fire Department undertook a comprehensive 'standard of response coverage study'. The Plan that resulted from that study established a city-wide target based on a performance measure of having the first engine arrive on scene within 6 minutes, 90 percent of the time. Given that response time target, the entire Duke Point/Cable Bay area was identified as being deficient. Because the incident rate is currently very low in the area, the Fire Department reasons it does not justify resourcing at this point in time.

In view of the population potential of the Oceanview Golf Resort and Spa, and increased growth and incident experience from Duke Point, the Fire Department notes that at some point in the future, demands may well justify additional resourcing in this (larger) area. The ultimate fire station location needs to service the broader area to be cost effective in the community funding perspective.

***Fire Suppression Capabilities***

An adequate and reliable water supply for firefighting is an essential part of a community's fire protection system. The BC Building Code states all structures (proposed and existing) within interface areas should have a water supply for firefighting purposes that meets requirements of either the FUS (Fire Underwriters Survey) or the National Fire Protection Association (NFPA).

Water supply for fire protection in serviced areas generally consists of a piped system in common with domestic potable water (water mains and hydrants). The subject site is to be supplied with City of Nanaimo piped water in conjunction with development. Connection with the City water system should meet all municipal, BC Building Code, and FUS requirements for hydrants (and interior sprinkling).

## HAZARD ASSESSMENT METHODOLOGY

The field investigation involved a detailed analysis of the interface fire hazard that the site is exposed to, from the perspective of the general area, local site, and proposed and existing structures (in the vicinity). I inspected terrain in the site's interior, along the perimeters, and for a distance of up to 100+ m beyond the project site boundaries.

Hazard assessment methodology was based on standard fire danger and hazard assessment models:

1) The **Canadian Forest Fire Danger Rating System** (CFFDRS) – internationally recognised fire danger rating system

2) **FireSmart Interface Community Fire Hazard analysis** - quantitative assessment of interface fire hazard (based on FireSmart)

3) **Hazard, Impact, Risk and Vulnerability (HIRV) model** – community risk assessment

**1. Canadian Forest Fire Danger Rating System**: Developed by Forestry Canada, the CFFDRS comprises two major subsystems: the Fire Weather Index (FWI) system and the Fire Behaviour Prediction (FBP) system.

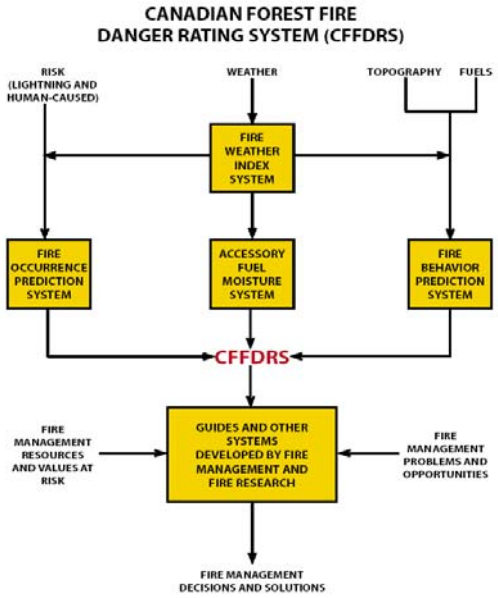



Figure 3. Canadian Forest Fire Danger Rating System.

The Fire Weather Index system accounts for the effects of fuel moisture and wind on ignition potential and probable fire behaviour. Fuel moisture codes reflect the fuel moisture content of fine surface litter (Fine Fuel Moisture Code – FFMC), loosely compacted duff of moderate depth (Duff Moisture Code – DMC), and deep compact organic matter (Drought Code – DC).

The FWI fuel moisture codes plus wind are linked in pairs to form two intermediate and one fire behaviour index. The Initial Spread Index (ISI) combines the effects of wind and fine fuel moisture content (FFMC). The Buildup Index (BUI), based on DMC and DC represents a measure of the total fuels for combustion.

The Fire Behaviour Prediction System predicts how wildfire will behave under extreme weather conditions. The Fire Behaviour System uses benchmark fuel types to forecast how a wildfire will react. Any substance that will burn is a fuel. Forest fuel types are described according to characteristics of the forest layer in which they are burning – ground, surface, or crown:

- Ground fires creep through the duff (organic soil) and decaying woody material beneath the forest floor. Ground fires often smolder for a long time, and are persistent, slow burning, and difficult to detect.

- Surface fires burn needles, cones, twigs, branches, logs, stumps, and leaves on the forest floor, in addition to lower branches of standing timber.
  Surface fuels include "ladder fuels" (aerial fuels) – i.e., branches, leaves, and bark on tall bushes; the lower branches of trees; or young understorey trees – which help ground and surface fires spread upward through the forest canopy into the tree crowns. Surface fires spread more rapidly by wind.

- Crown fires burn in the upper foliage and branches, and also consume surface and ground fuels. Crown fires occur when high-intensity surface fire spreads ("ladders") through the lower foliage into the canopy above. Crown fires spread from tree to tree.
  Crown fires travel quickly, are difficult to control, and are the most destructive fires.

Fire weather, fuel types and topography are used to predict three output fire behaviour factors:

1. Fire Intensity – a measure of the rate of heat energy released – based on the rate of spread and predicted fuel consumption.

2. Rate of Spread – measure of the speed at which a fire extends horizontally – based on the hourly Initial Spread Index (ISI) value, and adjusted for steepness of slope.

3. Crown Fraction Burned – measure of the proportion of tree crown involved in a fire – based on the rate of spread, crown base height, and foliar moisture content.

Severity of wildfire hazard is measured using the following key components:

- Fire behaviour
- Risk of ignition
- Structures at risk
- Suppression constraints

**2. FireSmart Interface Community Fire Hazard Analysis:** The Ministry of Forests and Range Protection Branch "Interface Community Fire Hazard" analysis (customised for use on the BC south coast) provides a quantitative procedure for assessing the interface fire hazard. Over 23 risk factors are rated.

Based on FireSmart, the Interface Community Fire Hazard analysis assigns points – the greater the hazard, the greater the number of points – to each risk factor. Hazard categories are low, moderate, high, and extreme (Table 2). An interface area, site, or structure is not considered to be "fire safe" unless it obtains a low or moderate assessment score.

**Table 2. Wildland-Urban Interface (WUI) fire hazard rating classes:**

**Low – urban, suburban, and farm areas with modified forest fuels, generally flat terrain; no readily combustible vegetation; low risk to adjacent development**
**Moderate – partially modified forest fuels; scattered mixed forest in suburban areas; moderate to good water availability; homes and structures may be threatened**
**High – areas with little or no fuel modification; continuous ground fuels; sloping terrain with/without gullies present; moderate to low availability of water; some areas hard to access**
**Extreme – areas with little or no fuel modification, continuous ground fuels; rolling and gullied terrain; rock outcrops may be present; low water availability; some inaccessible terrain; may or may not be heavy use areas; direct threat to homes/structures/values.**

**3. Hazard, Impact, Risk and Vulnerability (HIRV) Process:** Risk assessments allow communities to anticipate and reduce the impacts of natural and manmade hazards by analysing current and historical data and information resources. The HIRV process consists of Hazard Identification, Risk Analysis, Vulnerability Assessment, Impact Analysis, and Risk Management.

Hazard can be loosely thought of as the product of risk, vulnerability, exposure, and the capacity of humans to respond to extreme conditions. For the purposes of this report, hazard refers to an unplanned or unwanted natural or human-caused fire, or a prescribed fire that threatens to escape.

Risk is a measure of the probability of occurrence of an event and the expected severity, and an analysis of potential factors (human or natural) which can contribute to the potential for fire occurrence.

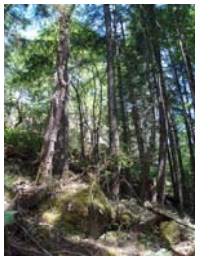
Risk should not be confused with risk of ignition. For the purposes of this report, the probability of ignition can be accounted for by assigning a higher hazard rating to areas where fires are most likely to be started.
Vulnerability defines the ability of people, property, industry, resources, and areas of environmental and historic concern to weather, resist, or recover from the impacts of a hazard in the long term as well as the short term.

Impact is assessed through an analysis of social, environmental, economic, and political factors. Impact analysis provides the necessary links between vulnerabilities and hazards.

## ASSESSMENT RESULTS

### 1. Canadian Forest Fire Danger Rating System.

Five generic fuel types were identified at the proposed development site: coniferous stands, mixed wood stands, deciduous (riparian) stands, dispersed woody stands (mossy rock outcroppings with dispersed tree/shrub layer), and slash areas (logged) (photos below). Output fire behaviour factors (fire intensity, rate of spread, crown fraction burned) are compared for different fuel types in Table 3 on the following page.


Coniferous Stands


Mixed Wood Stands


Deciduous (riparian) stands


Dispersed woody stands (i.e., terrestrial herbaceous ecosystem)


Slash

**TABLE 3. FIRE BEHAVIOUR CHARACTERISTICS AND FIRE BEHAVIOUR OUTPUTS BASED ON WEATHER CONDITION PREDICTIONS FOR 90TH PERCENTILE FIRE WEATHER INDICES: OCEANVIEW GOLF RESORT & SPA**

| **OUTPUT FACTORS→**<br><br>**FUEL TYPES↓** | **FIRE INTENSITY**<br>(BASED ON RATE OF SPREAD AND PREDICTED FUEL CONSUMPTION) | **RATE OF SPREAD**<br>(SPEED OF FIRE – ADJUSTED FOR STEEPNESS OF SLOPE AND WIND) | **CROWN FRACTION BURNED**<br>(PROPORTION OF TREE CROWNS INVOLVED IN FIRE) |
|---|---|---|---|
| **CONIFEROUS STANDS**<br>**Characteristics:**<br>**FOREST FLOOR/ORGANIC LAYER**<br>-shallow to moderately shallow organic layer (duff): needle litter, small twigs, cones, feather moss<br>**SURFACE/LADDER FUELS**<br>-discontinuous to moderately continuous understorey<br>**STAND STRUCTURE AND COMPOSITION**<br>-mature second-growth; height to dbh ratio high<br>-Variable incidence of root rot diseases | **MODERATE TO HIGH** | **RAPID** | **HIGH** |
| **% OF TOTAL AREA:**<br>HIGH | | | |
| **MIXED WOOD STANDS**<br>**Characteristics:**<br>**FOREST FLOOR/ORGANIC LAYER**<br>-discontinuous to continuous leaf and needle litter<br>-organic layers are generally uncompacted and friable<br>**SURFACE/LADDER FUELS**<br>-discontinuous herb layer<br>-moderate to continuous shrub layer<br>-multistoried stands with critical ladder fuels that help move ground fires into crowns<br>**STAND STRUCTURE AND COMPOSITION**<br>-moderately to well-stocked mixed stands of Douglas-fir/ western redcedar, with big leaf maple/red alder | **LOW TO MODERATE** | **MODERATE** | **MODERATE** |
| **% OF TOTAL AREA:**<br>MEDIUM | | | |

| | | | |
|---|---|---|---|
| **DECIDUOUS STANDS**<br>**CHARACTERISTICS:**<br>**FOREST FLOOR/ORGANIC LAYER**<br>-continuous leaf litter; shallow, uncompacted organic layer<br>**SURFACE/LADDER FUELS**<br>-discontinuous herb layer<br>-moderate to discontinuous shrub layer<br>-sparse, dead, down woody fuels<br>**STAND STRUCTURE AND COMPOSITION**<br>-moderately to well-stocked mixed stands predominately composed of alder, with dispersed conifers. These stands occupy a small proportion of the property, mainly in riparian areas. | **LOW** | **LOW** | **LOW** |
| **% OF TOTAL AREA:**<br>LOW | | | |
| **COASTAL CEDAR-DOUGLAS-FIR SLASH**<br>**FOREST FLOOR AND ORGANIC LAYER**<br>-continuous feather moss or compacted old needle litter below fresh needle litter from slash; moderately deep, compacted organic layer<br>**SURFACE/LADDER FUELS**<br>-continuous slash, high foliage retention (cedar), moderate for other spp., mod. to heavy slash loading; sparse to moderate shrub and herb cover<br>**STAND STRUCTURE AND COMPOSITION**<br>-slash from clearcut logging; mature to overmature cedar or Douglas-fir stands | **MODERATE TO HIGH** | **HIGH** | **N/A** |
| **% OF TOTAL AREA:**<br>MODERATE | | | |

| | | | |
|---|---|---|---|
| **MOSSY ROCK OUTCROPPINGS**<br>**FOREST FLOOR/ORGANIC LAYER**<br>-very shallow organic layer<br>-moss layer dries out in summer<br>**SURFACE/LADDER FUELS**<br>-sparse to scattered trees and shrubs<br>**STAND STRUCTURE AND COMPOSITION**<br>-scattered trees with variable branching habits | **MODERATE TO HIGH** | **MODERATE TO HIGH** | **MODERATE TO HIGH** |
| **% OF TOTAL AREA:**<br>LOW | | | |

Fire behaviour factors were incorporated into a summary analysis of the severity of wildfire hazard in Table 4. Table 5 provides a prediction of risk at the developed site.

**TABLE 4. SUMMARY OF CURRENT WILDFIRE HAZARDS**

| PROPERTY | FIRE BEHAVIOUR | RISK OF IGNTION | STRUCTURES AT RISK | SUPPRESSION CONSTRAINTS | OVERALL WILDFIRE HAZARD |
|---|---|---|---|---|---|
| **PROPOSED DEVELOPMENT SITE: OCEANVIEW GOLF RESORT & SPA** | **L (**riparian areas) to **E** (remaining upland slopes) | **M-H** | **H-E** | **E** | **H-E** |

L = LOW, M = MODERATE, H = HIGH, E = EXTREME

The current wildfire hazard is HIGH to EXTREME.

**TABLE 5. PREDICTION OF WILDFIRE HAZARDS AT SITE AT BUILDOUT**

| PROPERTY | FIRE BEHAVIOUR | RISK OF IGNTION | STRUCTURES AT RISK | SUPPRESSION CONSTRAINTS | OVERALL WILDFIRE HAZARD |
|---|---|---|---|---|---|
| **PROPOSED DEVELOPMENT SITE: OCEANVIEW GOLF RESORT & SPA** | **L (**riparian corridor) to **M** (overall area) | **M** | **M** | **M** | **M** |

L = LOW, M = MODERATE, H = HIGH, E = EXTREME

At build-out, the wildfire hazard is projected to be MODERATE (within acceptable limits).

## 2. FireSmart Interface Community Fire Hazard Analysis.

Results from a FireSmart Interface Community Fire Hazard Analysis indicate the current interface fire hazard at the subject site is EXTREME (unacceptable). (The hazard is lower in localised riparian areas). The overall EXTREME rating results from a range of contributing factors, including types and extents of fuel complexes, size of property, fire weather, terrain, and suppression capabilities.

The interface fire hazard is projected to fall to MODERATE (within acceptable limits) at the future developed site, providing mitigative factors are incorporated into long-term planning and project development. Reduction in the hazard level will result from a combination of mitigating factors, including management of combustible vegetation; fire-resistant building materials; and improvements in infrastructure (i.e., looping road accesses with multiple entry/exit points; piped water and hydrants; and a new fire hall). Many design features of the proposed development are aimed at reducing the fire risk.

## 3. Hazard Impact Risk Vulnerability Model.

A Hazard Impact Risk Vulnerability (HIRV) model was developed to determine the potential impact of interface fire at the proposed development site. Simplified summaries are shown in Tables 6 and 7. High values for risk and vulnerability at the present site indicate the necessity for risk management (mitigation).

**TABLE 6. CURRENT IMPACT OF INTERFACE FIRE AT OCEANVIEW GOLF RESORT & SPA (HIRV MODELING)**

| HAZARD | RISK RATING | VULNERABILITY | IMPACT ANALYSIS | RISK & VULNERABILITY ANALYSIS |
|---|---|---|---|---|
| WUI FIRE | Moderate to High | High | Environmental = 3<br>Social = 2-3 Economic = 2<br>Political = 2 | Risk = HIGH<br>Vulnerability = HIGH-EXTREME |

1=LOW 2=MODERATE 3=HIGH 4=EXTREME

**TABLE 7. PREDICTED IMPACT OF INTERFACE FIRE AT BUILD-OUT (HIRV MODELING)**

| HAZARD | RISK RATING | VULNERABILITY | IMPACT ANALYSIS | RISK & VULNERABILITY ANALYSIS |
|---|---|---|---|---|
| WUI FIRE | Moderate | Moderate | Environmental = 3<br>Social = 2-3 Economic = 2<br>Political = 2 | Risk = MODERATE<br>Vulnerability = MODERATE |

1=LOW 2=MODERATE 3=HIGH 4=EXTREME

## ASSESSMENT SUMMARY

1. Oceanview Golf Resort and Spa:
   - current interface fire hazard rating at site: **EXTREME** (not acceptable)
   - predicted interface fire hazard rating at build-out: **Moderate** (acceptable)

2. Primary concerns:

   ▲types and extent of combustible fuel complexes at property
   ▲interfacing combustible fuel complexes bordering subject property (i.e., NE, SW)
   ▲proportion of site with sloping topography
   ▲limited accessibility to substantial portion of property
   ▲current lack of conventional fireflow (fireflow)
   ▲delayed response (Fire Department)
   ▲history of recent, human-caused wildfires in the Duke Point-Cedar area
   ▲recreational lands in the area (i.e., Cable Bay Trail, Joan Point)
   ▲wildfire-associated hazards to air quality and sensitive ecosystems (i.e., habitat loss)

3. Risk of Ignition
   Ignition risk could come during the construction phase of the development, from incendiaries along access routes, from unauthorized fires, or from existing and/or future homeowners in the general area.

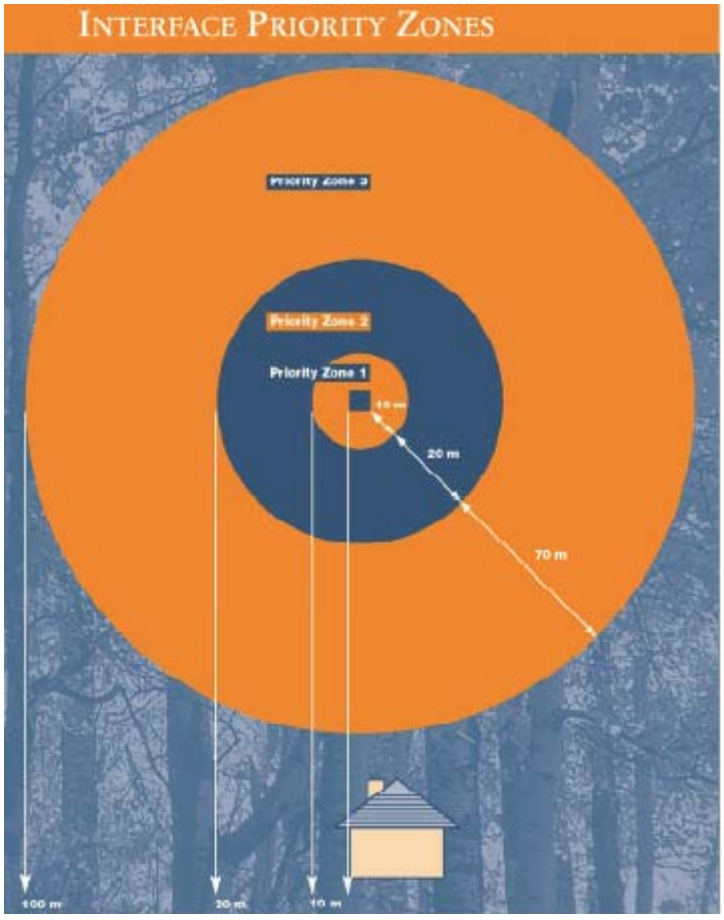
**Mitigative measures are required to reduce the interface fire hazard to acceptable levels (Low or Moderate).**

## MITIGATION TO REDUCE THE INTERFACE FIRE HAZARD POTENTIAL

Mitigative measures, based on FireSmart, have been incorporated in the design plans for Oceanview Golf Resort and Spa to reduce the threat of wildfire to life, property, adjacent lands, and sensitive ecosystems. Mitigation measures target vegetation management, construction options, and infrastructure.

### Vegetation Management-

Combustible fuels are a concern when development is proposed in the interface zone. The primary premise of the FireSmart program is management of combustible fuels (vegetation) to reduce hazard ratings to acceptable levels.




Vegetation management in interface areas involves the removal, reduction, or conversion of on-site fuels.

Vegetation management strategies are directed at three concentric FireSmart Fuel Modification Zones (or Priority Zones) around structures in the interface (Figures 4, 5, & 6).

Figure 4. Fuel Modified Zones are concentric zones around structures. Fuel modification zone distances should be increased where residences are located on sloping ground, tops of slopes, warm aspects, (i.e., south and west aspects), and/or border areas with continuous vegetation. (Photo Credit: FireSmart.)

**Fuel Modification: Priority Zone 1 - PZ 1 (Fuel Removal / Conversion)**: This area, immediately adjacent to the building, and extending outward in all directions for a recommended minimum of 10 m in flat terrain, is the most critical zone because

combustible vegetation within it will allow a wildfire to come within close proximity to, or direct contact with, the structure.

Photo. Fuel removal & conversion in PZ 1.

The primary objective of vegetation management in PZ 1 is to create a fuel-free environment that will not support a fire of any kind. Fuel management is essential to reduction of fire danger.

Increased setbacks are often recommended when residences are proposed on sloping ground, tops of slopes, warm aspects, (i.e., south and west aspects), and/or border areas with continuous vegetation. Slope setback provisions are intended to reduce fuel loading downslope of structures. Fire will burn more rapidly uphill than on a flat or level surface. Convective heat and firebrands from burning fuels on the slope below the building can readily ignite buildings located on the mid to upper portion of the slope. Setback requirements should be evaluated at subdivision phase.

**Fuel Modification: Priority Zone 2 - PZ 2 (Fuel Reduction)**: This zone commences 10 m from the building and extends to 30 m from the building on flat ground, and further on sloping terrain.

Fuel management in Priority Zone 2 focuses on creating an environment that will only support fires of lower intensity and rate of spread.

Photo. Fuel reduction in PZ 2.

**Fuel Modification: Priority Zone 3 - PZ 3 (Fuel Reduction and/or Conversion)**: This area begins 30 m from the building, extending to 100 m or farther, depending on topography.

Fuel management is required when high hazard levels are not sufficiently reduced by techniques used in PZ 2.

Photo. Vegetation management may be necessary in PZ 3 if fuel treatments in PZ 1 and 2 are insufficient to reduce hazard levels.

Figure 5. Fire in the interface without fuel modification.


Figure 6. Vegetation management strategies in the interface zone should be directed at the establishment and maintenance of Fuel Modification Zones.

### Building Construction and Design

Fire mitigation strategies must consider the vulnerability of buildings in the interface zone. FireSmart design standards must be incorporated into the construction (and retrofit) of interface buildings. The design, construction, and maintenance of interface residences or communities must reflect FireSmart guidelines for roofing, siding, stovepipes or chimneys (i.e., spark arrestors), windows and door glazing, eaves and vents, decks and porches, and on-site firefighting equipment.

Photo. New residence features FireSmart landscaping and fire retardant construction.

### Infrastructure

Infrastructure consists of the network of roadways and communications, utilities, services, and local planning tools that define a community. Key features of FireSmart infrastructure are safe access routes and an adequate water supply for firefighting (fireflow). Standard references for FireSmart infrastructure include:

- FireSmart: Protecting Your Community from Wildfire (interface management) www.partnersinprotection.ab./ca
- National Fire Protection Association (structural fire protection) www.nfpa
- Fire Underwriters Survey (fireflow) http://www.firecomm.gov.mb.ca/municipal_support_fire_underwriters.html
- Geometric Design Guide for Canadian Roads (accesses)

FireSmart infrastructure is designed to increase resident and firefighter safety, and facilitate quick response by firefighters.


Photos. FireSmart infrastructure features adequate fireflow and good access.

## ACTION PLAN - EXECUTIVE SUMMARY

The interface fire hazard at the proposed Oceanview Golf Resort and Spa site is currently rated Extreme (unacceptable). A variety of factors contribute to the elevated fire threat: the large site has variable topography with significant areas of inaccessibility; the site contains combustible fuel complexes; infrastructure is not developed at the site; Fire Department response time to the site is "lengthy". A wildfire in the area would have a significant impact on public safety, sensitive ecosystems, air and water quality, and recreational values.

Mitigative measures to reduce the interface fire risk are being incorporated into design and development plans for the property. At build-out, the interface fire risk is expected to be moderate (acceptable), providing mitigation is maintained on a long-term basis.

Recommendations aimed at reducing interface the fire hazard to acceptable levels (moderate or lower) include:

### Education

- Actively engage property owners in interface management awareness:
  ⇨ promote interface management at strategic locations and community events (i.e., coffee shops, Oceanview Golf Resort and Spa community website, firehall notice board, Cable Bay Trailhead)
  ⇨cooperate with neighbouring tenure holders on joint fuel reduction projects where forest cover straddles common boundaries
  ⇨encourage new residents to volunteer with the Nanaimo Fire Department

### Vegetation/Site Management

The subject property is classified in the CDFmm, a biogeoclimatic unit characterised by widespread loss of native forest cover. Reduction of combustible fuels (vegetation) around structures and along development perimeters will decrease potential for major fire damage to both structures and undeveloped lands. Vegetation management for fire hazard reduction should be balanced with the need to retain forest cover in sensitive ecosystems.

- Establish and maintain a high-priority Fuel Modified Zone (**Priority Zone 1**) 0 to10 m around structures (i.e., areas that border adjacent forested properties)

  **Recommended Fuel Treatment in Priority Zone 1:**
  ⇨Remove/convert combustible vegetation
  ⇨Remove fuels on an ongoing basis (i.e., downed branches, dry leaf litter)

- Establish and maintain a Fuel-Reduced zone (**Priority Zone 2**) 10-30 m around new structures at areas of the property bordering lands with continuous fuel complexes (i.e., forested areas, including southwest portion of the property bordering Harmac lands, and the upper portions of the Cable Bay Trail – but not including wetland areas fringing the trail)

**Recommended Fuel Treatment in Priority Zone 2:**
⇨Conduct light understorey thinning to reduce stand density (i.e., remove unhealthy and suppressed trees to "open up" dense stands).
⇨Prune conifers to 3 m
⇨Regularly reduce surface and ladder fuels

- Develop a landscape plan featuring fire-resistive* vegetation
  **Fire-resistive native plants ecologically suited to the property include deciduous trees (dogwood, bitter cherry, cascara); shrubs (redcurrant, well-spaced Saskatoon berry, and baldhip rose), and ground cover (salal, Oregon-grape, evergreen huckleberry, boxwood, and ferns)*

  ⇨Retain fire-resistive native ground cover, where possible. Restore disturbed areas with native ground cover and shrubs
  ⇨Retain healthy native deciduous trees, which provide shading, and are generally less combustible than coniferous species

  *See FireSmart Landscaping on Southeastern Vancouver Island* (brochure), Strathcona Forestry Consulting, 2004
  http://www.cityoflangford.ca/documents/brochures/FireSmartLandscaping.pdf

- Review setback provisions at subdivision phase to ensure sufficient vegetation setbacks for buildings on sloping ground

- Regularly remove broom and other invasive weed species from access routes and disturbed areas (ensure disturbed areas are promptly planted with native, fire-resistive vegetation)

- Limit the use of wooden fences and coniferous hedges to low risk areas (combustible landscaping features can act as conduits for fire spread)

- Minimise disturbance to Environmentally Sensitive Areas (ESAs) (vegetation in these areas does not generally contribute to the fire hazard)

- Liaise with City of Nanaimo Parks Dept. to review options for a UBCM Fuel Treatment Pilot Project at the popular Cable Bay Trail (and, as a lower priority, at the interface boundary with Joan Point Park)
  Recommended Treatment:
  ⇨Reduce stand density in dense coniferous stands in upland areas – do a light, selective understorey thinning
  ⇨remove invasive plant species (i.e., broom, ivy, daphne)
  ⇨conduct a Danger Tree Assessment (via certified assessor) and appropriate treatment to remove hazardous woody materials branches, etc.
  ⇨reduce ladder and surface fuels (of selected shrub species and woody debris)
  ⇨rehabilitate areas with disturbed vegetation: develop and implement a plan to replant native, fire-resistive species ecologically suited to the site
  ⇨ minimise disturbance to wetland areas along trail

- Cooperate with the City of Nanaimo Parks Dept. to ensure vegetation management is regularly conducted along interface boundaries of parks/trails

**Structural Options**

Architectural design plans should feature fire-resistant building materials.

- Use fire-retardant roof covering assemblies rated Class A, B, or C (i.e., metal, tile, ULC- rated asphalt) on all structures

- Use non-combustible siding materials (i.e., stucco, metal siding, brick, cement shingles or cementitious materials, poured concrete, or ULC-rated wood siding) on all structures

- Follow FireSmart guidelines for design, construction and maintenance of chimneys, window and door glazing, eaves and vents, and decking http://www.partnersinprotection.ab.ca

**Infrastructure**

**Access-**

Standards of new access routes must meet minimum FireSmart guidelines for width, gradient, and overhead clearance (in accordance with the latest edition of the "Geometric Design Guide for Canadian Roads".)

Roadways in interface areas should provide safe simultaneous access for emergency vehicles and public evacuation.

- Implement plans to develop looping access routes to the site (by developing access routes in the northwest and southeast – with secondary access from Nicola Road) that will be capable of accommodating two-way traffic

- Ensure dead ended portions of strata roadways less than 90 m have 3-point turnaround for passenger and light truck vehicles

- Ensure maximum driveway gradients do not exceed local standards: 15% gravel; 20% hard-surfaced

- Ensure building numbers (during construction phase) and strata unit addresses are clearly evident from roadway

**Fire Protection-**

- At subdivision phase, consult with the Nanaimo Fire Department to ensure fire hydrant distribution and spacing complies with required standards

- In consultation with the Nanaimo Fire Department, consider plans to build a new fire hall at the subject property (as identified in a "Standard of Response Coverage" Study conducted by the Nanaimo Fire Department)

- Cooperate with the Nanaimo Fire Department to ensure fire protection and prevention issues in the area are adequately addressed

- At subdivision phase, consult with the Nanaimo Fire Department regarding the option of interior sprinkling in new, single family dwellings

- Ensure new structures and accesses are mapped on Fire Department fire plan "pre-org" maps

**Fire Plan-**

- Develop an Emergency Fire Plan to be implemented during the construction phase of the development (the Plan should outline emergency procedures in case of fire; all workers on site should be familiar with the plan, as should visitors (realtors, professionals, salesmen, prospective buyers, and insurance agents)

- Secure access to the construction site, including evenings and weekends

**Water Supply-**

- Ensure hydrant spacing meets and complies with current municipal and FUS specifications for spacing and distribution for the type of development proposed

**Utilities-**

- Explore cost options and feasilbity of underground utilities

**Regulatory Provisions-**

- During development (either at the land clearing stage or at building permit), a follow-up interface assessment should be conducted to ensure appropriate mitigative measures are being implemented

- A Section 219 wildfire interface covenant should be enacted on bare land and any strata titles, in favour of the City of Nanaimo, in order that enforcement may be enacted

Fire prevention and protection in the interface zone are ongoing processes. Long-term implementation of mitigative measures is essential to ensure protection for life, property, and ecological processes in the wildland urban interface.

In my professional opinion, with the recommended mitigation addressed, the property will be safe for the intended development.

**LIMITATIONS**

*This report provides an assessment of the wildland urban interface fire hazard. Evaluation is based on professional judgement. The investigation involved a field observation of physical features and geographical factors, and a review of fire suppression capabilities in the area. The recommendations contained in the report pertain only to the particular site as disclosed to Strathcona Forestry Consulting at the time of the inspection. This report was prepared considering circumstances and conditions applying specifically to the client. It is intended only for internal use by the client for the purposes for which it was commissioned, and for use by government agencies regulating the activities to which it pertains.*

Prepared by:

Margaret Symon, R.P.F.

## Appendix 1

## Structural stages and codes

From Standards for Terrestrial Ecosystems Mapping in British Columbia. 1998. Ecosystems Working Group of the Terrestrial Ecosystems Task Force, Resources Inventory Committee.

| Structural stage | Description |
|---|---|
| ***Post-disturbance stages or environmentally induced structural development*** | |
| **1 Sparse bryoid** | Initial stages of primary and secondary succession |
| **Substages** | |
| 1a Sparse | <10% vegetation cover |
| 1b Bryoid | Bryophyte- and lichen-dominated communities |
| ***Stand initiation stages or environmentally induced structural development*** | |
| **2 Herb** | Early successional stage or herbaceous communities Maintained by environmental conditions or disturbance; time since disturbance <20 yrs for normal forest succession |
| Substages | |
| 2a Forb-dominated | Herbaceous communities dominated by non-graminoid herbs |
| 2b Graminoid-dominated | Herbaceous communities dominated by grasses, sedges, reeds, and rushes |
| 2cAquatic | Herbaceous communities dominated by floating or submerged aquatic plants |
| 2dDwarf shrub | Communities dominated by dwarf woody species |
| **3 Herb/Shrub** | Early successional stage or shrub communities maintained by environmental conditions or disturbance; dominated by shrubby vegetation; seedlings and advanced regeneration may be abundant |
| **Substages** | |
| 3a Low shrub | Communities dominated by shrub layer vegetation < 2m tall; seedlings and advanced regeneration may be abundant; time since disturbance <20 yrs for normal forest succession |
| 3b Tall shrub | Communities dominated by shrub layer vegetation that are 2 – 10 m tall; time since disturbance <40 yrs for normal forest Succession |

***Stem exclusion stages***

| | |
|---|---|
| **4 Pole/Sapling** | Trees > 10 m tall, typically densely stocked, have overtopped shrub and herb layers; time since disturbance usually <40 yrs for normal forest succession; up to 100+yrs for dense (5 000-15 000+ st/ha) stagnant stands |
| **5 Young Forest** | Self-thinning has become evident; forest canopy has begun differentiation into distinct layers (dominant, main canopy, and overtopped); time since disturbance generally 40-80 yrs, but may begin as early as age 30 |

***Understorey reinitiation stage***

| | |
|---|---|
| **6 Mature Forest** | Trees established after the last disturbance have matured; time since disturbance generally 80-250 yrs for CDFmm |
| **7 Old Forest** | Old, structurally complex stands composed mainly of shade-Tolerant and regenerating tree species; snags and coarse woody Debris in all stages of decomposition typically, as are patchy understoreys; time since disturbance generally >250 yrs |

# APPENDIX B - ENVIRONMENTAL ASSESSMENT

MADRONE
environmental services ltd.

# ENVIRONMENTAL ASSESSMENT
# PROPOSED DEVELOPMENT PROPERTY
# OCEANVIEW GOLF RESORT AND SPA
# CABLE BAY, BC

*for:*

**Mr. Glenn Brower, Oceanview Golf Resort and Spa Ltd.**
**Suite 400 – 7015 MacLeod Trail SW**
**Calgary, Alberta, T2H 2K6**

*by:*

**Tania Tripp, R.P.Bio., Tyler Innes, B.Sc.,**
**Trystan Willmott, B.Sc., A.Sc.T, Helen Reid, R.P.Bio.,**
**and Bjorn Simonsen, Archaeologist, R.P.C.A.**
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**1081 Canada Avenue, Duncan, BC V9L 1V2**

**August 2, 2009** Dossier 08.0360

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## Executive Summary

Madrone Environmental Services Ltd. (Madrone) was retained by Mr. Glenn Brower of Oceanview Golf Resort and Spa Ltd. (the client) to provide a professional opinion on the environmental and archaeological attributes within a proposed development area. Madrone understands that the information provided will be used as supporting documentation to the Master Plan application to the City of Nanaimo seeking an amendment to the Official Community Plan (OCP). The proposed development as we understand it would consist of residential neighbourhoods, retail-commercial centres, golf course, marina and natural green spaces and parks.

The area of assessment is located on the southeast coast of Vancouver Island, south of the Duke Point ferry terminal. It is in the extreme south-east corner of the City of Nanaimo, bounded by the waters of Northumberland Channel on the north, Stuart Channel on the east, Regional District of Nanaimo and the community of Cedar-by-the-Sea on the south, and the City of Nanaimo on the west.

The total size of the property (study area) is approximately 214.8 hectares (530.5 acres), of which 190.6 ha (470.8 acres) is within the Urban Containment Boundary (UCB) as per the City of Nanaimo Official Community Plan (OCP). Madrone had a team of professional consultants with specialized expertise in ecological, wildlife, fisheries, riparian and archaeological assessments conduct the fieldwork between 2005 and 2009.

## Ecosystems and Vegetation

The property is located within the Coastal Douglas-fir moist maritime biogeoclimatic subzone, which represents the dry, Douglas-fir dominated forests along southeastern Vancouver Island and the Gulf Islands. Most of the area has been logged at least once. The northern and eastern portions of the area are now dominated by mature second growth. A single patch of old growth forest is present along the southeastern slope overlooking Stuart Channel. Some large Douglas-fir and small patches of younger forest were left dispersed throughout the recent selectively logged areas.

The City of Nanaimo has mapped Environmentally Sensitive Areas (ESAs) that consist of certain ecosystems, or related groups of ecosystems, that are rare, depleted, or sensitive to disturbance. Three types of ESAs are mapped on the property. The three types are Terrestrial Herbaceous, Older Forest, and Mature Second Growth Forest.

Madrone mapped all of the ecosystems on the entire property at a larger scale (*i.e.*, in finer detail) than the original ESA mapping. We identified 39 forested and non-forested ecosystem polygons. Our final mapping more accurately identified the boundaries of the ESA polygons, extending the boundaries in some places and shrinking them in others.

### Terrestrial Herbaceous Ecosystems

There are a series of open meadows ("terrestrial herbaceous areas") scattered throughout the property on exposed bedrock slopes. Based on relative rarity and on sensitivity to disturbance, the series of meadows that run through the central portion of the property have the highest priority for protection. The largest and most ecologically valuable is Polygon 634 which occupies almost 5 ha. In addition to being a provincially endangered ecosystem, this area supports populations of two red-listed and five blue-listed plant species (one of which is also covered under the federal *Species at Risk Act*). This significant ecological site feature has been incorporated in the project design through the protection of the large meadow and its watershed as shown on the Master Plan dated May 1, 2009.

### Older Forest and Mature Second-Growth Ecosystems

In the Coastal Douglas-fir biogeoclimatic zone, most of the forested area has been logged at some time in the past 140 years. Undisturbed forested areas or areas where regenerated forest is approaching old-growth characteristics are relatively rare. ESA Polygon 642, on the east side of the property adjacent to Stuart Channel, was mapped as having old-growth attributes. Madrone identified a portion of ESA Polygon 642 that had been selectively logged since the ESAs were mapped in 2003. This area is no longer functioning as an older forest ecosystem.

ESA Polygons 603, 633, and 639 are mapped as Mature Second Growth. This forest type represents areas that have been logged or otherwise disturbed but now are covered by 60 to 100-year-old forest. Within ESA Polygon 603, a small area of mature Western redcedar forest in a wet area just south of Joan Point Park is considered to be sensitive and of significant conservation value (ecosystem Polygon 30).

As well as being a mature forested sensitive ecosystem, this area forms the subsurface headwaters of the creek that drains northwest out of the property. The boundary of the rich, mature forest identified as Polygon 30 has been flagged in the field and surveyed professionally. A portion of the development unavoidably passes through a section of Polygon 30. In recognition of the ecological significance of the ecosystem, mitigation measures will be incorporated.

Mitigation will include supervision by a certified environmental consultant. Measures will be implemented to ensure that the subsurface drainage regime is maintained or restored.

## Riparian Areas, Non-classified Drainages and Wetlands

One riparian area was identified on the property. The creek runs northwest out of the central portion of the property, and discharges into the ocean approximately 200 m north of the property's northern boundary. It is a seasonal drainage, in that it flows less than six months of the year. Background research indicates that it is not fish-bearing, although this cannot be used to assume the creek does not support fish. Portions of the upper eastern fork of this drainage were mapped as a Non Classified Drainage (NCD), due to lack of stream attributes. A second NCD was mapped in the northeastern portion of the study area. When water is present, it flows east into Dodd Narrows.

The City of Nanaimo has taken the "meet or beat" approach to implementing the *Riparian Area Regulation*s (RAR) made under the provincial *Fish Protection Act (2004)*. For the main Cable Bay drainage that follows the public access trail, the Streamside Protection and Enhancement Area (SPEA) width is 15 m on either side (measured from the top of bank). The main Cable Bay drainage has been mapped and associated with a SPEA as per City of Nanaimo bylaws; no other "RAR applicable drainages have been identified by the City, or as part of the ecological assessment. Madrone recommends that all NCDs be protected by a 7.5 m no vegetation disturbance zone adjacent to both sides (for a total of 15 m).

In addition to a riparian area and two NCDs, Madrone identified four small wetlands on the property, two of which straddle the southern property boundary. While the wetlands are small and do not support fish, or connect to fish bearing habitat, they contribute significantly to biodiversity on the property, and provide habitat for numerous species of wildlife. Development adjacent to wetlands has the potential to alter drainage characteristics, which can result in the loss of wetland areas. Madrone recommends a 15 m setback (no vegetation disturbance zone) to protect the wetland ecosystems whenever possible. All drainages and wetlands (including the top of bank and HWM, where appropriate) have been surveyed by professional surveyors for consideration in design of the development.

Avoidance of any activities related to development within the identified NCDs or wetlands and their associated buffers, is our preference. If avoidance is not possible, we recommend, in order of preference, mitigation, restoration or compensation plans designed by a qualified professional.

As with setbacks from riparian areas, the City of Nanaimo also requires a 15 m no vegetation disturbance zone from the high water mark along the foreshore. From an environmental perspective, an undisturbed buffer here will maintain the important forest-ocean interface habitat and will act as a corridor from Joan Point Park for terrestrial wildlife.

## Wildlife

The focus of our field surveys for wildlife values was to identify the presence of suitable habitat for rare species (federally or provincially listed). Sections of the property were assessed as low to moderate overall habitat suitability for potential use by the red- and blue-listed focal wildlife species. A breeding bird survey was completed in 2005 to identify any species (including raptors and herons) nesting within the project footprint. No rare wildlife species were detected on the property. The presence of three Bald Eagle nest trees within the assessment area, however, represents a significant wildlife attribute. Two additional nest trees exist outside of the study area, one in Joan Point Park and another along the northern foreshore on Island Timberlands property. As per the *BC Wildlife Act*, it is illegal to destroy an eagle nest tree at any time of the year.

To ensure that the nests are not abandoned by eagles at this site we recommend a buffer of 60 m around each nest tree (approximately 1 to 1.5 tree lengths to maintain natural vegetation around the nest tree) as per *Best Management Practices for Raptor Conservation during Urban and Rural Land Development in British Columbia* (MoE 2005) and *Develop with Care* (MoE 2006). Development is to be avoided in the nest buffer and human disturbance should be minimized during the breeding season (February 1st to August 15th). The key habitat features to maintain within the nest buffer are mature trees, especially any significant trees as identified and documented by Madrone for the entire property.

At present, we have identified a circular shaped buffer around each of the nest trees. Development should be avoided in this buffer, and human disturbance minimized during the breeding season. If avoidance is not possible, we recommend, in order of preference, mitigation, restoration or compensation plans designed by a qualified professional. The final configuration of the nest tree buffer should be determined by a qualified professional, maintaining an equivalent area of protection (approx. 1 ha around the nest tree).

In addition to the 60 m nest tree buffer, no land clearing or "construction" should occur within a 150 m of the nest tree during the breeding season when a nest is active. "Construction" not permitted inside the seasonal buffer includes those activities that are most likely to cause disturbance to the nesting eagles. Examples include use of heavy machinery, clearing land, pouring concrete, building roads and blasting. It is unlikely that lighter construction activities such as roofing, hammering or use of nail guns will cause disturbance to the nesting birds as they are exposed to industrial noise, aircrafts and boats on a regular basis. Eagles at this site appear to have acclimatized to frequent noise exposure, as reflected by successful annual breeding and a high density of nest territories.

Although eagles at this site are used to exposure to noise, as an extra level of precaution we recommend that no un-controlled blasting occur within 1 km of an active nest during the breeding season. Controlled blasting within the 1 km seasonal buffer (*e.g.,* using sound deadening techniques) may be permitted, with involvement from qualified environmental professionals.

We encourage continued monitoring of Bald Eagle nest activity on the property. Nest status will vary from year to year, and monitoring of nests will allow for the relaxation of the seasonal development restrictions should a nest be deemed inactive in any given year. Monitoring will also likely lead to changes in the precise dates of the seasonal development restrictions, as the February 1st to August 15th breeding season is a "blanket" breeding period.

The client has adhered to the recommended management strategies, as per our original recommendations provided in 2005, to ensure the success of the Bald Eagle nests. All buffers have been implemented, and monitoring (including the installation of a web cam for nest E105-102) has occurred to enable a greater understanding regarding nesting activity in the study area. Bald Eagle breeding activity at the site has been documented and shared with appropriate agencies, such as the Wildlife Tree Stewardship Program (WiTS) and the Ministry of Environment (MoE), with the support of the client.

## Tree Management Plan

The most common forest type on the Oceanview Golf Resort and Spa property consists of second growth stands of Douglas-fir of various ages with localized pockets of older forest.

The dominant tree is Douglas-fir, but redcedar, grand fir, bigleaf maple and arbutus are also present. By far the majority of the trees in these forests are not significant in terms of size. However, scattered throughout are veteran trees that are significantly larger than the surrounding forest. To date, we have identified a total of 2,107 significant trees on the property. The majority of large trees recorded were Douglas-fir. Garry oak are also well represented in the property.

We recorded the occurrence of all Garry Oak that meet the Bylaw's criteria of significance (>10 cm DBH). The survey revealed that the majority of this species existed either within, or in proximity to the boundary of the open meadow habitats.

The tree protection Bylaw #4695 sets out general measures to protect trees in development areas. The main restriction is the prohibition of cutting significant trees unless a Tree Removal Permit has been granted. In each development area, a Tree Management Plan is required. A detailed Tree Management Plan will be completed at the appropriate stage in the development application process.

## Archaeological Assessment

Madrone conducted an overview archaeological assessment of the property including research into available historical data and provincial records, and an inspection of the property for evidence of undocumented archaeological sites, burial remains, petroglyphs, or other evidence of past aboriginal use. We identified two previously recorded shell midden sites along the coastline and three small unrecorded inland midden deposits. All five are protected under the provincial *Heritage Conservation Act*. We conducted shovel-testing to delineate the horizontal extent of all of the identified sites.

The two coastal sites (DgRw-171 and 173) proved to be smaller than had been estimated by previous work. They are mainly contained within the 15 m no vegetation disturbance zone along the shoreline. In our opinion both of these site areas have a high cultural significance to local First Nations. However, they are not particularly archaeologically important, since they contain very little information or archaeological material of any significance (such as artifacts, faunal bone, deeply stratified midden deposits, burial remains etc.).

We recommend that the coastal sites be excluded from any future land development plan. This would leave all site areas in their present condition and would allow both future subdivision and land development to proceed without any further archaeological investigation or encumbrances, insofar as the *Heritage Conservation Act* is concerned.

However, should this option not be feasible, the next level of site mitigation would be to carry out a partial site preservation program, coupled with an archaeological excavation and data recovery program. Capping the sites with landscape cloth and clean fill would be an alternative provided no building footprint extended onto the sites.

A final option would be to carry out a more extensive and detailed archaeological excavation program to negate any future site preservation requirements. Such a program of data recovery would be expensive and may not necessarily be supported by the BC Archaeology Branch.

The three inland sites (DgRw-T-1, T-2, and T-3) occupy only a few square meters each. We feel that these three site locations can be easily avoided during land development, or they can be capped.

# List of Acronyms

| Acronym | Definition |
|---|---|
| AIA | Archaeological Impact Assessment |
| AOA | Archaeological Overview Assessment |
| BEC | Biogeoclimatic ecosystem classification |
| CDC | Conservation Data Centre |
| CDFmm | Coastal Douglas-fir moist maritime biogeoclimatic subzone |
| COSEWIC | Committee on the Status of Endangered Wildlife in Canada |
| CWD | Coarse Woody Debris |
| CWS | Canadian Wildlife Service |
| DBH | Diameter at breast height (for tree circumference measurements) |
| DFO | Department of Fisheries and Oceans |
| EC | Environment Canada |
| ESA | Environmentally Sensitive Area |
| GIF | Ground Inspection Form |
| GPS | Global Positioning System |
| LWD | Large Woody Debris |
| MoE | Ministry of Environment, previously Ministry of Water, Land and Air Protection, previously Ministry of Environment, Lands and Parks |
| MSRM | Ministry of Sustainable Resource Management |
| OCP | Official Community Plan |
| DPA | Development Permit Areas |
| PLA | Preliminary Layout Acceptance |
| RISC | Resource Inventory Standards Committee |
| SARA | Species At Risk Act |
| SEI | Sensitive Ecosystem Inventory |
| SPEA | Streamside Protection and Enhancement Area |
| TU | Traditional Use |
| WiTS | Wildlife Tree Stewardship Program |

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environmental services ltd.

# ENVIRONMENTAL ASSESSMENT
# PROPOSED DEVELOPMENT PROPERTY
# OCEANVIEW GOLF RESORT AND SPA
# CABLE BAY, BC

## 1.0 INTRODUCTION

Madrone Environmental Services Ltd. (Madrone) was retained by Mr. Glenn Brower of Oceanview Golf Resort and Spa Ltd. (the client) to provide a professional opinion on the environmental and archaeological attributes within a proposed development area. Madrone understands that the information provided will be used as supporting documentation to the Master Plan application to the City of Nanaimo seeking an amendment to the Official Community Plan (OCP). The proposed development would consist of residential neighbourhoods, retail-commercial centres, golf course, marina, and natural green spaces and parks. Madrone had a team of professional consultants with specialized expertise in ecological, wildlife, fisheries, riparian and archaeological assessments conduct the fieldwork between 2005 and 2009.

### 1.1 Study Area

The area of assessment is located on the southeast coast of Vancouver Island, south of the Duke Point ferry terminal, at the extreme south-east corner of the City of Nanaimo, bounded by the waters of Northumberland Channel on the north, Stuart Channel on the east, Regional District of Nanaimo and the community of Cedar-by-the-Sea on the south, and the City of Nanaimo on the west. The total size of the property (study area) is approximately 214.8 hectares (530.5 acres), of which 190.6 ha (470.8 acres) is within the Urban Containment Boundary (UCB) as per the City of Nanaimo Official Community Plan (OCP).

Stuart Channel forms the natural (high tide) northeast boundary of the site. The highest point of land on the property is approximately 120 m above the natural boundary. The majority of the site is between 30 m and 80 m above the natural boundary and has relatively gentle to moderate slopes. The property also has some high bank waterfront and areas of steep slopes. A pre-existing road and trail network (Cable Bay Trail) bisects the area, providing access to the property (Figure 1). A network of hiking trails is used regularly by local residents.

## 1.2 Objectives

### 1.2.1 Ecology and Wildlife

The terms of reference for the vegetation and wildlife components generally follow those outlined in the document Environmental Best Management Practices for Urban and Rural Land Development, Appendix C: Terms of Reference for Bio-Inventory (BC Ministry of Water, Land and Air Protection, 2004).

The main objectives of the vegetation and wildlife field assessments were to:

- Provide delineation of ecosystems and forest cover for the entire property;
- Map and describe wildlife features, including heron and raptor nesting and perch trees where present;
- Identify whether suitable habitat for provincial red- and/or blue-listed wildlife species and federally listed Species At Risk (SAR) was present, and if necessary, provide appropriate recommendations for sustainable development activities to minimize potential impacts;
- Provide a detailed delineation of rare wildlife habitat if present; and
- Determine whether any rare plant assemblages were present within the assessment area, and provide a detailed delineation of rare plant and ecosystem areas.

Study Area Boundary
Stream
Non-classified Drainage
Wetland

N

ENVIRONMENTAL ASSESSMENT
Oceanview Golf Resort and Spa
Figure 1 - Study Area Location Map

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NORTHUMBERLAND CHANNEL

DODD NARROWS

Mudge Island

STUART CHANNEL

Cable Bay Trail


Scale = 1:7,000

Created April 30, 2009

0 200 400 600 800 1,000 m

### 1.2.2 Riparian and Fisheries Assessment

The main objectives of the riparian assessments were to:

- Identify fish habitat,
- Determine the setback area (Streamside Protection and Enhancement Area-SPEA) adjacent to all water bodies providing fish habitat or that connect to fish habitat (*i.e.,* "RAR applicable" water-bodies) and;
- Recommended appropriate buffers adjacent to all non classified drainages (NCDs) and isolated wetlands that do not provide fish habitat or connect to fish habitat (*i.e.,* "non RAR applicable" drainages and water-bodies).

### 1.2.3 Tree Management Assessment

The objectives of the tree management assessment were to:

- Map and describe the distribution of tree species and sizes; and
- Identify significant trees, as per City of Nanaimo bylaws.

### 1.2.4 Archaeological Assessment

The objectives of the Archaeological Assessment included the following components and tasks:

- Carry out a review of archaeological, ethnographic and historical reports and accounts that may be of relevance to the study area;
- Carry out a review of the BC Archaeological Site Registry System (maintained by the Archaeology and Registry Services Branch of the Ministry of Sustainable Resource Management in Victoria) to determine the location and nature of previously recorded archaeological sites in and around the study area;
- Review all Traditional Use (TUS) information (as may be provided by local First Nations organizations) for all lands that might be impacted by the proposed development project;
- Identify local First Nations community elders, as well as other individuals who may be knowledgeable about traditional aboriginal land-use or occupation within the study area and who may be able to provide such information through direct interviews during a later stage of study;

- Determine areas of archaeological resource potential within the proposed development lands – including proposed access road alignments and other ancillary development areas; this will require a brief one day field reconnaissance of the development area; and
- Produce a Final Report outlining the results of research and data analysis, including an archaeological site potential scheme for the project lands and recommendations relating to the nature and scope of additional archaeological and traditional use study within areas that may be impacted by the proposed development.

# 2.0 BACKGROUND

## 2.1 Ecology and Wildlife

### 2.1.1 Sensitive Ecosystem Inventory (Environmentally Sensitive Areas)

In 1997 Sensitive Ecosystem Inventory (SEI) was completed for the East Coast of Vancouver Island by a Technical Advisory Group consisting of representatives from Environment Canada (EC), the Canadian Wildlife Service (CWS), the Ministry of Environment (MEnv), the Ministry of Sustainable Resource Management (MSRM), and the Conservation Data Centre (CDC) (Ward *et.al.*, 1998). "An ecosystem is defined as a portion of landscape with relatively uniform dominant vegetation; a sensitive ecosystem is one that is fragile and/or rare" (CDC, 2005). Sensitive ecosystems are particularly valuable in that they provide critical habitat for species at risk, they contain a high level of biodiversity, and also form wildlife corridors and linkages.

The main objectives of the SEI and mapping were to identify remnants of rare and fragile terrestrial ecosystems, and encourage appropriate management techniques that take into account the fragility of the specific ecosystems. The East coast of Vancouver Island is of particular significance when considering the threats to sensitive ecosystems, due to development pressures associated with a growing population.

The SEI recognizes seven specific sensitive coastal ecosystems, which are:

- Wetlands
- Riparian areas
- Old forest
- Woodland
- Terrestrial herbaceous
- Coastal bluff
- Sparsely Vegetated

Two additional modified sensitive ecosystem types are also included: seasonally flooded agricultural fields and older second growth forest. These ecosystem types are described in detail in Appendix I. The results of SEI showed that the land base of East Vancouver Island and the Gulf Islands contained only 7.9% sensitive ecosystems and 11.6% other important ecosystems (Ward *et al.*, 1998).

Using SEI polygons as a baseline, the City of Nanaimo completed a more detailed inventory of sensitive ecosystems, also referred to as Environmentally Sensitive Areas (ESAs) in the Nanaimo area (Williams and Rose, 2004). This work expanded on the present SEI polygons where necessary, in some cases resulting in larger polygons. The recent assessment was intended to identify those areas that are of significant ecological value and to identify areas that may have suitable habitat associated with rare wildlife and plant species (site suitability).

Due to the growing awareness and concern for ESAs within the City of Nanaimo (CoN), ecological assessments of proposed development areas are recommended to provide planners with information for effective management practices. For this report, the ESA maps provided on the City of Nanaimo's website were used to identify sensitive ecosystems in the Oceanview Golf Resort and Spa assessment area.

### 2.1.2 Wildlife Status Ranking Systems

One component of the ecology and wildlife assessment was to determine whether there was suitable habitat for rare plants, plant communities, and wildlife species. The following sections summarize the federal and provincial status ranking systems, which are referred to throughout relevant ecology and wildlife sections.

#### **2.1.2.1** Federal Ranking System

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the status of wild species in Canada. The application of ranking criteria by COSEWIC describes the relative condition of a particular species and gives some indication as to the likelihood of extinction. For example, a species that is "Endangered" faces imminent extirpation or extinction; a species that is "Threatened" is likely to become endangered if limiting factors are not reversed (Table 1). Species ranked as G1 are considered of greatest risk for global extinction, and are therefore of highest management priority.

**Table 1. Federal Species at Risk Ranking and Definitions.**

| Rank | Description |
|---|---|
| X – Extinct | Species no longer exists. |
| XT – Extirpated | Species no longer exists in Canada, but it still occurs elsewhere. |
| E – Endangered | Species is facing imminent extirpation or extinction. |
| T – Threatened | Species is likely to become endangered if limiting factors are not reversed |
| SC – Special Concern | Species that are sensitive to human activities and natural events, but are not considered to be Endangered or Threatened. |
| DD – Data Deficient | Species with inadequate information to make direct / indirect assessment. |
| NAR – Not at Risk | Species that have been evaluated, but are considered not to be at risk. |

#### **2.1.2.2** Provincial Ranking System

Within BC, the Conservation Data Centre (CDC) is responsible for assigning provincial status of indigenous species. The CDC is a branch of the Ministry of Environment (MEnv). The coding is by colour, with red indicating species at greatest risk (threatened and endangered species), and yellow indicating the lowest level of risk (Table 2). For a full list of federal and provincial species ranking definitions, refer to Appendix II.

**Table 2. Provincial Ranking System and Definitions.**

| Rank | Description |
|---|---|
| Yellow List | Indigenous species, subspecies and natural plant communities deemed not to currently be at risk in BC. |
| Blue List | Indigenous species, subspecies and natural plant communities of Special Concern in BC. |
| Red List | Indigenous species, subspecies and natural plant communities that are extirpated, endangered or threatened in BC. These species either have, or are candidates for, official extirpated, endangered, or threatened status in BC. |

### 2.1.3 Rare Plant Species and Rare Ecosystems

The conservation status of rare plant species is characterized according to a ranking system in place throughout North America that was developed by the Nature Conservancy. Rankings reflect both the global and sub-national (*i.e.,* provincial) status of the species and are based primarily on the number of documented occurrences.

The CDC also ranks ecological communities according to their conservation status using factors such as range extent, area of occupancy, threats, vulnerability, and number of occurrences. Ecological communities are assemblages of species that co-occur in defined areas including the processes and systems that they interact with.

Ecological communities, also referred to as ecosystems, are classified by multiple ecological criteria, including vegetation composition, structure, and local environmental setting. Due to extensive logging and development, all mature and old growth forested ecosystems in the CDFmm biogeoclimatic subzone that are in good condition (little disturbance or fragmentation, >1 ha, low percent cover of invasive plants, etc.) are red-listed, meaning they are endangered or threatened in British Columbia.

Plant species included in Schedule 1 of the *Species At Risk Act* (SARA) are protected on federal lands and the BC Ministry of Environment has a responsibility to provide a similar level of protection on provincial Crown lands. British Columbia has identified some plant species and ecological communities as species at risk within the Integrated Wildlife Management Strategy (IWMS) (MWLAP 2004) pursuant to the BC *Forest and Range Practices Act*.

Given that the subject property lies on private land, there are no established standards for determining the significance of effects to rare ecosystems and rare plants, however the CoN has established ESA's for the purpose of identifying areas of importance unto themselves as well as to endangered wildlife and wildlife habitat in general. As part of the CoN Environmental Assessment procedures, Professional Biologists assess the ESAs for condition of the sites and suitability for species at risk and provide recommendations on the protection of ESAs where appropriate.

## 2.2 Riparian and Fisheries

Setback areas (also referred to as buffers), and/or no vegetation disturbance zones help to maintain the function of riparian vegetation, both for fish and wildlife value. An important aspect of developing near any water body is to ensure the adequate provision and maintenance of a setback area measured from the top of bank on both sides of a creek or the high water mark of wetlands. Riparian vegetation plays numerous key roles, including: provision of shade to regulate water temperature; provision of leaf litter and nutrient input to the adjacent water body; allowing for the introduction of terrestrial insects to the water body (insect drop as potential fish food); providing a source of Large Woody Debris (LWD); and stabilization of bankside material, decreasing erosion and sediment input into the water.

## 2.3 Tree Management Plans

The City has identified the need to protect significant trees in its Official Community Plan (OCP). The Plan recognizes the critical role that trees play in the natural environment, as well as in the built environment.

The plan articulates several tree protection policies to support its objectives to protect – where appropriate – trees and treed areas, to preserve wildlife trees, and to encourage tree planting.

In addition to the OCP, the City enforces a "Bylaw for the Management and Protection of Trees within the City of Nanaimo" (Bylaw No. 4695). In this bylaw, the City defines significant trees in terms of heritage, wildlife and landmark values. It stipulates that no cutting of significant trees may be done without the prior acquisition of a Permit from the City, and specifies the information needed for permit application. The bylaw also prohibits activities that may damage trees, such as placing fill over roots or removing soil from near a tree. It also identifies requirements for tree replacement.

## 2.4 Archaeology

An Archaeological Overview Assessment (AOA) is often undertaken in advance of an Archaeological Impact Assessment (AIA) study and usually constitutes the first stage of an AIA, should it be found that such a study is warranted. The purpose of an AOA is to carry out a review of past archaeological studies and site inventory data within the project area and to determine the locations and nature of both known and potential archaeological resources in the development area. Most AOA studies also include a First Nations consultation component that focuses on gathering information from local First Nations groups and individuals about areas that may contain physical evidence of past aboriginal land-use or occupation.

# 3.0 METHODS OF ASSESSMENT

## 3.1 Ecology and Wildlife

Madrone performed a general ecosystem, vegetation, and wildlife inventory for the entire project footprint including a screening for rare plants, wildlife, and ecosystems. ESA polygons, as assessed by the City of Nanaimo, were also reviewed. Fieldwork to confirm the ecosystem distribution and to inventory any occurrence of provincial and federal listed plants and ecosystems was conducted in late April/early May and again in late May/early June of 2005 (*i.e.,* when ephemeral plant species are most likely to be present).

Additional site surveys took place in 2006, 2007, and 2008 to search for rare plants and to locate sensitive ecological features. Field inventories continued in 2009 to update the ecosystem mapping, to complete tree surveys, and to more accurately delineate wetland and riparian areas.

Wildlife surveys consisted of owl surveys as per the provincial standards (RISC, 1999a), songbird point counts as per provincial standards (RISC, 1999b), and wildlife habitat suitability assessments as per provincial standards (RISC, 2001). Eagle nest monitoring was also performed twice a month from January to April from 2005 to 2009. In addition to standardized surveys, a species list was maintained and updated on a regular basis of all species observed at the site by Madrone staff.

### 3.1.1 Prefield Research

Background information was gathered from the report "Inventory of Environmentally Sensitive Areas within the City of Nanaimo (Williams and Rose, 2003). Tracking lists for red and blue-listed plants, plant communities, and wildlife were obtained from the Conservation Data Centre of BC (CDC, 2005). These tracking lists were then re-visited in 2009 to update rare species occurrences (CDC 2009).

A search of the CDC database for red and blue-listed plant species occurring in the Regional District of Nanaimo (CDFmm subzone) yielded 44 records. Of this total, 17 are red-listed and 27 are blue-listed plants, all of which are vascular except one moss species. In addition, 12 of the plant species are listed on Schedule 1 of the federal Species at Risk Act (SARA). Based on our knowledge of the site ecosystems and conditions, many of the possibilities were ruled out by our Sr. Vegetation Ecologists.

A list of wildlife species of interest was also determined based on the location of the proposed development, known distributions and habitat requirements of wildlife species, and current red- and blue-listed species tracking lists (CDC, 2005). Our initial list of focal species for habitat suitability assessment consisted of red-and blue-listed species that had the greatest likelihood of occurrence in the area. Red-listed species included Marbled Murrelet (*Brachyramphus marmoratus*), Northern Goshawk, *laingi* subspecies (*Accipiter gentilis laingi*), and Keen's long-eared myotis (*Myotis keenii*). Blue-listed assessment species included Red-legged Frog (*Rana aurora*), Band-tailed Pigeon (*Columba fasciata*), Northern Pygmy-owl (*Glaucidium gnoma swarthi*), Western Screech-owl (*Megascops kennicottii*), Great Blue Heron, *fannini* subspecies (*Ardea herodias fannini*), and Townsend's big-eared bat (*Corynorhinus townsendii*).

In addition to being listed provincially, the Northern Goshawk, *laingi* subspecies and Marbled Murrelet are listed under the *Species At Risk Act* (SARA) as Threatened, while the Great Blue Heron (*fannini* subspecies) and Red-legged Frog are listed as species of Special Concern.

Additional site assessments were made to determine if seasonal habitats within the proposed development were suitable for other species of significance including Bald Eagle (*Haliaeetus leucocephalus*), Black Bear (*Ursus americanus*) and Columbian Black-tailed Deer (*Odocoileus hemionus columbianus*).

### 3.1.2 Field Sampling

Ecological plot sampling data was collected using ground inspection forms (GIF) as per "The Field Manual for Describing Terrestrial Ecosystems" (RISC, 1998). The following attributes were given priority for assessment:

- Potential habitat for threatened and endangered vertebrate species (provincially red and blue-listed); and
- Ecologically sensitive habitats such as wetlands and old growth forest.

The following habitat and site variables were recorded at each plot:

- Location: measured with GPS unit
- Slope: measured with a clinometer
- Aspect: measured with a compass
- Elevation: measured with an altimeter and 1:20 000 map
- Mesoslope position
- Average dbh (cm) and range of tree girths
- Average canopy height (m)
- Canopy closure %
- Overstorey – tree species composition
- Vegetation identification and % composition (shrub, herb and moss layers)
- Ecosystem type
- Presence of CWD and wildlife trees/snags
- Landscape factors
- Evidence of wildlife use
- Disturbance history
- Representative habitat photographs.

Plants were identified according to Pojar and MacKinnon (1994) and Douglas *et al.* (1998 – 2000). A rating of 1 to 6, as per the RISC standards for Capability/Suitability habitat mapping (RISC, 1999), was recorded at each plot for red and blue-listed vertebrates that are known to have the potential to occur in the area.

### 3.1.3 Ecosystem Mapping

Following fieldwork, polygons lines were drawn on the provided orthophoto base map (0.5 m resolution), and then numbered and described according to their dominant plant community type or 'ecosystem'. The ecosystem mapping provides descriptions in the form of structural stages and mapcodes. Up to three mapcodes can be applied to each ecosystem polygon. These interpretations describe each polygon's dominant ecosystem and vegetation structure. For example, the zonal ecosystem is represented by the mapcode 'DS' and exhibits a range of structural stages from 3 – 6 (refer to Appendix I for structural stage definitions). More information on mapcodes, modifiers and field methods can be found in the Resource Inventory Committee *Standards for Terrestrial Ecosystem Mapping in British Columbia* (RISC, 1998).

All ecosystems, with the exception of wetlands, were coded using two upper case letters indicated in the provincially correlated TEM code list (MEnv, 2006), including anthropogenic (human altered) units. Wetlands were classified following the Wetland and Riparian Ecosystem Classification system (WREC), which is based on the BEC system (Mackenzie & Moran, 2004).

The structure of the vegetation was determined using structural features and age criteria considered together. Structural stage 3, without additional substages, are used for regenerating forest communities that are herb or shrub dominated, including shrub layers consisting of only 10% – 20% tree species, and undergoing normal succession toward climax forest. Substages 3a and 3b may, for example, include cultivated fields, cultivated orchards or wetlands that are dominated by low or tall shrubs. Structural stages 4 – 7 are typically estimated from a combination of attributes based on field inventory results and/or aerial photography interpretation.

Three stand composition codes were applied to the structural stage modifiers indicating whether forested stands were coniferous (C), broadleaf (B) or mixed (M).

Stand composition modifiers were applied to tall shrub, pole/sapling, young and mature forests (structural stages 3 – 6). Coniferous stands are comprised of greater than 75% coverage of conifer trees. Mixed stands have neither coniferous nor broadleaf dominating (<75%) the total tree cover.

### 3.1.4 Breeding Bird Survey

A breeding bird survey was completed during May and June of 2005 to identify any species (including raptors and herons) nesting within the project footprint. Priority was given to the identification of the occurrence of provincial and federal listed species. Bird surveys involved traversing the study area and identifying birds both through vocalizations and visual confirmations. All bird species heard and/or seen were recorded on the site assessment field forms. An early dawn chorus survey was also conducted in June for breeding songbirds. Additional field assessments from September 2005 to April 2009 continued to note bird species observed on the property.

### 3.1.5 Owl Survey

During the initial site assessments for habitat suitability, it was determined that the property had some potential for nesting by five species of forest-dwelling owls found in the area. From smallest to largest these are: Northern Pygmy Owl (nesting period: mid-March to July), Northern Saw-whet Owl (Migratory; nesting period: early March to July), Western Screech-owl (Resident; nesting period: mid-March to July), Barred Owl (Resident; nesting period: late March to July), and Great Horned Owl (Resident; nesting period: mid-February to July) (Campbell *et.al.*, 1990).

The nocturnal raptor survey conducted on June 1 2005, followed the survey protocol outlined in the provincial standards for raptor inventory (RISC, 2001). At each site a modified RISC data form was used to record the survey data. Data collected included: environmental conditions, date and time of survey, general location of survey (descriptive), specific location (UTMs), surveyor(s), direction and distance of observation, comments, and other pertinent data as needed.

The survey involved broadcasting the calls of local owls using a megaphone and compact disc player at each station. Nine stations were conducted in total, providing complete coverage of the site. It is considered that the megaphone carries the songs a distance of approximately 300 m from the survey station. Each set of songs was broadcast towards the area of study at different directions (e.g., N, S, E, and W) in order to cover as much of the site as possible.

At each station we initially listened for spontaneous vocalizations for a period of 2 minutes. If no owls were detected within that time then call broadcasts resumed, starting with the smallest owl (Northern Pygmy Owl) and ending with the largest owl (Great Horned Owl).

Owl calls for each species were broadcast at intervals of 30 seconds, followed by 30 seconds of silence, and one full minute of silence at the end, for a total of 2 minutes of song broadcast and 3 minutes of listening (5 minutes per species). An additional 5 minutes of listening time occurred between small owl surveys and large owl surveys to make sure that small owls had adequate time to respond before large owl songs were played. If a large owl was detected, small owl calls were not played. Each station took a minimum of 10 minutes to complete for both small and large owl broadcasts.

## 3.2 Riparian and Fisheries

Initial field assessments carried out in 2005 focused on determining an appropriate riparian setback for the un-named creek that flows through the central and northern portion of the study area to determine the Streamside Protection and Enhancement Area (SPEA) width. As part of the background research, the Fish Wizard website (http://pisces.env.gov.bc.ca) was accessed to determine whether the creek had been identified as fish bearing, and for permanency of flow. This background work was also carried out as part of the overview ecological assessment to determine whether any known additional water bodies occurred on site. The City of Nanaimo and the Department of Fisheries and Oceans (DFO) were contacted for advice regarding the issue of fish presence or absence and the creation of an applicable SPEA adjacent to the known drainage.

Initial riparian assessments were completed by Helen Reid and Trystan Willmott in May, October, and November of 2005. Drainages were identified in the field by marking creek centre lines with flagging. During surveys fish habitat was noted and riparian vegetation was assessed regarding extent and functionality. To allow for the eventual setting out of the SPEA, top of bank was flagged on both sides of the creek in the field and mapped.

Top of bank was determined by locating the first break in slope adjacent to the creek where the slope angle was less than 30% for a distance of at least 15 meters. Current City of Nanaimo bylaws, which meet or exceed the Riparian Area Regulations (RAR) made under the *Fish Protection Act* 2004, were used as a basis for identifying top of bank.

Additional field work carried out by Trystan Willmott in January 2009 formed the basis of a more detailed site assessment to identify all drainages and wetlands on site. All wetland edges and creek lines were mapped using GPS and flagged in the field to facilitate accurate surveying (completed by professional surveyors – Williamson and Associates) and inclusion on base maps.

The applicability of City of Nanaimo bylaws and the provincial RAR was considered for each water body when determining appropriate setbacks.

## 3.3 Tree Management Plan

The Oceanview Golf Resort and Spa property encompasses 214.8 hectares (530.5 acres) of land containing a diverse tree resource. The City of Nanaimo requested an overview tree management plan to guide how this resource will be managed over the course of development.

It is not possible at this time to develop a site-specific tree management plan, as per the standards set out in Bylaw #4695. This Bylaw was not designed to be applied to a site as extensive as the proposed Oceanview Golf Resort and Spa development. As development proceeds and development footprints are determined, it will be necessary to work with the City of Nanaimo to implement a workable, realistic tree management plan for the property. In preparation for the next step, tree inventory data was collected by Madrone in 2006 and 2009 for the entire property. This data can be used to help manage the on-site tree resource.

### 3.3.1 Significant Tree Inventories

To provide the client with a general overview of the spatial distribution of remaining patches of old growth forest and isolated veterans, two days were spent in 2005 traversing the study area. On October 18 and 19 2005, veteran trees were mapped using GPS, with effort concentrated in the identified SEI old growth and second growth ESA polygons. Large trees identified elsewhere were also recognized, if encountered.

The criteria for significant trees as described in Schedule C of the City of Nanaimo Bylaw #4695 was used in all inventories to recognize significant trees in the field.

In addition to recording a UTM position for each tree, dbh, height and species were also collected. Further information regarding tree health and significant wildlife attributes were noted.

An additional assessment was carried out to record significant occurrences of Garry oak trees (*Quercus garryana*) adjacent to or within areas previously identified as ESAs by the provincial government and the City of Nanaimo.

In addition to the initial overview tree inventory carried out in 2005, a detailed assessment was carried out in February 2006 for a 100-acre parcel of land in the eastern portion of the property. This area encompassed the steep, forested slopes overlooking Stuart Channel and the selectively logged area to the immediate west. Four field days were spent traversing the 100 acre area, to ensure that all significant trees were inventoried.

An integral part of the tree inventory involved the collection of significant tree data, including Diameter at Breast Height (DBH). A GPS position was also recorded for each significant tree. To distinguish significant trees in the field, pink or orange spray paint was used to place a circular mark on each measured tree. A small proportion of trees were also marked clearly with pink or orange flagging tape, and labeled accordingly (2006 inventory). To assist in the inventory process of significant trees in the 100-acre parcel of land assessed in 2006, trees already marked by Chatwin Engineering Limited (Chatwin) during the preparation of their road tree management plan were included in the Madrone database. Trees were marked by Chatwin in the field with pink flagging.

In January and February 2009, the remainder of the development area (approximately 400 acres) was traversed over 2 weeks to inventory all significant trees. The significant tree inventory methodology in 2009 was the same as the 2006 inventory, with the improvement of marking each tree with a unique numbered metal tree tag for ease of tracking the data associated with each tree.

In addition to measuring the DBH, height and GPS location of each significant tree, Wildlife Trees were also measured and recorded by GPS location. Dead trees that displayed attributes in the form of woodpecker feeding sign and excavated nesting cavities were recorded and marked in the field as "WT" with blue or orange spray paint.

The entire portion of the development area was traversed during the detailed tree inventories in 2006 and 2009, with the exceptions being the 15 metre wide coastal buffer zone, the 15 metre wide buffer on either side of the Cable Bay Trail, and the 15 metre riparian buffers. These buffer areas were not inventoried for significant trees, with the understanding that they are to remain undeveloped.

## 3.4 Archaeological Impact Assessment – Scope and Nature of Investigation

The recently completed AIA project within the Oceanview Golf Resort and Spa lands employed standard archaeological assessment practices. This included:

- A review of information relating to previously documented archaeological sites and features within the project lands and immediate vicinity;
- A review of various archaeological and ethnographic publications, reports and related documentation that would provide an historic and cultural context for the Oceanview Golf Resort and Spa AIA project;
- A half-day field reconnaissance of portions of the Oceanview Golf Resort and Spa lands to assist in determining the location of previously recorded sites, briefly examine other areas that may have archaeological potential and to determine points of access and other logistical issues;
- A three day detailed AIA-level archaeological site inventory program to relocate and document both existing sites and to examine the project area for additional archaeological sites and/or features; this component of the field work entailed extensive foot traverses throughout the subject property;
- An examination of mature timber within the Oceanview Golf Resort and Spa lands (with a particular emphasis on redcedar stands) for the presence of cultural modification (*i.e.,* bark strips, test holes, etc.); and
- A comprehensive subsurface shovel testing program within the two previously recorded shell midden sites; shovel tests were also carried out at two newly discovered inland shell midden deposits and at several archaeological site potential locations along the Stuart Channel shoreline.

The boundaries of all previously recorded sites, as well as two new site locations, were flagged in the field with yellow surveyor's ribbon to facilitate future inclusion in a land survey program. Site locations were also fixed by means of a hand-held GPS instrument and plotted on project plans previously supplied by the client.

In the course of foot traverses throughout the property, all existing surface and subsurface exposures were examined for the presence of archaeological deposits or remains. In addition, a detailed examination was carried out of all rock crevice features, rock overhangs and rock-fall areas as these features often contain evidence of burial remains or other evidence of past aboriginal use. Finally, all sandstone outcrops and large sandstone boulders were examined for evidence of petroglyph (rock carving) features as these are common in the Nanaimo and adjacent Gabriola Island locales.

# 4.0 RESULTS

An initial site visit with the client was conducted in April of 2005 to discuss the property and the required assessments. Detailed fieldwork of a time sensitive nature (*i.e.*, rare plant and breeding bird surveys) were completed in May and June, 2005. Additional field surveys were conducted between September and November, 2005. Following completion of the Overview Environmental Assessment in 2005, further surveys were required due to modifications to the proposed development over time, requests from City of Nanaimo staff, and public information sessions. Field surveys continued into 2009 to further define the extent and distribution of riparian, wetland and meadow ecosystems as well as to complete the tree data collection.

## 4.1 General Site Description

The project area is located within the Coastal Douglas-fir moist maritime (CDFmm) biogeoclimatic subzone, which represents the dry, Douglas-fir forests along southeastern Vancouver Island and the Gulf Islands (Green and Klinka, 1994). Most of the area has been logged once between the 1950's and 1990's. More recent selective logging has occurred throughout the property, with remnant large Douglas-fir (*Pseudotsuga menziesii*) and small patches of younger forest (Photo 1).

More contiguous forest is present along the northern and eastern portion of the area, dominated by mature second growth. One patch of old growth forest is present along the coastal fringe that makes up the southeastern boundary of the study area. This forest stand was identified by the provincial government and the City of Nanaimo as an ESA.

**Photo 1.** Recent selectively logged area in the western portion of the study area.

Other significant ecological areas interspersed within the study area include a drainage running parallel to the Cable Bay trail, a mature Western redcedar forest, open meadows (also recognized as ESAs) and small wetland areas.

## 4.2 General Vegetation Description

### 4.2.1 Tree Composition

Tree species composition is primarily Douglas-fir, while redcedar (*Thuja plicata*) dominates in the moister areas. Other common species include big leaf maple (*Acer macrophyllum*), grand fir (*Abies grandis*) and red alder (*Alnus rubra*). Western hemlock (*Tsuga heterophylla*) is also present, but is represented only by trace occurrences. Garry oak and arbutus (*Arbutus menziesii*) occur on the drier sites and around the open meadows.

For the forested areas, canopy cover averages 50%, and ranges from very open (15%) to closed (85%). The average height of trees observed in the area was 25 m (ranging between 15 m and 35 m). The girth of trees varies throughout the proposed block, with an average of 45 cm dbh (ranging between 15 cm to 80 cm). In recently logged areas the canopy cover ranges from 1 – 10%, and is dominated by Douglas-fir and arbutus.

### 4.2.2 Shrub Layer

The shrub layer varies throughout the property. This layer is primarily dominated by salal (*Gaultheria shallon*) and dull Oregon grape (*Mahonia nervosa*). Other scattered shrubs include red huckleberry (*Vaccinium parvifolium*), Indian plum (*Oemleria cerasiformis*) ocean spray (*Holodiscus discolour*), common snowberry (*Symphiocarpos albus*), baldhip rose (*Rosa gymnocarpa*), and western trumpet honeysuckle (*Lonicera ciliosa*). On wetter sites, salmonberry (*Rubus spectabilis*), several species of willow (*Salix spp.*), hardhack (*Spiraea douglasii*) and devil's club (*Oplopanax horridus*) were present. In recently logged areas the shrub layer is dominated by ocean spray, salal, Oregon grape and bracken fern (*Pteridium aquilinum*).

### 4.2.3 Herbaceous Layer

The herbaceous layer varied throughout the area. This layer is dominated by sword fern (*Polystichum munitum*), trailing blackberry (*Rubus ursinus*), star flower (*Trientalis latifolia*), vanilla leaf (*Achlys tryphylla*), bracken fern, Alaska oniongrass (*Melica subulata*) and big-leaved sandwort (*Moehringia macrophylla*).

In wetter, richer areas, lady fern (*Athyrium filix-femina*), spiny wood fern (*Dryopteris austriaca*) and foamflower (*Tiarella trifoliata*) were often present. Skunk cabbage (*Lysichiton americanum*), Pacific water parsely (*Oenanthe sarmentosa*) and slough sedge (*Carex obnupta*) occurred where the moisture regime was high.

In recently logged areas the herbaceous layer is dominated by grasses, including onion grass and a variety of introduced grass species. Other herbs include trailing blackberry, western trumpet honeysuckle, sword fern and star flower, hairy cat's ear (*Hypochaeris radicata*) and yerba buena (*Satereja douglasii*).

### 4.2.4 Mosses

The most common mosses that occur are Oregon-beaked moss (*Eurhynchium oreganum*), step moss (*Hylocomium splendens*) electrified cat tail's moss (*Rytidiadelphous triquestris*) and palm tree moss (*Leucolepis menziesii*).

## 4.3 Summary of Ecosystem Map

Ecosystem mapping performed in 2005 resulted in 39 ecosystem polygons. The initial mapping focused on general ecosystem community types and structural stages. Subsequent to the 2009 field data collection and removal of the Regional District of Nanaimo portion of the study area in the south, the ecosystem mapping was refined to include more structural stage information and ecosystem identification resulting in an additional twelve polygons for a total of 51 ecosystem polygons (Figure 2).

Of the 51 Polygons mapped to date, only the ones located within the scope of the current development plan are included in this report, for a total of 39 Polygons.

Of the 39 Polygons depicted in Figure 2, 26 contain forested ecosystems, five of which have been recently harvested by a selective-patch system. Non-forested ecosystems consist of four small wetlands, and five terrestrial herbaceous meadows. In addition to natural ecosystems there are a number of anthropogenic areas including a gravel pit, a rock quarry/gravel pit area, a hydro right-of-way, roads and trails. Table 3 lists the ecosystem units, age (structural stage), confirmed presence of rare plants and additional comments.

Study Area Boundary
Stream
Non-classified Drainage
Ecology Plot (2009)
Ecology Plot (2005)
Meadow Watershed
Old Growth
Mature Forest
Young Forest
Terrestrial Herbaceous
Selectively Harvested
Gravel Pit
Right-of-Way
Riparian Area
Wetland

# ENVIRONMENTAL ASSESSMENT

Oceanview Golf Resort and Spa

Figure 2 - Ecosystem Map

MADRONE environmental services ltd

NORTHUMBERLAND CHANNEL

DODD NARROWS

Mudge Island

STUART CHANNEL

Cable Bay Trail

| Polygon ID | Vegetation Type | Site Series | TEM Label | Area (ha) |
|---|---|---|---|---|
| 2 | Meadow | 00 | 10SC2a | 0.13 |
| 3 | Meadow | SC | 10SC2a | 0.66 |
| 7 | Meadow | SC | 10SC2a | 0.71 |
| 9 | Wetland | Ws50 and 11 | 6Ws503a/4RC5 | 0.05 |
| 11 | Young Forest | 01 and 02 | 8DS5/2DA5 | 6.47 |
| 12 | Young Forest | 01 and 05 | 5DS5/3RK5/2DS5 | 12.71 |
| 13 | Selective Harvest | 01 and 05 | 7DS3/3RK3 | 53.89 |
| 16 | Selective Harvest | 01 | 10DS3 | 0.15 |
| 17 | Young Forest | 06 and 01 | 7RF5/3DS5 | 0.05 |
| 19 | Mature Forest | 04 | 10DG6 | 0.81 |
| 20 | Old Growth | 04 | 10DG7 | 1.33 |
| 21 | Young Forest | 01 | 10DS5 | 2.96 |
| 22 | Hydro R/W | R/W | 10RW | 0.74 |
| 23 | Meadow | SC | 10SC2a | 4.81 |
| 24 | Mature Forest | 01 and 04 | 6DS6/4DS6 | 9.55 |
| 25 | Young Forest | 01 and 02 | 7DS5/2DA5/1SC2a | 16.11 |
| 26 | Mature Forest | 04 and 01 | 8DG6/2DS6 | 5.44 |
| 27 | Mature Forest | 04 | 10DG6 | 6.44 |
| 28 | Selective Harvest | 01 | 6DS3/2DS3/2RF3 | 3.59 |
| 29 | Gravel Pit | GP | 10GP1a | 0.37 |
| 30 | Riparian Mature | 11 and 06 | 7RC6/3RF6 | 1.02 |
| 31 | Wetland | Ws50 and 11 | 6Ws503a/4RC5/ | 0.10 |
| 32 | Young/Mature mix | 01 | 6DS5/4DS4 | 5.54 |
| 33 | Selective Harvest | 01 and 06 | 6DS3/4RF3 | 3.91 |
| 34 | Young/Mature mix | 01 and 02 | 7DS6/3DA5 | 2.67 |
| 35 | Riparian Mature | 06 and 07 | 6RF6/4RS6 | 4.82 |
| 37 | Trail R/W | 01 | 10DS5 | 2.52 |
| 38 | Hydro R/W | R/W | 10RW | 0.64 |
| 39 | Selective Harvest | 01 and 05 | 8DS3/2RK3 | 4.58 |
| 41 | Mature Forest | 01 | 10DS6 | 1.24 |
| 42 | Meadow | SC | 8SC2a/1RO1a/1GP1a | 0.92 |
| 43 | Mature Forest | 01 and 06 | 6DS6/4RF6 | 3.49 |
| 44 | Young Forest | 01 and 02 | 8DS5/2DA5 | 1.88 |
| 45 | Young Forest | 01 | 10DS5 | 2.62 |
| 47 | Mature Forest | 01 and 05 | 6DS6/4RK6 | 2.57 |
| 48 | Mature Forest | 01 and 05 | 6DS6/4RK6 | 6.17 |
| 49 | Wetland | Ws50 and 11 | 6Ws503a/4RC5 | 0.04 |
| 50 | Shrub Wetland | Ws50 and 14 | 7Ws503a/3CS5 | 0.03 |
| 51 | Gravel Pit | GP | 10GP1a | 0.08 |

Scale = 1:7,000

Created April 30, 2009

0 200 400 600 800 1,000 m

## Table 3. Summary of Mapped Ecosystem Polygons with Respective Plant Communities and Status Rankings.

| Structural Stage | Polygon # | Dominant Plant Community | Provincial Code | Rare Plants | Comments |
|---|---|---|---|---|---|
| Old growth forest (7) | 20 | Douglas-fir/grand fir – Oregon grape | CDFmm/04 | | Southeast corner, small patch. |
| Mature forest (5–6) | 4, 5, 10, 11, 16, 17, 24, 34 | Douglas-fir – Salal | CDFmm/01 | | Small openings throughout these stands, some large FD vets. |
| Mature forest (6) | 1, 36, 37 | Douglas-fir/grand fir – Oregon grape, Western redcedar/grand fir – foamflower | CDFmm/04. CDFmm/06 | | Cable Bay Trail. |
| Mature forest (5–6) | 19, 26, 27,32 | Douglas-fir/grand fir – Oregon grape | CDFmm/04 | | Primarily along eastern portion on steep colluvial slopes and on the gentler lower slopes throughout the project area. |
| Mature forest (5–6) | 35 | Riparian area | CDFmm/04/06 | | Seasonal drainage into Cable Bay, alongside Cable Bay trail. |
| Mature forest (6) | 30 | Western redcedar/grand fir – foamflower | CDFmm/06 | | Adjacent to small wetland in northeastern portion of property, containing small patch of skunk cabbage-Pacific water parsley community. |
| Young forest (4) | 15, 21 | Douglas-fir – Salal | CDFmm/01 | | Young forest adjacent to right of way on eastern portion of property and along southern boundary. |
| Selectively logged forest | 8, 12, 13, 14, 25, 28, 32, 33, 39, | Douglas-fir – Salal and Douglas-fir/grand fir – Oregon grape, Western redcedar | CDFmm/01/04 | | Selectively logged areas with some large Douglas-fir and small patches of younger forest. |
| Herbaceous Terrestrial grass and herb dominated (2a) | 2, 3, 7, 23, 42 | Cladina – Wallace's selaginella | CDFmm/00 | Yes (Appendix III) | Seepage areas, and well-developed wildflower meadows in shallow soils. |
| Herbaceous/ shrubby (2b-3a,3b) | 22, 38 | Right of Way | NA | | Power line right of way. |
| Shrubby wetland (3a) | 9, 49, 50 | Spirea-trembling aspen | CDFmm/00 | | Small wetlands in selectively logged area. |
| Shrubby (3a) | 18 | Spirea Wetland | CDFmm/00 | | Adjacent to Cable Bay trail. Some skunk cabbage. |
| Wetland (2b) | 31 | Sedge wetland | CDFmm/00 | | Small wetland in northeastern portion of property. |
| N/A (1a) | 29, 51 | Gravel Pit | GP | | Frequent use by motorbikes. |

### 4.3.1 Forested Ecosystems

The project area is dominated by mature and selectively logged sites of Douglas-fir – salal (zonal site series 01). These zonal sites merge into the second most common plant community Douglas-fir/grand fir – Oregon grape (site series 04) in the slightly richer areas located primarily on the east facing colluvial slopes.

Also well represented is the richer, moister community labeled western redcedar/grand fir – foamflower (site series 06) (Photo 2). A small open area was found along the drainage from a small wetland near plot DN3 within the western redcedar/grand fir – foamflower (site series 06) plant community containing a patch of skunk cabbage and Pacific water parsley (Photo 3, and Figure 2).

Less common on the site is the plant community Douglas-fir – onion grass (site series 03), observed in drier, richer sites above the steep east facing colluvial slopes. The following subsections provide more detailed descriptions of the dominant forested ecosystems mapped within the area of study.

**Photo 2**. West of small wetland in northeastern portion of study area. The site series represented is western redcedar/grand fir – foamflower 06.

#### **4.3.1.1** Douglas-fir/ Salal (mapcode DS)

The Douglas-fir / salal (CDFmm/01) sites occur on gentle slopes above moisture receiving areas where nutrient availability and drainage conditions are moderate. These forested ecosystems are dominated by Douglas-fir, in association with western redcedar and bigleaf maple. The understorey is primarily dense salal, dull Oregon-grape, sword fern, and Oregon beaked moss. Less frequent species include oceanspray, red huckleberry, bracken fern, western hemlock, grand fir, step moss, and electrified cat's-tail moss. Indicator species that were recorded include orange and hairy honeysuckle and oceanspray. These ecosystems were found throughout the entire study area in harvested areas and maturing forests.

#### **4.3.1.2** Douglas-fir – shore pine / arbutus (mapcode DA)

The Douglas-fir – shore pine / arbutus (CDFmm/02) sites occur in small patches in association with shallow soils or exposed crest positions on sandstone bedrock where nutrients are more readily available. Douglas-fir – Shore pine – Arbutus ecosystems are typically found on drier, poorer sites including crests, upper slopes, warm aspects, and sites with deeper medium-textured (fine sand to silty loam) soils. Some have only a thin veneer of soil derived from glaciomarine or till origin overlying bedrock. Drainage ranges from very rapid to well. Forested ecosystems are dominated by Douglas-fir and arbutus with Garry oak occurring on the driest and poorest sites. Forest canopies are discontinuous with large gaps, partly as a result of historic fires. The understorey has a relatively diverse layer of drought-tolerant shrubs such as hairy honeysuckle, dull Oregon grape, oceanspray and salal. Herbs are relatively sparse in these forest types. Mosses cover much of the ground and woody debris (where present) featuring electrified cat's-tail moss, step moss, Oregon beaked moss and juniper haircap moss (*Polytrichum juniperinum*).

#### **4.3.1.3** Douglas-fir – Grand fir / Oregon grape (mapcode DG)

Richer than zonal sites, Douglas-fir – Grand fir / Oregon grape (site series CDFmm/04) ecosystems occur mostly on middle to upper sites on moderately to steeply sloping ground with deep, coarse-textured soil and large blocks of bedrock and colluvium. Douglas-fir and western redcedar are the dominant tree species. Bigleaf maple, grand fir, western hemlock and red alder are generally present. In the understorey, salal, dull Oregon-grape, sword fern and Oregon beaked moss are dominant. Younger stands have denser canopies due to the varying shade tolerance of the component species and sparse understories until canopy breakup occurs later in structural stage 5.

DG is uncommon in the study area but is locally common on the east facing slopes in the eastern portion of the property. DG is generally mapped in complex with DS (CDFmm/01) and DA (CDFmm/02) ecosystems.

#### **4.3.1.4** Western redcedar - Grand fir - Foamflower (mapcode RF)

Western redcedar - Grand fir - Foamflower (site series CDFmm/06) ecosystems are found in similar terrain and slope positions to site series 05 (gentle lower slopes and moisture receiving sites), but soils tend to be deeper, richer and imperfectly drained.

Dominant tree species include western redcedar, Douglas-fir, bigleaf maple, red alder and grand fir. The canopy tends to have more complete closure and ingress of western redcedar, with few shade-tolerant shrubs and herbs persisting in the understorey – primarily sword fern, red huckleberry, salal and dull Oregon grape. The most common mosses in these forest types are Oregon beaked moss and slender beaked-moss (*Eurhynchium praelongum*). Young ecosystems often contain a high percentage of red alder in the canopy and have a dense shrub layer of moisture loving species such as salmonberry.

#### **4.3.1.5** Western redcedar – Skunk cabbage (mapcode RC)

Western redcedar—Skunk cabbage forests (site series CDFmm/11) are nutrient-medium to nutrient-rich swamps with poor drainage. Soils often include a major component of organic material intermixed with deep, medium textured soils such as silty loam or silty clay loam. These forests inhabit level sites to depressions. Western redcedar, red alder, bigleaf maple and western hemlock are the dominant trees. The shrub layer has moderately high cover but low diversity, comprising of salal and salmonberry. The herb layer is often relatively diverse with many species, but the major components are lady fern, skunk cabbage and three-leaved foamflower. The moss layer often has a high cover of Oregon beaked-moss, palm tree moss, slender beaked-moss and leafy moss.

These swamp forest are often adjacent to wetlands and are commonly complexed with RF and Ws50 wetlands. RC sites are also found near water courses and on terraces above water courses, where it is commonly complexed with RF ecosystems.

#### **4.3.1.6** Western redcedar-Slough sedge (mapcode CS)

The Western redcedar-Slough sedge swamp forest (site series CDFmm/14) occurs on fluctuating water tables on poorly drained level sites and depressions. Western redcedar and sword fern may dominate elevated microsites, while sedges, lady fern, and horsetails (*Equisetum* sp.) occupy hollows with occasional skunk cabbage.

Soils are moderately deep to deep (0.5-1+ m) with medium texture, typically gleyed, with fluctuating water tables.

Tree species are limited to shade- and moisture-tolerant trees with relatively shallow roots: western redcedar, grand fir on margins, as well as red alder. Shrubs in CS sites are diverse, with salmonberry, salal, trailing blackberry, red-osier dogwood (*Cornus stolinifera*) and common snowberry. Herbaceous species are variable, with slough sedge the most common component of the herb layer, and sword fern also common. Moss tends to occupy little of the substrate with Oregon beaked-moss, step moss, slender beaked-moss and palm tree moss present.

The CS unit commonly occurs in small pockets mixed within other wet forest ecosystems such as the RF and RC and wetlands (Ws50).

### 4.3.2 Non-forested Ecosystems Mapped

Non-forested community types present on the assessed property include herbaceous communities (open meadows) and four small wetlands. Five polygons are identified as terrestrial herbaceous plant communities, which are also considered ESAs as previously documented by the provincial government and the City of Nanaimo.

The four wetlands mapped within the study area include Polygons 9, 31, 49, and 50 (Table 3). These wetlands are generally quite small, but still contribute to the biodiversity of the area and to wildlife habitat. One small open wetland, Polygon 31, is found in the northeastern portion of the area (Figure 2). This wetland has been altered by surrounding logging and road building. Some herbs are present on the edges and include slough sedge and skunk cabbage.

Two shrub-dominated wetlands were mapped in the southern portion of the property (Polygons 9 and 50), as well as Polygon 49 (a very small shrub wetland) located within the large selectively harvested Polygon 13 (Figure 2). These sites tend to be dominated by shrubs that include hardhack, willow species (*Salix spp.*) and red osier dogwood. Skunk cabbage and slough sedge are scattered throughout these wetland ecosystems (Photo 3).

**Photo 3.** Skunk cabbage site near wetland (Polygon 31) and mature Western redcedar forest in northeastern portion of study area.

#### **4.3.2.1** Selaginella – cladina (mapcode SC)

The selaginella-cladina non-forested meadow ecosystem (CDFmm/00) is a non-correlated map unit that consists of grasses and herbs, with a high cover of mosses and lichens. This ecosystem occurs on very shallow soils over exposed bedrock and contains the rare plant occurrences on site.

### 4.3.3 Anthropogenic Units Mapped

#### **4.3.3.1** Gravel Pit (mapcode GP)

Gravel pits were mapped in two locations: one in the far west as a component of a herbaceous community (Polygon 42) and the other as an entire polygon in the northeast. Both areas have been highly disturbed due to gravel and bedrock removal.

#### **4.3.3.2** Right-of-way (mapcode RW)

The hydro right-of-way has been mapped as separate unit because vegetation removal and maintenance have created a disturbed vegetation community. The right-of-way has disturbed soils over bedrock and is occupied by non-native vegetation, such as Scotch broom (*Cytisus scoparius*) and Himalayan blackberry (*Rubus discolor*).

## 4.4 Environmentally Sensitive Areas

Sensitive ecosystem types, also referred to as environmentally sensitive areas (ESAs), identified on the property include Terrestrial Herbaceous, Old Forest, and Mature/Older Second Growth Forest.

The most recent ESA mapping by the City of Nanaimo is depicted in Figure 3. Table 4 details the characteristics and ecological value of each ESA type.

The ESAs were mapped in more detail through the ecosystem mapping described above by Madrone (Figure 2). The general boundaries of the ESAs did not vary significantly from the polygons delineated in 2003 by the City of Nanaimo (Williams and Rose, 2003). The main differences in boundaries delineated in 2003 versus 2005 were due to recent logging activity prior to purchase of the site by the present landowners.

The boundary of the largest ESA meadow (ESA #634) was expanded and merged with ESA #653. The entire meadow boundary was walked and flagged by Madrone and professionally surveyed. In addition, the meadow watershed upslope was delineated and recommended for protection.

## Table 4. Characteristics of Environmentally Sensitive Areas in the Study Area.

| Ecosystem Type | SEI Polygon Number | City of Nanaimo ESA Number | Size (ha) | Description | Values |
|---|---|---|---|---|---|
| Old Forest (conifer dominated) | N0026 | 642 | 14.91 | Coniferous forests with <15% deciduous tree coverage. Average age of trees >100 years. Trees >50 m tall with dbh up to 1.5 m. | Structurally diverse and often specialized habitat for various species. High biodiversity. |
| Second Growth Forest (conifer dominated) | N0031 (part)<br>N0033 (part)<br>N0029 | 603<br>633<br>639 | 3.26 | Coniferous forests with <15% deciduous tree coverage. Typically between 60–100 years old. | Often forms effective buffers around other sensitive ecosystems (e.g., Terrestrial Herbaceous meadows and forest openings). Increasing biodiversity with age and potential to become Old Forest in the near future. |
| Terrestrial Herbaceous | N0028,<br>N0028A,<br>N0030,<br>N0027 | 657<br>655<br>653<br>634 | 0.79<br>0.54<br>0.29<br>3.35 | Open wildflower meadows and grassy hilltops interspersed with moss-covered rock outcrops. Gentle slopes (not exceeding 30%). Includes openings in forested areas and summits of local hills/mountains. | Specialized microclimates often exist (e.g., hummocks, hollows, vernal pools) that meet requirements of many niche-dependent species of plants and animals. Contain rare plants. |

Information regarding ecosystem description and values obtained from the CDC:
http://srmwww.gov.bc.ca/sei/index.html

N

Study Area Boundary
Stream
Non-classified Drainage

Older Forest ESA (as originally mapped for the City of Nanaimo in 2003)
Second Growth Forest ESA (as originally mapped for the City of Nanaimo in 2003)
Terrestrial Herbaceous ESA (as originally mapped for the City of Nanaimo in 2003)

ENVIRONMENTAL ASSESSMENT
Oceanview Golf Resort and Spa
Figure 3 - Ecologically Sensitive Areas Map

MADRONE environmental services ltd

NORTHUMBERLAND CHANNEL
DODD NARROWS
STUART CHANNEL
Mudge Island
Cable Bay Trail
ESA #603
ESA #603
ESA #633
ESA #634
ESA #639
ESA #642
ESA #653
ESA #655
ESA #657

Characteristics of Identified Sensitive Ecosystems Within the Cable Bay Property

| Ecosystem Type | SEI Polygon Number | City of Nanaimo ESA Number | Size (ha) | Description | Values |
|---|---|---|---|---|---|
| Old Forest (conifer dominated) | N0026 | 642 | 14.9 | Coniferous forests with <15% deciduous tree coverage. Average age of trees >100 years. Trees >50m tall with dbh up to 1.5m. | Structurally diverse and often specialized habitat for various species. High biodiversity. |
| Second Growth Forest (conifer dominated) | N0031 (part)<br>N0033 (part)<br>N0029 | 603<br>633<br>639 | 90.5<br>42.0<br>3.26 | Coniferous forests with <15% deciduous tree coverage. Typically between 60-100 years old. | Often forms effective buffers around other sensitive ecosystems (e.g. Terrestrial Herbaceous meadows and forest openings). Increasing biodiversity with age and potential to become Old Forest in the near future. |
| Terrestrial Herbaceous | N0028,<br>N0028A,<br>N0030,<br>N0027 | 657<br>655<br>653<br>634 | 0.79<br>0.54<br>0.29<br>3.35 | Open wildflower meadows and grassy hilltops interspersed with moss-covered rock outcrops. Gentle slopes (not exceeding 30%). Includes openings in forested areas and summits of local hills/mountains. | Specialized microclimates often exist (e.g. hummocks, hollows, vernal pools) that meet requirements of many niche-dependent species of plants and animals. Contain rare plants |

Scale = 1:7,000
Created April 30, 2009

0 200 400 600 800 1,000 m

### 4.4.1 Terrestrial Herbaceous Ecosystems

This sensitive ecosystem type is described as "Non-forested ecosystems, less than 10% tree cover, generally with shallow soils and often with bedrock outcroppings; includes large openings within forest areas, coastal headlands and shorelines: vegetated with grasses and herbs, sometimes low shrubs, and moss and lichen communities on rock outcrops" (Williams and Rose, 2003).

Four terrestrial herbaceous ecosystem polygons identified during the Sensitive Ecosystem Inventory (SEI) exist within the study area, labeled as Polygons N0028, N0028A, N0030, and N0027 (Ward *et.al.,* 1998). These terrestrial herbaceous ecosystems were also highlighted during the recent inventory of Environmentally Sensitive Areas (ESAs) within the city of Nanaimo in 2003 (Table 4 and Figure 3).

Dominant vegetation within the open meadows consists of rock mosses, grasses, lichens, and wildflowers. During the early field assessments, the meadows were covered with carpets of sea blush (*Plectris congesta)* and common camas (*Camassia quamash)* (Photos 4 and 5). The species lists on these sites are extensive (Appendix III). Several other commonly occurring species include yellow monkey flower (*Mimulus guttatus)*, large-flowered blue-eyed Mary (*Collinsia grandiflora* var. *pusilla*), few-flowered shooting star (*Dodecateon pulchellum)* and sweet vernal grass (*Anthoaxanthum odoratum*). Several Garry oaks were scattered throughout these herbaceous communities, particularly along the edges.

**Photo 4.** Blooming sea blush and monkey flower growing within ESA #634.

**Photo 5.** Camas growing within one of the open meadow ecosystems.

#### **4.4.1.1** Disturbance of Meadows

Direct evidence of ecological damage was witnessed during fieldwork assessments of the open meadows. Intrusion by off-road vehicles had resulted in the displacement of the thin coverage of vegetation and soil in many areas, especially in the south western portion of the largest meadow (ESA #634) and throughout ESA #653 (Photo 6). Another source of negative ecological impact is represented by the considerable infestation of broom, which is apparent throughout all the identified open meadows.

**Photo 6.** Example of damage from off-road vehicles within ESA #653.

### 4.4.2 Old Forest Ecosystems

One Old Forest ESA (#642) exists within the study area. Ecosystems found within this polygon are Douglas-fir – salal (zonal site series 01) and Douglas-fir/grand fir – Oregon grape (site series 04) (refer to sections 4.3.1.1 and 4.3.1.3 for a detailed description of these sites). The old growth tree assessment completed on October 18 and 19 2005 revealed that the ecosystem represented by ESA #642 remains relatively intact, with a good continuous cover of large coniferous and deciduous trees (some with a dbh in excess of 1.6 m) (e.g., Photo 7). There is no apparent fragmentation within the majority of ESA #642, although recent harvesting has occurred along the northwestern section of the polygon.

Douglas-fir is the dominant tree species within ESA #642, with grand fir, western redcedar and bigleaf maple also present. Arbutus also occurs, but to a lesser extent. The majority of large trees identified during surveys were Douglas-fir, although occasional western redcedars and bigleaf maples >80 cm dbh were also observed. The largest bigleaf maples were found on the lower slope along the coastal fringe. Almost all of the veteran Douglas-fir and western redcedar trees within the study area exhibited evidence of fire scarring.

**Photo 7.** Example of Douglas-fir veteran found within the southern portion of ESA #642.

### 4.4.3 Older Second Growth Ecosystems

Older second growth forest ESAs are found on the northern and eastern portion of the property in Polygons #603, 633, and 639 (Figure 3). As with the Old Forest ESA polygons, ecosystems found within these polygons are Douglas-fir – salal (zonal site series 01) and Douglas-fir/grand fir – Oregon grape (site series 04). Much of ESA #639 has been subjected to recent logging activities and associated fragmentation.

Disturbance through the construction of logging roads and skid trails is also apparent. Douglas-fir is the dominant tree species within ESA #639, with grand fir, bigleaf maple and redcedar also present. Despite the impacts of logging, patches of old forest and isolated veteran fir and redcedar are present (Photo 8).

**Photo 8.** Example of isolated Douglas-fir veteran found within central portion of ESA #639. Note recent (within the last 10 years) disturbance from logging.

### 4.4.4 Rare Plants

A full documentation of the four meadow areas was carried out by CDC during the sensitive ecosystem inventory (Ward *et.al.*, 1998). Significant occurrences of rare plant species exist within the terrestrial herbaceous meadows. Previous field work completed during the ESA mapping documented two red-listed and five blue-listed plant species within the largest meadow Polygon 23 (ESA #634). The red-listed species included: white top aster (*Aster curtus*) and Muehlenberg's centuary (*Centaurium muehlenbergii*).

Blue listed plants included: slimleaf onion (*Allium amplectans*), chaffweed (*Anagallis minima*), awned cyperus (*Cyperus squarrosus),* Nuttall's quillwork (*Isoetes nuttallii*), and banded cord-moss (*Entosthodon fascicularis).*

Three of the five blue-listed plant species were also found within Polygons 2 (ESA #653), 3 (ESA #655), and 7 (ESA #657) (Williams and Rose 2003) (see Appendix III). Two plants have been delisted since 2005: dune bentgrass (*Agrostis pallens*) and Hooker's onion (*Allium acuminatum*); populations are relatively stable, therefore they are now yellow-listed instead of blue-listed (Table 5).

Site visits since 2005 have indentified the potential for many of these species to also occur within Polygon 42 (a terrestrial herbaceous meadow adjacent to the old quarry and roads). CDC records from 2009 confirm that red and blue-listed plants are found within the same habitat found in portions of Polygon 42, which falls within ESA #633.

The presence of seepage sites through the meadows is an important habitat component for these rare plants (Photo 9). In addition, the meadows are bordered by second growth, selectively logged forest that creates a natural buffer around the meadows (Photo 10). It is important that these buffers be maintained in order to preserve the integrity of the sensitive meadows. The forest-meadow interface also provides highly suitable habitat for songbirds and other wildlife. Tree species within the forested edges consists mainly of Douglas-fir and arbutus, with the occasional Garry oak. Garry oaks can also be found within the open meadows (Photo 10).

**Table 5. Rare Plant Occurrences Within and Immediately Adjacent to the Assessment Area.**

| Plant Species | Common Name | Ecosystem Polygon # | Federal Status | Provincial Status |
|---|---|---|---|---|
| *Aster curtus* | white-top aster | 23, 42 | Threatened (May 2000) | Red-listed |
| *Centaurium muehlenbergii* | Muhlenberg's centaury | 23 | Endangered (Mar 2008) | Red-listed |
| *Allium amplectens* | slimleaf onion | 3, 7, 23 | | Blue-listed |
| *Anagallis minima* | chaffweed | 23 | | Blue-listed |
| *Cyperus squarrosus* | awned cyperus | 42 | | Blue-listed |
| *Entosthodon fascicularis* | banded cord-moss | 42 | Special Concern (May 2005) | Blue-listed |
| *Isoetes nuttallii* | Nuttall's quillwort | 2, 3, 7, 23, 42 | | Blue-listed |
| *Agrostis pallens* | dune bentgrass | 23 | | Yellow-listed* |
| *Allium acuminatum* | Hooker's onion | 23, 42 | | Yellow-listed* |

*listing status changed from 2005 to 2009 (blue-listed plants reduced to yellow-list)

**Photo 9.** Sea blush and monkey flower growing on a wet seepage area within ESA #634. Note the thin and fragile nature of the available soil.

**Photo 10.** Typical forested buffer around the edge of one of the open meadows; Garry oak visible in centre of photo.

### 4.4.5 Introduced Plant Species

Introduced non-native species are documented primarily in the open herbaceous terrestrial sites. Sweet vernal-grass (*Anthoxanthum odoratum)*, Kentucky bluegrass *(Poa pratensis)* and soft brome *(Bromus hordeaceus*) and other grasses were present on these sites. Scotch broom occurs sporadically throughout the more open disturbed and logged areas. Other introduced species include hairy cat's ear (*Hypochaeris radicata)*, English holly (*Ilex aquifolium*) and Himalayan blackberry. The species of greatest concern is Scotch broom, which tends to colonize disturbed and cleared areas and introduced grasses in the meadows.

## 4.5 Wildlife Habitat Assessment

The focus of field surveys for wildlife values was to identify the presence of suitable habitat for rare species (federal or provincially listed). Sections of the property were assessed as having low to moderate overall habitat suitability for potential use by the red- and blue-listed focal wildlife species. No rare wildlife species, however, were confirmed on the property during surveys. Field forms used to determine habitat values for potential red and blue-listed species within the areas of interest are available on request (30 pages of notes).

During field assessments, direct observations were made of a number of wildlife species (Table 6). One species of reptile, a common garter snake (*Thamnophis sirtalis*), and two species of amphibians (tree frog – *Hyla regilla* and rough-skinned newt – *Taricha granulosa*) were noted. The early-morning bird survey resulted in the identification of forty one species of bird. Three active Bald Eagle nest were located inside the property boundaries during the wildlife assessments. Two additional nest trees exist outside of the study area, one in Joan Point Park and another along the northern foreshore on Island Timberlands property (Figure 4). All bird species observed on the property are listed in Table 6 (fifty nine species in total).

Six species of mammals were observed on the property (Table 6). Evidence of Columbian black-tailed deer in the form of bedding areas, trails, browse and pellets was seen in numerous locations. Deer are known to be common in the area. Sign left behind by raccoons (*Procyon lotor*) and river otters (*Lutra Canadensis*) was identified on the shoreline adjacent to Dodd Narrows (Figure 4, plot DN6). Two Stellar's sealions (*Eumetopias jubatus*) were seen on the beach during surveys in October of 2005.

N

Study Area Boundary
Stream
Non-classified Drainage

Eagle Nest Location
Wildlife Habitat Suitability Plots (2005)
Owl Survey Stations (2005)

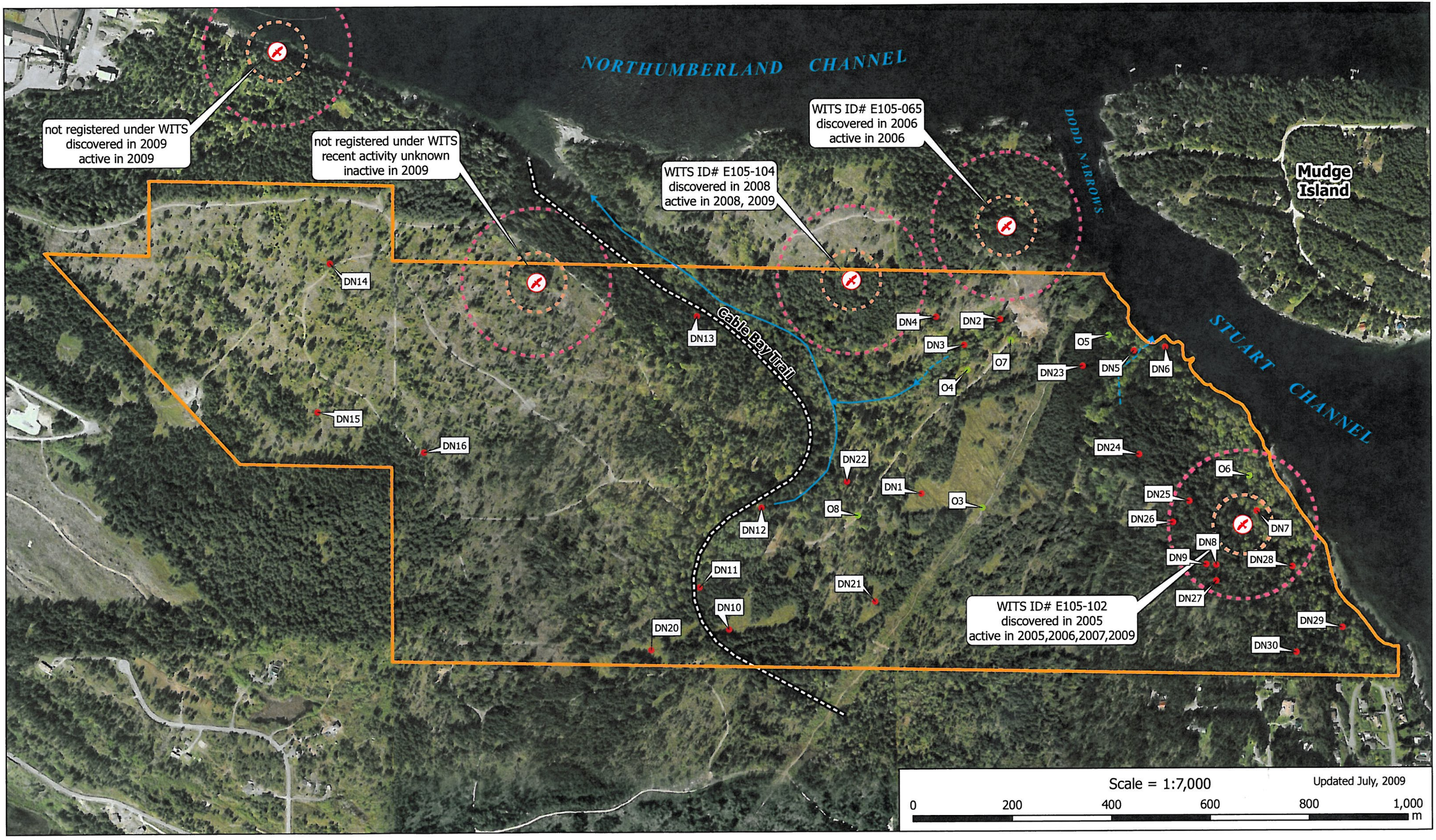
Nest Tree Buffer (60m)
Seasonal Buffer (150m)
WITS = Wildlife Tree Stewardship Program

ENVIRONMENTAL ASSESSMENT

**Oceanview Golf Resort and Spa**

**Figure 4 - Wildlife Survey Map and Bald Eagle Nest Sites**

MADRONE environmental services ltd



## Table 6. Wildlife Species Confirmed on the Oceanview Golf Resort and Spa Property During Field Surveys.

| AMPHIBIANS AND REPTILES | | |
|---|---|---|
| Pacific Tree Frog | | |
| Red-legged Frog (adult) | | |
| Rough-skinned Newt | | |
| Western Garter Snake | | |
| **BIRDS** | | |
| American Goldfinch | Glaucous-winged Gull | Song Sparrow |
| American Robin | Great Blue Heron | Spotted Towhee |
| Bald Eagle | Great Horned Owl | Stellar's Jay |
| Barred Owl | Hairy Woodpecker | Swainson's Thrush |
| Belted Kingfisher | Hammonds Flycatcher | Townsend's Warbler |
| Bewick's Wren | House Finch | Tree Swallow |
| Black-headed Grosbeak | House Wren | Turkey Vulture |
| Black-throated Grey Warbler | Mallard | Varied Thrush |
| Black Swift | McGillvery Warbler | Vaux's Swift |
| Brown Creeper | Merlin | Violet-green Swallow |
| Bushtit | Northern Flicker | Warbling Vireo |
| California Quail | Olive-sided Flycatcher | Western Tananger |
| Chipping Sparrow | Orange-crowned Warbler | White-crowned Sparrow |
| Common Raven | Pacific slope Flycatcher | Willow Flycatcher |
| Cooper's Hawk | Pileated Woodpecker | Wilson's Warbler |
| Cedar Waxwing | Pine Siskin | Winter Wren |
| Chestnut-backed Chickadee | Purple Finch | Yellow-rumped Warbler |
| Common Nighthawk | Red-breasted Nuthatch | |
| Dark-eyed Junco | Red-breasted Sapsucker | |
| Double crested Cormorant | Red-tailed Hawk | |
| European Starling | Rufous Hummingbird | |
| | | |
| **MAMMALS** | | |
| Columbian Black-tailed Deer | | |
| Eastern Cottontail | | |
| Raccoon | | |
| Red Squirrel | | |
| River Otter | | |
| Stellar's Sealion – hauled out on beach | | |

### 4.5.1 Owl Surveys

Nocturnal raptor surveys for local owl species were conducted on June 1, 2005. Surveys resulted in the detection of Barred Owls. The first response was detected at station 6, located along the coastal fringe of forested habitat in the eastern portion of the study area (Figure 4). The owl was highly vocal, with at least three owls detected (one juvenile and two adults). Another Barred Owl was heard near the Cable Bay trail parking lot to the south of the property boundary in the previously assessed RDN portion.

Despite the lack of response from the other owl species, it is likely that additional nocturnal raptors use the area. This assumption is made based on the identified owl habitat values (discussed in the following section), and the discovery of owl pellets made by a small owl near the wetland delineated as Polygon 31 (Figure 2). The presence of Barred Owls, which are known to predate small owls, may explain the lack of responses from small owls. Appendix IV contains a detailed account of the observations made during the owl survey. Following surveys in 2005, an incidental observation of a Great-horned Owl at the site was made during riparian assessments in 2009.

### 4.5.2 Habitat Suitability Summaries

Below are brief summaries of the habitat requirements of red- and blue-listed focal species and other high profile species (black bear, deer and Bald Eagles) as they relate to features present within the area of assessment.

#### **4.5.2.1** Marbled Murrelet (Red-listed)

This species typically nests in trees in coastal old-growth forests or mature forests with old growth characteristics (Burger, 2004). The lack of large trees (>80 cm dbh) with epiphyte coverage in the canopy generally precludes the use of the area by this species. Two wildlife assessment plots (DN30 and DN8), were considered to have limited potential for Marbled Murrelet nesting, due to the presence of large platforms within the canopy (Figure 4). Epiphyte coverage, however, was low at these plots, which reduces the overall suitability of the site for nesting. In addition, trees that are suitable for nesting, but that are located adjacent to the ocean, are downgraded due to increased predator abundance (e.g., eagles, crows, ravens, and jays) along coastal edge habitat.

#### **4.5.2.2** Northern Goshawk, laingi subspecies (Red-listed)

The survey of the study area provided no evidence of goshawk occupancy. No stick nests were observed, and no visual or audio evidence was identified.

Despite the apparent lack of occupancy, some portions of the area assessed were rated moderately for potential suitability based on benchmark habitat data summarized by McClaren (2004) and Proulx et al. (2003). In particular, assessment plots DN5, DN25 and DN26 were determined to be moderately suitable for goshawks. These sites were found in the older forest habitat along the eastern part of the study area. Habitat attributes at the identified plots included an open forest floor, a relatively high canopy cover and a large amount of CWD. These qualities are known to be required by goshawks. The CWD could provide suitable habitat for smaller mammals and passerines—the majority of prey animals, which comprise the diet of goshawks in the region. Potential prey species were heard and seen within the assessment area (e.g., Steller's Jays - *Cyanocitta stelleri* and American Robins – *Turdus migratorius*), and Red-breasted Sapsucker (*Sphyrapicus ruber*) feeding signs were also noted on several wildlife trees. Additional sites with low to moderate habitat suitability for goshawks were found at assessment sites DN8, DN29, and DN30. Again, these plots were found within older forest habitat. Despite the attributes of the identified assessment plots, the majority of the property was not rated highly for northern goshawk suitability.

#### **4.5.2.3** Keen's Long-Eared Myotis (Red-listed)

Davis et al. (2000, as cited in Chatwin 2004) indicated that caves >100 m in length and above 500 m elevation are known to be important winter hibernation sites for myotis bats. Rock faces and knolls with crevices that are solar or geothermally heated are important maternity roosts while tree cavities in wildlife trees and loose bark are important natural roost sites and may be limiting in some parts of their range. Insect-rich low elevation coastal forest and riparian areas are important foraging areas.

The surveyed area contained several wildlife trees which could serve as suitable roosting sites. Large (>1 m dbh), rotted out snags, especially cedar trees, provide the highest suitability for potential bat roosting on site. Some hollow cedar trees were identified during the old growth tree assessment. The majority of roosting sites existed within isolated veteran trees (Douglas-fir and cedar), and older forest ecosystems. Additional potential roosting sites were identified within sandstone outcrops near assessment plot DN8 (Figure 4). No suitable habitat for hibernating was present.

Important foraging habitat exists within the insect-rich riparian area of the creek that flows through the property and the open meadow ecosystems. The forested edges of the meadows would provide for roosting opportunities in close proximity to prime forage.

#### **4.5.2.4** Townsend's Big-Eared Bat (Red-listed)

The habitat requirements of Townsend's Big-Eared Bat essentially mirror those of Keen's Long-eared Myotis (BC MELP, 1998). No suitable habitat for hibernating (critical habitat) was present on the assessed property.

#### **4.5.2.5** Band-tailed Pigeon (Blue-listed)

In the US Pacific Northwest, this species is found primarily below 1000 m in fir-hemlock-cedar-spruce stands (Braun 1994). Nesting occurs in virtually all habitat types, and in areas which are rich in berry-producing shrubs as well as in areas rich in bud-producing deciduous trees.

Overall, nesting suitability was considered moderate to good within the forested areas, especially in the older forest in the eastern and south eastern portion of the property. Foraging habitat is plentiful throughout the area, especially in recently greened-up cleared areas that are thick in berry producing shrubs.

#### **4.5.2.6** Northern Pygmy Owl (Blue-listed)

The Northern Pygmy-Owl has been reported breeding in mature and second-growth coniferous forests, mixed riparian forest, and pure deciduous stands, and tends to breed near the edge of forest openings, rather than in interior forest (Johnsgard, 1988). It is largely dependent on woodpecker cavities for nest and roost habitat. In British Columbia, the Northern Pygmy Owl prefers edges of open coniferous forests or mixed woodlands during the breeding season (Campbell et al., 1990).

Nesting habitat suitability for the area surveyed was considered to be moderate to high in several places. The best habitat was found at assessment plots DN5, DN6, DN8, DN9, DN22, DN28, DN29, and DN30. Sites with moderate suitability included assessment plots DN2, DN3, DN7, DN14, DN25, and DN 26 (Figure 4). At all of these sites, large Douglas-fir snags with woodpecker cavities were evident. Most of the identified suitable habitat was found within or adjacent to patches of older forest, or inside the old forest ecosystem within the eastern and south eastern part of the assessment area.

Valuable edge habitat around wetlands and adjacent to natural and human-made clearings was commonly encountered throughout the property.

#### **4.5.2.7** Western Screech Owl (East coast, CDF population is Blue-listed)

In the northern potion of its range, the Western Screech-Owl is generally found in lower elevation forested or treed environments, especially in riparian forests (Johnsgard, 1988).

This species will roost in tree cavities, on branches, in nest boxes, and in cliff crevices (Johnsgard, 1988). Like the Northern Pygmy Owl, this species is a secondary cavity nester and is largely dependent on the excavations made by large woodpecker species. Overall, nesting habitat suitability for the area surveyed was moderate to high in numerous locations. The best habitat was identified at assessment plots DN2, DN3, DN5, DN6, and DN30. Moderately-suitable habitat was identified at plots DN7, DN8, DN9, DN22, DN24, and DN29. Again, the majority of suitable screech owl habitat was found either within, or adjacent to, old forest ecosystems that contained wildlife trees with excavated cavities.

#### **4.5.2.8** Red-legged Frog (Blue-listed)

The life history of this species requires it to have suitable heavily vegetated aquatic areas in which to breed and to have the terrestrial component of its habitat dominated by tall shrubs, CWD and a relatively flat substrate (Maxcy, 2004). The riparian area adjacent to the creek flowing through the centre of the study area and the wetlands located within the property boundaries (e.g., at assessment plot DN2) (Photo 11) may provide suitable breeding habitat for Red-legged Frogs. At the very least, these habitats would provide important forage and security areas for this species. Other suitable terrestrial habitat exists within the older forest ecosystems, where CWD is plentiful. An adult Red-legged Frog was observed during assessments carried out in 2009 in a ditch adjacent to Cable Bay Trail.

**Photo 11.** Wetland found at assessment plot DN2. This habitat could provide potential breeding habitat for red legged frogs. Note presence of aquatic vegetation, which is required by breeding females.

#### **4.5.2.9** Black Bear (Yellow-listed)

No direct evidence of black bear use was encountered during the field assessments. The relative abundance of berry-producing shrubs and other potentially important forage, however, indicate that this area will support black bears (BC MELP, 2001). Salal is widespread in the area and is often heavily used in late summer. While no bear dens were located, it is possible that they exist within the root systems of some of the larger veteran trees that exist within the older forest ecosystems.

#### **4.5.2.10** Columbian Black-tailed Deer (Yellow-listed)

Deer use within the study area is high, with evidence of use in the form of pellets, browse, bedding areas and trails present throughout. There is no lack of food for deer, and winter conditions are mild enough along the coast that snow pack is not an issue (deer winter range habitat is therefore of little importance within the assessment area). Overall values for deer are high for forage and security all year.

#### **4.5.2.11** Bald Eagle (Yellow-listed)

Bald Eagles are a significant and conspicuous component of the BC avifauna, especially on the coast. Bald Eagles are generally considered ecologically significant, as they are keystone predators, helping to regulate other bird populations (Environment Canada, 2004). They also have a very high public profile, and are significant in the BC ecotourism industry.

Bald Eagles are large birds with some specific and exacting perching and nesting habitat requirements. Throughout the coastal forests, Bald Eagles nest typically in large, old trees that have developed sufficiently stout limbs to support their often huge nests. They exhibit a strong preference for large, dominant or co-dominant trees in a heterogeneous stand of mature or old-growth coniferous timber (Stalmaster *et.al.*, 1984). The preferred trees also need to be in a strategic location, with a good viewscape of the surroundings and, importantly, a good line of sight to a nearby productive feeding area. Generally speaking, the larger diameter the trees, the higher the potential nest tree value, and the higher the value for a whole suite of other species that are generally associated with wildlife trees and old or mature forest stands.

The best territories are thus likely to include:

- highly productive feeding area(s) (*i.e.*, shoreline, salmon river and/or well stocked lake),
- a number of actual and potential nest trees present,

- a good selection of ideal perching and roosting trees, well distributed in strategic sites throughout the territory.

On the coast, eagles typically occupy nest territories of about 1.5 $km^2$ to 6.0 $km^2$ (Broley, 1947, cited in Blood & Anweiler, 1994). The actual territory defended probably is limited to a much smaller area where nesting and foraging activities are concentrated, especially along shorelines (Stalmaster *et.al.*, 1984). Each pair will defend an area around the nest; average defended distances from active nests are 600 m (Mahaffy and Frenzel, 1987 in Blood and Anweiler, 1994). Minimum observed distances between active nests in areas of high abundance can be as little as 500 m to 650 m, although mean densities are about 1 nest per 3 to 4 km of shoreline (Blood and Anweiler, 1994).

In addition to the active nest, a pair of eagles may have up to three alternate nest sites within their territory. The exact function of alternate nests is uncertain, but it is variously suggested that alternate nests may:

- be used if the active nest is disturbed/destroyed,
- reduce susceptibility to nest parasites or predators,
- promote nest security,
- reduce negative impacts to the nest trees and adjacent resources,
- act as a visual signal indicating territory boundaries,
- play a role in courtship and pair bonding.

Bald Eagles are not currently on federal (COSEWIC) or provincial (red and blue) status lists for threatened or endangered species; however, they are protected both directly and indirectly by provincial legislation and were blue-listed prior to 1995. In addition to the direct protection afforded to wildlife under the *Wildlife Act*, Bald Eagle nests - and hence, effectively, their nest trees - are further given year round protection. Section 34 of the provincial *Wildlife* Act states:

> 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 (b) when the nest is occupied by a bird or its egg.

In this regard, **nest** is defined as "a structure, or part of a structure, prepared by or used by an animal of the class Aves to hold its eggs or offspring." In other words, it is illegal to destroy an eagle nest at any time of year, regardless of whether it is active or inactive. Any removal or topping of identified eagle nest trees must be approved via a Permit issued by the Regional Manager of the Ministry of Environment (MoE) in Nanaimo.

To date, three Bald Eagle nests have been found on the Oceanview Golf Resort and Spa property in addition to two other nest trees immediately adjacent to the property. Based on numerous observations of eagle activity in the area, we believe that the five nest trees represent up to three territories within the area, which are spaced approximately 500 to 800 m apart. All five of the nests are located in veteran Douglas-fir, which have significant height and girth and fall under the "significant tree" classification as per the City of Nanaimo Bylaw. The following is a summary of information on the five nest trees:

1. Nest E105-102, located on the eastern slope of the property adjacent to Dodd's Narrows, was active during 2005, 2006, 2007, and 2009. At least one chick successfully fledged in 2005, although the singular chick that hatched in 2006 died. During 2007, one chick fledged from the nest. The nest was inactive during the 2008 breeding season, but was active again in 2009, with the adults sitting on eggs as of April 27th.
2. Nest E105-104, west of Joan Point Park, was known to be active in 2008 with the successful fledging of one chick. We believe that the pair at E105-102 used this nest as an alternate in 2008. The nest was not active in 2009, however, but at least one adult was often observed perched on the tree top, sometimes with an immature eagle. On at least one occasion a pair of adults was seen at this nest tree in 2009, which could indicate a second pair (as it is highly unlikely that both adults from E105-102 would leave their eggs unattended).
3. A third nest tree is located on the property to the west of Cable Bay Trail, and has yet to be registered under WiTS. This nest tree may have been active historically based on the MacMillan-Bloedel forestry company "Wildlife Tree" sign on the tree. There is no evidence of recent nesting activity at this tree, and no eagles have been seen at it during our surveys from 2005 to 2009. Most of the vegetation around this nest tree was logged prior to 2004.

4. Nest E105-065 (Joan Point) was known to be active during the 2006 breeding season, with at least one chick fledging. Breeding activity in 2007, 2008, and 2009 was not observed.
5. A fifth known nest occurs on the northern foreshore outside of the study area (on Island Timberlands property) (Figure 4). The nest was active in 2009, with birds sitting on eggs as of April 21st. In our opinion, this nest represents a third breeding pair/territory.

All Bald Eagle breeding activity at the site has been documented and shared with appropriate agencies, such as the Wildlife Tree Stewardship Program (WiTS) and the Ministry of Environment (MoE), with the support of the client. In addition, a member of WiTS joined Madrone during one of the eagle nest tree monitoring sessions in 2008.

## 4.6 Riparian and Fish Habitat Assessment

### 4.6.1 Riparian Areas

One riparian area was identified and mapped on the property adjacent to Cable Bay Trail. The creek runs northwest out of the central portion of the property, and discharges into the ocean approximately 200 m north of the property's northern boundary. It is a seasonal drainage, in that it flows less than six months of the year. The creek originates from two smaller first order streams, one from the south and one from the east (Figure 5). The gradient in the upper reaches of the drainage is gentle, and the riparian area is wide and characterized with numerous sword ferns, skunk cabbage and Pacific water parsley. The canopy consists primarily of mature Western redcedar, bigleaf maple, and red alder in the upper portion.

At the confluence of the two first order streams, the gradient is very low and the drainage spreads out to encompass an extensive wetted area; the creek is difficult to determine within this area. Vegetation at the confluence consists primarily of salmonberry, skunk cabbage and slough sedge. The canopy is characterized mainly by mature Western redcedar and red alder.

Immediately downstream of the confluence, the gradient increases and the stream channel becomes easier to define. The channel becomes confined in some areas, and steep slopes exist above the right bank (eastern side) of the drainage.

The vegetation on both side of the channel is generally moist and rich (site series 04/06) and dominated by mature Western redcedar and Douglas-fir. The drainage eventually leaves the study area, where it flows into Northumberland Channel as a second order stream.

In addition to the more obvious benefits to connected lotic and lentic ecosystems, all riparian areas are particularly important for species of amphibians (both as breeding and forage/security habitat), as they offer moist, shaded habitat. In addition, bats will use these insect-rich areas for foraging, and the adjacent forest for roosting.

### 4.6.2 Non-classified Drainages

A section of drainage that connects to the riparian area from the eastern branch was mapped as a Non Classified Drainage (NCD), as the extreme upper limits of the watercourse could not be classified as a stream.

A second small drainage classified as a NCD was mapped in the northeastern portion of the study area (Figure 5). When water is present, it flows east into Dodd Narrows. Vegetation within this NCD consists mainly of sword fern, with small patches of slough sedge. Tree species consist of bigleaf maple, Douglas-fir and Western redcedar. The occasional red alder also occurs. Fish habitat does not exist anywhere within this drainage, as there are no areas where pools can develop creating wetted habitat for fish survival. More importantly, the drainage is not connected to the ocean. A vertical drop of approximately 3 meters marks the point where water in the creek would fall down to flat bedrock above the high tide mark, meaning that anadromous species cannot access this drainage. Lack of water within this creek, even in the form of residual pools, indicates that it flows only during high rainfall events, or for short periods of time in the late fall and winter.

### 4.6.3 Wetlands

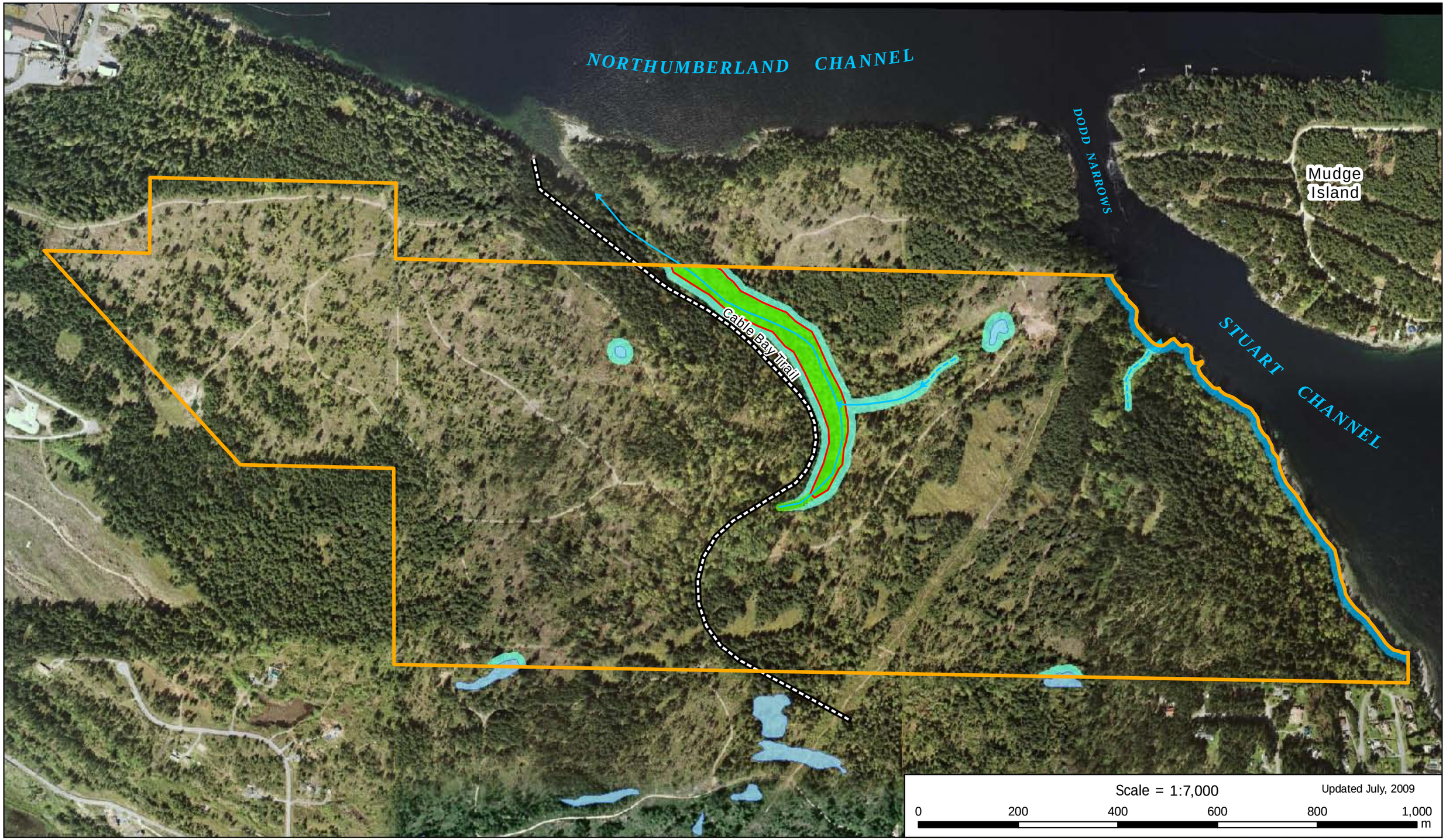
In addition to a riparian area and two NCDs, Madrone identified four small wetlands (from the smallest at 0.04 ha to the largest at 0.27 ha) on the property, two of which straddle the southern property boundary. While the wetlands are small and do not support fish, or connect to fish bearing habitat, they contribute significantly to biodiversity on the property, and provide habitat for numerous species of wildlife. Development adjacent to wetlands has the potential to alter drainage characteristics, which can result in the loss of wetland areas. All drainages and wetlands (including the top of bank and HWM, where appropriate) were surveyed by professional surveyors for consideration in design of the development.

N

Study Area Boundary
Stream
Non-classified Drainage
Wetland
Wetland Buffer
(15m No Vegetation Disturbance Zone)
Top of Bank
Riparian Area
Buffers (Classified and Non-classified Drainages)
Coastal Buffer

ENVIRONMENTAL ASSESSMENT
Oceanview Golf Resort and Spa
Figure 5 - Riparian (Classified and Non-classified Drainages) and Wetlands

MADRONE environmental services ltd




Scale = 1:7,000
Updated July, 2009
0 200 400 600 800 1,000 m

### 4.6.4 Fish Habitat Potential

Potential fish habitat (albeit marginal) exists in the lower reaches of the main drainage that parallels Cable Bay Trail. No other drainages or wetlands on site offer fish habitat, due to a lack of required habitat attributes and lack of connectivity to known fish habitat.

Limited fish habitat value was identified within the main Cable Bay drainage where it flows through the property, due to an overall lack of permanent wetted habitat and residual pools for rearing. Spawning gravel was limited throughout the system, although adequate gravel was present close to and below tidewater. Outside of the property, some potential for chum (*Oncorhynchus keta*) and pink salmon (*O. gorbuscha*) spawning exists, as the eggs of these species can withstand some saltwater intrusion.

The lack of perennial water flow should not be used to assume fish absence, as fish may use the creek during high flow periods. For example, anadromous fish may use the creek for spawning in late fall, and incubation of eggs and development of embryos could occur over the winter months. Upon hatching, survival of juvenile salmonids that depend upon freshwater for rearing (e.g., coho salmon – *Oncorhynchus kisutch*) would be dependent upon the presence of wetted habitat, which may vary from year to year (Sandercock, 1991). Other species of salmonids that may be more likely to occur include chum salmon and pink salmon. Juveniles of these species enter the ocean almost immediately after hatching, and are not as dependent upon wetted habitat in freshwater for survival (Salo, 1991; Heard, 1991).

Background research using Fish Wizard (http://pisces.env.gov.bc.ca) suggested that the creek was non fish-bearing. Fish absence, however, would need to be proven by multiple samples carried out during different seasons. Further sampling to justify fish absence may include a late fall visual assessment of adult spawning salmon, and minnow trapping and/or electroshocking in the late spring (while wetted habitat is still present) to assess for juvenile fish. Detailed fish habitat assessments (including sampling) have not been completed on site, as the dimensions of existing riparian setbacks would remain unchanged if fish were found.

### 4.6.5 Riparian Setbacks

The City of Nanaimo has taken the "meet or beat" approach to implementing the *Riparian Area Regulation*s (RAR) made under the provincial *Fish Protection Act (2004)*. For the main Cable Bay drainage that follows the public access trail, the Streamside Protection and Enhancement Area (SPEA) width is 15 m on either side (measured from the top of bank).

All the mapped setbacks meet or beat the RAR, and as long as the setbacks are respected, the RAR process does not need to be followed. All mapped creeks have been added to the Development Permit Application process. The main Cable Bay drainage has been mapped and associated with a SPEA as per City of Nanaimo bylaws; no other "RAR applicable drainages have been identified by the City, or as part of the ecological assessment. All additional water-bodies found during the ecological assessment are either NCDs or isolated wetlands that do not provide fish habitat or connect to fish habitat.

## 4.7 Tree Management Plan and Significant Tree Inventory

The density, size and distribution of forests on the Oceanview Golf Resort and Spa property are dictated mainly by disturbance in the form of logging, as well as soil condition. The most common forest type consists of second growth stands of Douglas-fir of various ages. The dominant tree is Douglas-fir, but redcedar, grand fir, bigleaf maple, red alder, Garry oak and arbutus are also present and locally abundant. By far the majority of the trees in these forests are not significant in terms of size. However, scattered throughout are veteran trees that tower above the surrounding younger stands.

All significant trees, as defined in the City's Tree Protection Bylaw 4695, have now been marked in the field and mapped (Figure 6). This information can be used to determine an appropriate tree management strategy if development proceeds over the coming years. The specifics of Bylaw #4695 may not be directly applicable to a development of this magnitude, although the bylaw should be used as a basis for the permitting process and developing general recommendations for tree management.

### 4.7.1 Distribution and Abundance of Significant Trees

A total of 2,107 significant trees have been identified on site (Figure 6). The majority of large trees recorded were Douglas-fir (41% of the total). Some of these trees probably exceed 500 years in age, having survived several fires that may have eliminated many of their neighbours. These trees, several of which exceed 50 m in height, are disproportionately important for wildlife, for aesthetic value and as landmark features.

Garry oak are also well represented on the property, although they are generally of much smaller stature. They tend to be short for their diameter, typically with heights of 6 to 10 m and DBHs of 25 to 40 cm, probably due to the limited soil depths and severe summer drought conditions. However, all meet the criterion of significance (>10 cm DBH) in bylaw 4695. The tree inventories revealed that the majority of this species existed either within, or in close proximity to the boundary of the open meadow habitats.

Other significant species include western redcedar, bigleaf maple, grand fir, arbutus, western hemlock and Pacific yew (*Taxus brevifolia*). Table 7 presents a summary of the significant tree species and abundance located during the inventory:

**Table 7. Significant Tree Abundance by Species, Percent of Total and Percent of Coniferous and Deciduous Trees.**

| Tree Species | Number of Trees | Percent of All Significant Trees | Percentage of all Coniferous Trees | Percentage of all Deciduous Trees |
|---|---|---|---|---|
| Douglas-fir | 860 | 41% | 72% | |
| Red alder | 514 | 24% | | 56% |
| Western redcedar | 240 | 11% | 20% | |
| Garry oak | 236 | 11% | | 26% |
| Bigleaf maple | 140 | 7% | | 15% |
| Arbutus | 61 | 3% | 5% | |
| Grand fir | 24 | 1% | 2% | |
| Western dogwood | 16 | 0.8% | | 2% |
| Western yew | 7 | 0.3% | 0.6% | |
| Cascara | 4 | 0.2% | | 0.4% |
| Western hemlock | 4 | 0.2% | 0.4% | |
| Bitter cherry | 1 | 0.04% | | 0.1% |
| **Total** | **2,107** | **100** | **100** | **100** |

N

Study Area Boundary
Stream
Non-classified Drainage

Douglas Fir
Western Red Cedar
Other Coniferous

Garry Oak
Other Deciduous

ENVIRONMENTAL ASSESSMENT
Oceanview Golf Resort and Spa
Figure 6 - Significant Tree Survey Map

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NORTHUMBERLAND CHANNEL
DODD NARROWS
Mudge Island
Cable Bay Trail
STUART CHANNEL

| Tree Species | Number of Trees | Percent of All Significant Trees |
|---|---|---|
| Douglas fir | 860 | 41% |
| Red alder | 514 | 24% |
| Western red cedar | 240 | 11% |
| Garry oak | 236 | 11% |
| Bigleaf maple | 140 | 7% |
| Arbutus | 61 | 3% |
| Grand fir | 24 | 1% |
| Western dogwood | 16 | 0.80% |
| Western yew | 7 | 0.30% |
| Cascara | 4 | 0.20% |
| Western hemlock | 4 | 0.20% |
| Bitter cherry | 1 | 0.04% |
| Total | 2,107 | 100% |

Scale = 1:7,000
Created April 30, 2009

0 200 400 600 800 1,000 m

## 4.8 Results and Analysis of Archaeological Impact Assessment

### 4.8.1 History and Context of Previous Archaeological Investigations

Although no previous archaeological field examinations have been carried out in the past within the Oceanview Golf Resort and Spa Ltd. property per se, some of these lands were included in two previous archaeological site survey projects. The first of these was a 1975 survey carried out by the (then) BC Provincial Archaeologist's Office along the east side of Vancouver Island. This project focused on shoreline areas and resulted in the documentation of numerous sites in the Dodd Narrows-Cable Bay/Stuart Channel locale south of Nanaimo. These included sites DgRw-171 and DgRw-173 (both shell midden sites) which have now been confirmed to lay inside the boundaries of the Oceanview Golf Resort and Spa lands. Several other sites were also recorded in the immediate area by the 1975 project, including sites DgRw-44, 45, 172, and 174. In the summer of 1997, members of the BC Archaeological Society (Nanaimo Chapter) conducted a comprehensive archaeological site inventory project in and around the City of Nanaimo to "…promote heritage conservation and awareness…" The main goal of the project was to "… update the existing record of archaeological sites in and around the City of Nanaimo…" and to produce new site records for any previously unrecorded sites that might be found (Oakes and Young, 2005; i).

### 4.8.2 Survey Results

Fortunately for the Oceanview Golf Resort and Spa AIA project, the BCA.S. survey re-examined a number of sites in the Dodd Narrows locale – including sites DgRw-171 and 173 – and carried out limited shovel testing at these sites to more accurately determine the extent of archaeological shell midden deposits at these locations. The 2005 Madrone resurvey of these sites included a further refinement of the boundaries of these sites.

Site DgRw-171 and 173 are shallow shell midden sites that occupy a narrow strip of land between the high tide mark to an inland extent of up to 25 meters. A shell midden site is a location that contains both surface and subsurface evidence of past cultural use and occupation in the form of shellfish remains such as crushed and whole clam shell, cockles, mussels, and other varieties, mixed with dark organic soils, ash, and charcoal. Midden deposits may also contain artifacts, preserved faunal bone, human skeletal remains and other physical evidence of past human presence. Midden material within both site areas tend to occur as a series of discontinuous pockets of midden matrix, rather than as long continuous strands of archaeological deposits, as suggested by the documentation produced by the two previous site survey projects in the area.

To our knowledge, no other archaeological investigations have been carried out in the past within the Oceanview Golf Resort and Spa project lands. However, the history of past First Nations land-use and occupation of lands in the vicinity of Dodd Narrows has been well documented as a result of two major archaeological excavation projects at nearby False Narrows (Burley, 1988) and at Duke Point (Murray, 1982). These studies have documented a long sequence of aboriginal occupation in the Duke Point-Dodd and False Narrows locale that extends back in time for at least 3,500 years.

As mentioned, two previously recorded archaeological site areas within the Oceanview Golf Resort and Spa lands (Sites DgRw-171 and 173) were reexamined by the Madrone field team in the course of our recently completed AIA work. This served to more precisely determine the horizontal extent of these sites as this will have a bearing on the location and extent of areas that are available for future land development.

#### **4.8.2.1** Sites DgRw-171 and DgRw-173

We note that there is a large difference between the two previous site records for both of these sites, as the 1975 site survey form shows an estimated extent for site DgRw-171 as being 180 meters by 10 meters (with the larger measurement running along the shoreline and the lesser one being inland extent). Site DgRw-173 is shown as occupying an area of 197 meters along the shoreline and 10 meters inland. However, the 1997 ASBC record forms for site DgRw-171 indicate that the site occupies a shoreline extent of 555 meters and an inland extent of 25 meters; likewise, the 1997 record for site DgRw-173 also shows the site area as being 555 meters by 25 meters.

This apparent discrepancy is explained on page 31 of the BCAS 2004 report where the authors indicate that the society's field crew "…were unable to distinguish midden deposits at DgRw-171 from the adjacent site, DgRw-173" even though both site areas were subjected to soil-probe testing and a detailed surface examination of eroded natural exposures. The report concludes that the two sites are "…clearly contiguous…," thus explaining the estimated 555 shoreline extent of shell midden deposits when one combines the shoreline extent of the two previously recorded sites. However, the results of the more recent Madrone AIA investigation refutes this interpretation of site size and also questions the notion of a single site along the Stuart Channel shoreline.

Figure 7 shows the locations and horizontal extent of all archaeological sites situated within the Oceanview Golf Resort and Spa lands. These include previously recorded sites DgRw-171 and 173 along the Dodd Narrows shoreline and also the locations of three additional archaeological sites found in the course of the Madrone field investigation (sites DgRw-T-1, T-2, and T-3).

All five site locations and their boundaries were determined on the basis of a detailed surface and subsurface examination and are considered to be much more precise than site boundaries established by the two earlier archaeological survey projects.

As shown on Figure 7, previously recorded site DgRw-171 is now shown as a series of discontinuous shell midden deposits that begin north of the power line corridor, just beyond the northern boundary of the Oceanview Golf Resort and Spa Lands property and Joan Point Park, and continuing southward for a distance of 450 meters. The inland extent of the site averages 20 meters, with a maximum of 25 meters. Site DgRw-173 extends for only 75 meters along the Dodd Narrows shoreline, with the same inland extent as site DgRw-171.

Study Area Boundary
Stream
Non-classified Drainage
Archaeological Sites (assessed by Madrone)
Archaeology Branch Sites (not field verified)

N

ENVIRONMENTAL ASSESSMENT
Oceanview Golf Resort and Spa
Figure 7 - Archaeology Survey Map

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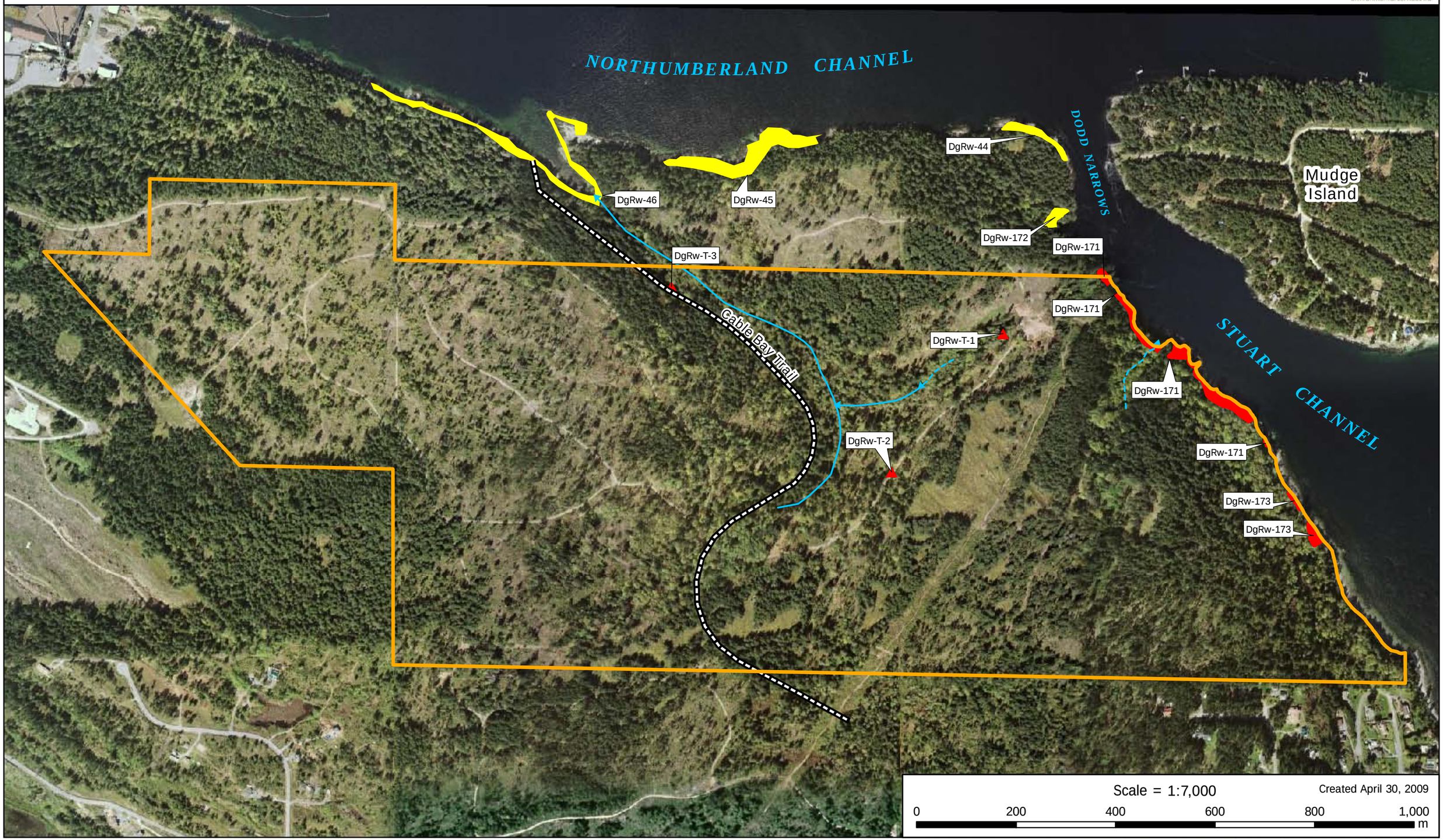


Scale = 1:7,000
Created April 30, 2009

0 200 400 600 800 1,000 m

# 5.0 CONCLUSIONS AND RECOMMENDATIONS

## 5.1 Ecological Assessment

### 5.1.1 Protection of Sensitive Ecosystems

The presence of eight ESAs within the proposed area of development is a significant ecological factor. Management strategies that mitigate potential impacts will need to be considered, and are discussed in the following section. Over the last four years Madrone has worked closely with the developer and City of Nanaimo staff to ensure that the most ecologically sensitive sites are protected. To date, we believe that all of the most significant areas for conservation have been incorporated in the current Master Plan. In future stages of the development we will continue to work closely with the project design and City staff to minimize impacts and provide mitigation or compensation measures if necessary.

#### **5.1.1.1** Terrestrial Herbaceous Ecosystems

Each identified terrestrial herbaceous ecosystem within the study area represents a fragile assemblage that is prone to degradation from external forcing factors. The proposed development of the area could potentially cause damage to these ecosystems if not properly implemented.

The influx of people to the area following construction could lead to both direct and indirect ecological impacts. Direct impacts might include erosion of the fragile soil layer through trampling and/or the action of vehicles and bikes. Indirect impacts could include the potential for the increased occurrence and spread of invasive species from nearby residential garden areas. Possible impacts from the initial development phase include the potential for altered hydrological regimes, leading to the loss of important wet seepage zones within the open meadows.

Development may also create areas of disturbance, which are prone to colonization from invasive species such as broom. Where the intent is to maintain open meadows, in order to reduce impacts from development, forested buffers of at least 15 meters should border them wherever possible. These buffers would help to maintain the integrity of the sensitive ecosystems.

The largest and most ecologically valuable is Polygon 634 which occupies almost 5 ha. In addition to being a provincially endangered ecosystem, this area supports populations of two red-listed and five blue-listed plant species (one of which is also covered under the federal *Species at Risk Act*).

We recommend that development be set back from the high point of land adjacent to the upslope border of the large meadow, which effectively marks the meadow's watershed. This significant ecological site feature has been incorporated in the project design through the protection of the large meadow and its watershed as shown on the Master Plan dated May 1, 2009.

One way to encourage preservation of the meadow habitat is to provide information signs to educate local residents about their ecological significance. The signs could be placed in strategic locations (*i.e.,* on trails or areas beyond the forested buffers). Information signs should encourage the public not to walk on the meadow, and advise them about potential damage from dogs. Interpretive walkways could be developed through the open meadows, in order to increase public awareness about the significance of sensitive ecosystems and associated threats. To reduce the impacts of invasive species, homeowners should be encouraged to plant native species and educated about the impacts of invasive plants. As compensation for ecological impacts in other portions of the development area, the developers could implement a continued program of invasive species removal.

#### **5.1.1.2** Old Forest Ecosystems

Identification of the most significant areas of older forest during the preliminary significant tree assessment (Figure 6) can be used by the developer to avoid ecologically sensitive areas. Loss of habitat is anticipated, however, within ESA #642 (Figure 3). This polygon represents a relatively intact portion of mature and older forest, and is therefore an extremely significant ecosystem, especially when considering its location on the east coast of Vancouver Island, where development and logging have removed the majority of this habitat type. The current development plan has incorporated our concerns through maintaining a significant portion of this ESA as green space (as shown on the current Master Plan).

To partially mitigate against fragmentation during development, a buffer should be implemented along the coastal foreshore of ESA #642 to help maintain the integrity of this habitat interface zone. The 15 m no vegetation disturbance zone setback (Development Permit Area) as required along the foreshore by the City of Nanaimo will provide the added benefit of a wildlife corridor linkage between developed areas and Joan Point Provincial Park. This will improve connectivity and habitat value in the area. Elsewhere in the study area, identified patches of mature second growth could be maintained where possible to compensate for loss of habitat in ESA #642. Again, public education regarding the ecological significance of older forests is encouraged to reduce potential impacts from the local population.

Our original concerns outlined in the 2005 assessment report have been incorporated in the current Master Plan, which maintains an ample foreshore setback and green-belt corridor linkages for both wildlife and humans.

The boundary of the rich, mature forest identified as Polygon 30 (Figure 2) has been flagged in the field and surveyed professionally. This ecosystem (containing site series 11 and 06) is considered a functioning representative of a red-listed plant community. The forested ecosystem also encompasses an area of sub-surface flow from a wetland (Polygon 31 – Figure 2), which eventually feeds into the eastern fork of the main Cable Bay drainage. The developer recognizes the importance of this ecosystem, hence the detailed boundary identification and professional survey.

A portion of the development unavoidably passes through a section of Polygon 30. In recognition of the ecological significance of the ecosystem, mitigation measures will be incorporated. Mitigation will include supervision by a certified environmental consultant. Measures will be implemented to ensure that the subsurface drainage regime is maintained or restored.

## 5.2 Wildlife Assessment

### 5.2.1 Bald Eagle Nests

The presence of three Bald Eagle nest trees within the assessment area represents a significant wildlife attribute. Two additional nest trees exist outside of the study area, one in Joan Point Park and another along the northern foreshore on Island Timberlands property. As per the *BC Wildlife Act*, it is illegal to destroy an eagle nest at any time of the year. Any removal or topping of identified eagle nest trees must be approved via a Permit issued by the Regional Manager of the Ministry of Environment (MoE) in Nanaimo.

To ensure that the nests are not abandoned by eagles at this site we recommend a buffer of 60 m around each nest tree (approximately 1 to 1.5 tree lengths to maintain natural vegetation around the nest tree) as per *Best Management Practices for Raptor Conservation during Urban and Rural Land Development in British Columbia* (MoE 2005) and *Develop with Care* (MoE 2006). Development is to be avoided in the nest buffer and human disturbance should be minimized during the breeding season (February 1$^{st}$ to August 15$^{th}$). The key habitat features to maintain within the nest buffer are mature trees, especially any significant trees as identified and documented by Madrone for the entire property.

As mentioned in the results section, all five of the Bald Eagle nests are located in veteran Douglas-fir, which have significant height and girth. The concentration of nests in the study area highlights the importance of the habitat which exists at the interface between the old forest, the cleared lands and the coast within the north eastern and south eastern portions of the study area. The older forest and abundance of potential nest trees (especially Douglas-fir veterans) provides for the nesting requirements of the Bald Eagle, as they are known to prefer the tallest trees in a stand for nesting (Campbell *et.al.*, 1990; Johnsgard 1988). The adjacent areas including the foreshore and ocean provide prime foraging opportunities in close proximity to the nest sites. The tallest trees within the old forest ecosystem and in selectively logged areas are known to be used as perch sites for Bald Eagles.

At present, we have identified a circular shaped buffer around each of the nest trees on Figure 4. Development should be avoided in this buffer, and human disturbance minimized during the breeding season. If avoidance is not possible, we recommend, in order of preference, mitigation, restoration or compensation plans designed by a qualified professional. It is important to note that the final shape of the buffer should be biologically significant in order to be effective. The final configuration of the nest tree buffer should be determined by a qualified professional, maintaining an equivalent area of protection (approx. 1 ha around the nest tree).

In addition to the 60 m nest tree buffer, no land clearing or "construction" should occur within a 150 m of the nest tree during the breeding season when a nest is active. "Construction" not permitted inside the seasonal buffer includes those activities that are most likely to cause disturbance to the nesting eagles. Examples include use of heavy machinery, clearing land, pouring concrete, building roads and blasting. It is unlikely that lighter construction activities such as roofing, hammering or use of nail guns will cause disturbance to the nesting birds as they are exposed to industrial noise, aircrafts and boats on a regular basis. Eagles at this site appear to have acclimatized to frequent noise exposure, as reflected by successful annual breeding and a high density of nest territories.

Although eagles at this site are used to exposure to noise, as an extra level of precaution we recommend that no un-controlled blasting occur within 1 km of an active nest during the breeding season. Controlled blasting within the 1 km seasonal buffer (*e.g.,* using sound deadening techniques) may be permitted, with involvement from qualified environmental professionals.

The following is a summary of management recommendations regarding each of the Bald Eagle nest trees where suggested buffers are contained within or overlap the property:

1. Nest E105-102, located on the eastern slope of the property adjacent to Dodd's Narrows: maintain 60 m buffer upslope to slope break above the nest tree. Maintain all significant trees downslope of the nest to the foreshore for habitat connectivity as a flyway between the nest and the water. This nest tree is located within a large protected area identified for the conservation of the environmentally sensitive mature and old forest. The protected forest will provide suitable nesting habitat above and beyond the 60 m buffer.
2. Nest E105-104, west of Joan Point Park: Maintain recommended buffers 60 m permanent (maintain all trees), 150 m seasonal, and 1 km blasting zones (as described in detail above). Provide documentation regarding buffer restrictions to future affected lot owners.
3. Nest tree west of Cable Bay Trail: There is no evidence of recent nesting activity at this tree, and no eagles have been seen at it during our surveys from 2005 to 2009. Most of the vegetation around this nest tree was logged prior to 2004, but at least four (4) adjacent significant trees remain within the 60 m buffer. The significant trees are the most important features to maintain around the nest to encourage future eagle use (for perching, preening, and/or nesting), and for future nest tree recruitment.
4. Nest E105-065 (Joan Point Park): Respect applicable buffers.
5. A fifth nest occurs on the northern foreshore outside of the study area (on Island Timberlands property): Respect applicable buffers.

We encourage continued monitoring of Bald Eagle nest activity on the property. Nest status will vary from year to year, and monitoring of nests will allow for the relaxation of the seasonal development restrictions should a nest be deemed inactive in any given year. Monitoring will also likely lead to changes in the precise dates of the seasonal development restrictions, as the February 1st to August 15th breeding season is a "blanket" breeding period.

The client has adhered to the recommended management strategies, as per our original recommendations provided in 2005, to ensure the success of the Bald Eagle nests. All buffers have been implemented, and monitoring (including the installation of a web cam for nest E105-102) has occurred to enable a greater understanding regarding nesting activity in the study area.

Bald Eagle breeding activity at the site has been documented and shared with appropriate agencies, such as the Wildlife Tree Stewardship Program (WiTS) and the Ministry of Environment (MoE), with the support of the client.

### 5.2.2 Wildlife Trees

Reduction in large wildlife trees, snags, and coarse woody debris (CWD) within and adjacent to the area being developed is likely to result in declines in species that depend upon these elements for their survival. This includes many species, but particularly cavity nesting birds, such as Western Screech-owls and Northern Pygmy-owls. Impacts on other species that rely on wildlife trees for food could also occur (*i.e.*, woodpeckers – Photo 12). In general, large snags (>1.5 m dbh), regardless of tree species, should be maintained whenever possible and safe because of their significant wildlife habitat values.

**Photo 12.** Example of Wildlife Tree exhibiting feeding activity from Pileated Woodpeckers.

As part of the 2006 and 2009 significant tree surveys, Wildlife Trees have been identified. Trees which displayed evidence of use, especially those with potential nesting cavities, were marked in the field with "WT" using blue or orange spray paint. All Wildlife Trees have also been mapped and measured for potential retention during subsequent development. It is understood that the retention of Wildlife Trees may not be feasible in many cases, due to safety concerns associated with dead or dying trees.

## 5.3 Riparian Assessment

### 5.1.2 Riparian Area Setbacks

The riparian area that exists adjacent to the main Cable Bay drainage represents important wildlife habitat, and is also an important component of potential fish habitat. The riparian area will be protected by implementing the 15 m SPEA, as per City of Nanaimo bylaws. The SPEA will be measured from the top of bank on both sides of the drainage, which has been surveyed by professional surveyors. The proximity of the riparian buffer to the Cable Bay Trail will result in the creation of a relatively large wildlife refuge, considering the combined buffers associated with the trail and the SPEA. The implementation of the SPEA setbacks on each side of the creek will help to maintain the attributes associated with the riparian zone regarding fish and wildlife.

### 5.1.3 Non-classified Drainage Buffers

The two identified NCDs on the property will be protected through the implementation of a recommended 7.5 m no vegetation disturbance buffer adjacent to both sides (total of 15 m buffer) (Figure 5).

### 5.1.4 Wetland Buffers

Despite not offering fish habitat value, the isolated wetlands on site may provide habitat niches for a number of wildlife species, including breeding areas for amphibians and foraging habitat for bats and birds. The wetlands also support specific vegetation assemblages adapted to moist areas. The integrity of the wetlands identified during the assessment (Figure 5) and the surrounding habitat will be maintained by the incorporation of a 15 m no vegetation disturbance zone (measured from the High Water Mark – HWM) to protect the wetland ecosystems whenever possible. The HWM of all wetlands were identified in the field and surveyed by professional surveyors for consideration in design of the development. We recommend that mitigation and/or compensation plans be developed by a qualified professional if any of the wetlands and their associated buffers cannot be preserved.

Our recommendations have been incorporated in the Master Plan through on-going communications with Oceanview Resort project consultants such as the surveyors and architects.

### 5.1.5 Foreshore Setbacks

As with setbacks from riparian areas, the City of Nanaimo also requires a 15 m no vegetation disturbance zone from the high water mark along the foreshore.

From an environmental perspective, an undisturbed buffer along the foreshore will maintain the important forest-ocean interface habitat and will act as a corridor from Joan Point Park for terrestrial wildlife.

## 5.4 Tree Protection in Developed Areas

The tree protection Bylaw #4695 sets out general measures to protect trees in development areas. The main restriction is the prohibition of cutting significant trees unless a Tree Removal Permit has been granted. In each development area, a Tree Management Plan is required. These plans must include:

- A plan showing the general location of vegetation coupled with a general description;
- A listing of trees on site, species, the range of sizes of each and approximate coverage of each (as percentage of the total site), as well as areas with no trees;
- The location of any large groups of same species trees (*i.e.,* arbutus groves, etc.), if present;
- The presence and location of any significant trees that are on site;
- The area to be dedicated as park (if applicable) should be clearly shown on the plan;
- Location of Bylaw 4000 Schedule "G" – Watercourses as well as the watercourse setback; other natural features such as ravines and/or steep slopes which might be impacted by removal of existing vegetation; Environmentally Sensitive Areas.

Nanaimo Parkway Design Guideline setbacks;

- Plan of road layout, service locations, building location(s), etc. indicating the extent of areas required to be cut; and for phased projects, the boundaries of each phase;
- The location of all areas where trees are to be removed and where trees are to be retained; and
- A topographical map of the area to be developed is often useful and sometimes required.

A detailed Tree Management Plan will be completed at the appropriate stage in the development application process. The significant tree data collected to date will help in the development of future Tree Management Plans.

## 5.5 Archaeological Impact Assessment

Sites DgRw-T-1, T-2, and T-3 are small inland midden deposits that are considered quite insignificant when compared to the two larger sites along the Dodd Narrows shoreline. We feel that these three site locations can be easily avoided in the scheme of any future land development project. This can be achieved by capping the archaeological deposits with landscape cloth and clean fill, or the small site areas could simply be deemed to be no development zones as the amount of land that would be impacted is miniscule.

With regard to the archaeological and cultural significance of sites DgRw-171 and 173, it is our opinion from our review of past site survey information, coupled with the results of our recent shovel testing program, that both of these site areas have a high cultural significance to local First Nations. From an archaeological significance perspective, these sites are not considered particularly valuable since very little information or archaeological material of any significance (such as artifacts, faunal bone, deeply stratified midden deposits, burial remains etc.) was found in the course of our recent subsurface testing program.

Given the above results and opinions regarding the extent and significance of archaeological resources found within the Oceanview Golf Resort and Spa lands, and given that all of the five identified archaeological sites areas are protected by the BC *Heritage Conservation Act*, we recommend that all five site areas be excluded from any future land development plan. This would leave all site areas in their present condition and would allow both future subdivision and land development to proceed without any further archaeological investigation or encumbrances, insofar as the heritage *Conservation Act* is concerned. However, should this option not be feasible, the next level of site mitigation would be to carry out a partial site preservation program, coupled with an archaeological excavation and data recovery program at sites DgRw-171 and/or 173. Capping the sites with landscape cloth and clean fill would be an alternative provided no building footprint entruded onto the site.

A final option would be to carry out a more extensive and detailed archaeological excavation program at both sites to negate any future site preservation requirements. Such a program of data recovery would be expensive and may not necessarily be supported by the BC Archaeology Branch. Any excavations of capping would require a permit from the BC Archaeology Branch and monitoring by a professional archaeologist.

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The 2009 Environmental Assessment report for the proposed Oceanview Golf Resort and Spa was developed by a team of professionals over a period of four years. The following list summarizes which authors were responsible for each of the topics covered in the assessment process and report:

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- Helen Reid, R.P.Bio. (Sr. Ecologist) – 2004-2007 field surveys for ecosystems, ESAs and rare plants, initial vegetation community overview mapping, follow-up site assessments related to ecology.
- Tyler Innes, B.Sc. (Sr. Ecologist) – 2008-09 field surveys, detailed terrestrial ecosystem mapping and wetland delineation.
- Trystan Willmott, B.Sc., A.Sc.T. – Riparian Area Assessments, Wetland delineation, Significant Tree Surveys, Bald Eagle Nest Monitoring.
- Bjorn Simonsen, R.P.C.A. and John Somogyi – Archaeological Assessments.
- Peter Berst, B.Sc. (GIS Analyst) – All map presentation products.

## CITATION

Madrone Environmental Services Ltd. 2009. Environmental Assessment of the Proposed Oceanview Golf Resort and Spa Properties. Prepared for Oceanview Golf Resort and Spa Ltd., Calgary, AB.

## FIELD ASSESSMENTS

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# APPENDIX I

## Sensitive Ecosystem Inventory / ESA Classification

Dossier 08.0360

# APPENDIX I. SENSITIVE ECOSYSTEM INVENTORY / ESA CLASSIFICATION

A Summary of sensitive ecosystems and other important ecosystems found in the City of Nanaimo (srmwww.gov.bc.ca/cdc/sei/) (2003).

| Ecosystem | Ecosystem Description |
|---|---|
| Wetlands | Non-forested ecosystems where the water table is at or near the surface; includes marshes wet meadows, and shallow open water ecosystems, including ponds. |
| Riparian | Streamside ecosystems on floodplains and benches along creeks and rivers, shrub ecosystems on floodplains; in gullies with intermittent or permanent creeks usually dominated by aspen; fringe ecosystems associated with streams, pond and lake shorelines or sites with significant seepage and large river systems, including gravel bars. |
| Old Forest | Forests dominated by trees that appear to be older than 140 years; includes coniferous forests, excludes old riparian. |
| Terrestrial Herbaceous | Non-forested ecosystems (less than 10% tree cover), generally with shallow soils and often with bedrock outcroppings; includes large openings within forested areas, coastal headlands, and shorelines: vegetated with grasses and herbs, sometimes low shrubs, and moss and lichen communities on rock outcrops. |
| Coastal Bluff | Found on the coast from the water's edge to lands just above the high tide mark. Coastal Bluff ecosystems have been divided into two distinct categories: vegetated rocky islets and shorelines and vegetated coastal cliffs and bluffs. |
| Woodlands | Open canopied forests (10–20% canopy cover). Excludes old forest structural stage. |
| Sparsely Vegetated | Shrub dominated rock outcrops; talus slopes, cliffs and sparse grassland vegetation on shallow soil to bedrock. All ecosystems have more than 5% vegetation cover but less than 10% tree cover except cliffs, which may have less than 5% vegetation cover. |
| Older Second Growth Forest | Large stands of conifer dominated forest between 60 and 100 years old with less than 15% deciduous trees and those with more than 15% deciduous tree cover. The size of the second growth forest patch and the composition and structures of vegetation are the primary determinants of biodiversity values in these ecosystems. |
| Seasonally Flooded | These fields are lands that have been modified for agricultural use, but have important wildlife habitat value during specific times of the year. They are located primarily in low-lying areas such as valley bottoms and deltas of large alluvial rivers and creeks. In some cases they are found on moisture-receiving sites, usually in association with lakeshores, or lowlands adjacent to coastal bays. They are often former wetlands, and in many cases, are located adjacent to surviving wetlands such as marshes, swamps, and wet meadows. |

## Structural Stages and Codes

As per Table 3.3 from the Standard for Terrestrial Ecosystem Mapping in British Columbia, Resources Inventory Committee, 1998.

| Structural Stage | Description |
|---|---|
| **Post-disturbance stages or environmentally induced structural development** | |
| 1 Sparse/bryoid | Initial stages of primary and secondary succession; bryophytes and lichens often dominant, can be up to 100%; time since disturbance less than 20 years for normal forest succession, may be prolonged (50–100+ years) where there is little or no soil development (bedrock, boulder fields); total shrub and herb cover less than 20%; total tree layer cover less than 10%. |
| **Substages** | |
| 1a Sparse | Less than 10% vegetation cover. |
| 1b Bryoid | Bryophyte- and lichen-dominated communities (greater than ½ of total vegetation cover). |
| **Stand initiation stages or environmentally induced structural development** | |
| 2 Herb | Early successional stage or herbaceous communities maintained by environmental conditions or disturbance (e.g., wetlands, grasslands, flooding, intensive grazing, intense fire damage); dominated by herbs (forbs, graminoids, ferns); some invading or residual shrubs and tress may be present; tree layer cover less than 10%, shrubby layer cover less than or equal to 20% or less than 1/3 of total cover; time since disturbance less than 20 years for normal forest succession; may herbaceous communities are perpetually maintained in this stage. |
| **Substages** | |
| 2a Forb- dominated | Herbaceous communities dominated (greater than ½ o the total herb cover) by non-graminoid herbs, including ferns. |
| 2b Graminoid-dominated | Herbaceous communities dominated (greater than ½ of the total herb cover) by grasses, sedges, reeds, and rushes. |
| 2c Aquatic | Herbaceous communities dominated (greater than ½ of the total herb cover) by floating or submerged aquatic plants; does not include sedges growing in marshes with standing water (which are classed as 2b). |
| 2d Dwarf shrub | Communities dominated (greater than ½ of the total herb cover) by dwarf woody species such as Phyllodoce empetriformis, Cassiope mertensiana, Cassiope tetragona, Arctostaphylos arctica, Salix reticulata, and Rhododendron lapponicum. (See list of dwarf shrubs assigned to the herb layer in the Field Manual for Describing Terrestrial Ecosystems). |
| 3 Shrub/Herb | Early successional stage or shrub communities maintained by environmental conditions or disturbance (e.g., snow fields, avalanche tracks, wetlands, grasslands, flooding, intensive grazing, intense fir damage); dominated by shrubby vegetation; seedlings and advance regeneration may be abundant; tree layer cover less than 10%; shrub layer cover greater than 20% or greater than or equal to 1/3 of total cover. |

## Structural Stages and Codes

| Structural Stage | Description |
|---|---|
| **Substages** | |
| 3a Low shrub | Communities dominated by shrub layer vegetation less than 2 m tall; may be perpetuated indefinitely to environmental conditions or repeated disturbance; seedlings and advance regeneration may be abundant; time since disturbance less than 20 years for normal forest succession. |
| 3b Tall shrub | Communities dominated by shrub layer vegetation that are 2–10 m tall; may be perpetuated indefinitely by environmental conditions or repeated disturbance; seedlings and advance regeneration may be abundant; time since disturbance less than 40 years for normal forest succession. |
| **Stem exclusion stages** | |
| 4 Pole/Sapling | Trees greater than 10 m tall, typically dense stocked, have overtopped shrub and herb layers; younger stands are vigorous (usually greater than 10–15 years old); older stagnated stands (up to 100 years old) are also included; self-thinning and vertical structure not yet evident in the canopy – this often occurs by age 30 in vigorous broadleaf stands, which are generally younger than coniferous stand at the same structural stage; time since disturbance ins usually less than 40 years for normal forest succession. |
| 5 Young Forest | Self-thinning has become evident and the forest canopy has begun differentiation into distinct layers (dominant, main canopy, and overtopped); vigorous growth and a more open stand than in the pole/sapling sate; time since disturbance is generally 40–80 years but may begin as early as age 30, depending on tree species and ecological conditions. |
| **Understorey reinitiation stage** | |
| 6 Mature Forest | Trees established after the last disturbance have matured; a second cycle of shade tolerant trees may have become established; understories become well developed as the canopy opens up; time since disturbance is generally 80–140 years. |
| **Old-growth stage** | |
| 7 Old Forest | Old, structurally complex stands composed mainly of shade-tolerant and regenerating tree species, although older seral and long-lived trees from a disturbance such as fire may still dominate the upper canopy; snags and coarse woody debris in all stages of decomposition typical, as are patchy understories; understories may include tree species uncommon in the canopy, due to inherent limitations of these species under the given conditions; time since disturbance generally greater than 150 years. |

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# APPENDIX II

## Pertinent Legislation Concerning Rare Species

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# APPENDIX II. PERTINENT LEGISLATION CONCERNING RARE SPECIES

## Federal Species at Risk Act (SARA)

SARA is federal legislation that aims to protect species at risk from becoming extinct or lost from the wild. It will cover all wildlife species listed as being at risk nationally (including critical habitats) by COSEWIC (Committee On the Status of Endangered Wildlife In Canada). Compliance to the act generally applies to Federal Lands, although compliance of private properties is applicable in some cases.

## Federal Rare Element Ranking

The federal Committee on the Status of Endangered Wildlife in Canada (**COSEWIC**) ranks rare elements as follows:

**XX** – EXTINCT
A species that no longer exists.

**XT** – EXTIRPATED
A species that no longer exists in the wild in Canada, but occurring elsewhere.

**E** – ENDANGERED
A species facing imminent extirpation or extinction.

**T** – THREATENED
A species that is likely to become endangered if limiting factors are not reversed.

**SC** – SPECIAL CONCERN
A species of special concern because of characteristics that make it is particularly sensitive to human activities or natural events.

**NAR** – NOT AT RISK
A species that has been evaluated and found to be not at risk.

**DD** – DATA DEFICIENT
A species for which there is insufficient scientific information to support status designation.

G1, N1, S1: **Critically imperiled** on a global (G), national (N) or provincial (S) scale. Especially susceptible to extirpation or extinction. Occurrences: 5 or less.

G2, N2, S2: **Imperiled**.
Very susceptible to extirpation or extinction. Occurrences: 6–20.

G3, N3, S3: **Vulnerable**.
Found only in a restricted range (even if abundant at some locations), or susceptible to extirpation or extinction. Occurrences: 21 to 100.

G4, N4, S4: **Apparently Secure**.
Uncommon but not rare, and usually widespread in the province. Occurrences: more than 100 existing.

## Provincial Rare Element Ranking

Rare and endangered plants, plant communities, and animals in British Columbia have been rated by both provincial and federal classifications. The BC system uses three "lists" associated with a colour, to indicate degree of rarity.

The **Red List** includes any indigenous native species, subspecies, or element (e.g., plant community) considered to be extirpated, endangered, or threatened in BC Extirpated species no longer exist in the wild in BC, but do occur elsewhere. Endangered species are extremely rare, facing imminent extirpation or extinction. Threatened species are likely to become endangered if limiting factors are not reversed.

The **Blue List** includes any rare indigenous species or subspecies (taxa) considered to be of special concern (vulnerable) in British Columbia. Taxa are of special concern because of characteristics that make them particularly sensitive to human activities or natural events. Blue-listed taxa are at risk, but are not extirpated, endangered or threatened. The Blue list also includes species that are generally suspected as being vulnerable, but for which information is too limited to allow designation in another category.

The **Yellow list** includes species that are apparently secure and not at risk of extinction. Unless otherwise indicated as Blue or Red, a plant is considered to be on the Yellow list.

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# APPENDIX III

## List of Species Observed – Oceanview Resort and Spa

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# APPENDIX III. PLANT LIST OF SPECIES OBSERVED ON THE OCEANVIEW GOLF RESORT AND SPA PROPERTY.

| Latin | Common Name | Federal Status - COSEWIC and SARA | Provincial Status - CDC |
|---|---|---|---|
| *Abies grandis* | grand fir | | |
| *Acer macrophyllum* | bigleaf maple | | |
| *Achillea millefolium* | yarrow | | |
| *Achlys triphylla* | vanilla leaf | | |
| *Adenocaulon bicolor* | pathfinder | | |
| *Agrostis exarata* | spike bentgrass | | |
| *Agrostis gigantea* | redtop | | |
| *Agrostis microphylla* | small-leaved bentgrass | | |
| Agrostis pallens | dune bentgrass | | Yellow-listed (recorded in ESA #634) |
| *Aira caryophyllea* | silver hairgrass | | |
| *Aira praecox* | early hairgrass | | |
| *Allium acuminatum* | Hooker's onion | | Yellow-listed (recorded in ESA #603 and 634) |
| ***Allium amplectens*** | **slimleaF onion** | | **Blue-listed (recorded in ESA #657, 634, 655)** |
| *Allium cernuum* | nodding onion | | |
| *Alnus rubra* | red alder | | |
| *Amelanchier alnifolia* | saskatoon | | |
| ***Anagallis minima*** | **chaffweed** | | **Blue-listed (recorded in ESA #634)** |
| *Antennaria neglecta* | field pussytoes | | |
| *Anthoxanthum odoratum* | sweet vernal grass | | |
| *Aphanes microcarpa* | | | |
| *Aquilegia formosa* | red columbine | | |
| *Arbutus menziesii* | arbutus | | |
| *Arctostaphylos uva-ursi* | kinnikinnick | | |
| ***Aster curtus*** | **white-topped aster** | **Threatened (May 2000)** | **Red-listed (found in ESA #603, 634)** |
| *Athyrium filix-femina* | lady fern | | |
| *Brodiaea coronaria* | harvest coronaria | | |
| *Bromus hordeaceus* | soft brome | | |

**Continued.**

| Latin | Common Name | Federal Status - COSEWIC and SARA | Provincial Status - CDC |
|---|---|---|---|
| *Bromus vulgaris* | Columbia brome | | |
| *Callitriche heterophylla* | | | |
| *Callitriche palustris* | spring water-starwort | | |
| *Calypso bulbosa* | fairy slipper | | |
| *Camassia leichtlinii* | great camas | | |
| *Camassia quamash* | common camas | | |
| *Campanula scouleri* | Scouler's harebell | | |
| *Cardamine sp.* | | | |
| *Carex deweyana* | Dewey's sedge | | |
| *Carex hendersonii* | Henderson's sedge | | |
| *Carex inops* | long-stoloned sedge | | |
| *Carex lyngbyei* | Lyngby's sedge | | |
| ***Centaurium muehlenbergii*** | **Muhlenberg's centaury** | **Endangered (Mar 2008)** | **Red-listed (found in ESA #634)** |
| *Cerastium semidecandrum* | | | |
| *Cerastium fontanum* | mouse-ear chickweed | | |
| *Cladina sp.* | cladina lichen | | |
| *Cladonia sp.* | cladonia lichen | | |
| *Claytonia sibirica* | Siberia miner's lettuce | | |
| *Claytonia exigua* | | | |
| *Clinopodium douglasii* | yerba buena | | |
| *Collinsia grandiflora var. pusilla* | large-flowered blue-eyed Mary | | |
| *Corallorhiza maculata* | spotted coralfoot | | |
| *Corylus cornuta* | wild hazelnut | | |
| *Cryptogramma acrostichoides* | parsley fern | | |
| ***Cyperus squarrosus*** | **awned cyperus** | | **Blue-listed (recorded in ESA #603)** |
| *Cytisus scoparius* | Scotch broom | | |
| *Dactylis glomerata* | orchard grass | | |
| *Danthonia californica* | California oatgrass | | |
| *Danthonia spicata* | poverty oatgrass | | |
| *Daucus pusillus* | American wild carrot | | |

**Continued.**

| Latin | Common Name | Federal Status - COSEWIC and SARA | Provincial Status - CDC |
|---|---|---|---|
| *Deschampsia danthonioides* | annual hairgrass | | |
| *Deschampsia elongata* | slender hairgrass | | |
| *Dicranum scoparium* | broom moss | | |
| *Dodecatheon hendersonii* | broad-leaved shootingstar | | |
| *Dodecatheon pulchellum* | few-flowered shootingstar | | |
| *Draba verna* | | | |
| *Dryopteris expansa* | spiny wood fern | | |
| *Elymus glaucus* | blue wildrye | | |
| ***Entosthodon fascicularis*** | **Banded cord-moss** | **Special Concern (May 2005)** | **Blue-listed (recorded in ESA #603)** |
| *Epilobium angustifolium* | fireweed | | |
| *Eriophyllum lanatum* | woolly eriphyllum | | |
| *Erythronium oregonum* | white fawn lily | | |
| *Eurhynchium oreganum* | Oregon beaked moss | | |
| *Festuca occidentalis* | western fescue | | |
| *Festuca roemeri* | Roemer's fescue | | |
| *Fossombronia sp.* | | | |
| *Fragaria virginiana* | wild strawberry | | |
| *Fritillaria affinis* | chocolate lily | | |
| *Galium aparine* | cleavers | | |
| *Galium triflorum* | sweet-scented bedstraw | | |
| *Gaultheria shallon* | salal | | |
| *Gnaphalium sp.* | cudweed | | |
| *Goodyera oblongifolia* | rattlesnake plantain | | |
| *Gratiola ebracteata* | | | |
| *Heuchera micrantha* | small-flowered alumroot | | |
| *Hieracium albiflorum* | white hawkweed | | |
| *Holcus lanatus* | common velvet-grass | | |
| *Holodiscus discolor* | oceanspray | | |
| *Hygrocybe conica* | blackening waxgill | | |
| *Hylocomium splendens* | step moss | | |

**Continued.**

| Latin | Common Name | Federal Status - COSEWIC and SARA | Provincial Status - CDC |
|---|---|---|---|
| *Hypericum anagalloides* | bog St.John's-wort | | |
| *Hypochaeris radicata* | hairy cat's-ear | | |
| *Ilex aquifolium* | English holly | | |
| ***Isoetes nuttallii*** | **Nuttall's quillwort** | | **Blue-listed (found in ESA #603, 634, 653, 655, 657)** |
| *Juncus bufonius* | toad rush | | |
| *Juncus ensifolius* | dagger-leaved rush | | |
| *Juncus vaseyi* | Vasey's rush | | |
| *Juniperus communis* | common juniper | | |
| *Lactuca muralis* | wall lettuce | | |
| *Lathyrus nevadensis* | purple peavine | | |
| *Leucolepis acanthoneuron* | Menzies' tree moss | | |
| *Linanthus bicolor* | bicoloured linanthus | | |
| *Linnaea borealis* | twinflower | | |
| *Lomatium utriculatum* | spring gold | | |
| *Lomatium nudicaule* | | | |
| *Lonicera ciliosa* | Western trumpet honeysuckle | | |
| *Lonicera hispidula* | hairy honeysuckle | | |
| *Lotus micranthus* | small-flowered birds-foot trefoil | | |
| *Luzula multiflora* | multi-flowered woodrush | | |
| *Luzula subsessilis* | short-stalked wood-rush | | |
| *Lysichiton americanus* | skunk cabbage | | |
| *Madia sp.* | | | |
| *Madia glomerata* | clustered tarweed | | |
| *Madia madioides* | | | |
| *Mahonia aquifolium* | tall Oregon-grape | | |
| *Mahonia nervosa* | dull Oregon-grape | | |
| *Melica subulata* | Alaska oniongrass | | |
| *Microsteris gracilis* | | | |
| *Mimulus guttatus* | yellow monkey-flower | | |

**Continued.**

| Latin | Common Name | Federal Status - COSEWIC and SARA | Provincial Status - CDC |
|---|---|---|---|
| *Moehringia macrophylla* | big-leaved sandwort | | |
| *Montia dichotoma* | | | |
| *Montia fontana* | blinks (water chickweed) | | |
| *Montia howellii* | | | |
| *Montia linearis* | narrow-leaved montia | | |
| *Montia parvifolia* | small-leaved montia | | |
| *Nemophila parviflora* | small-flowered nemophila | | |
| *Oemleria cerasiformis* | Indian plum | | |
| *Osmorhiza berteroi* | mountain sweet-cicely | | |
| *Panicum occidentale* | western witchgrass | | |
| *Paxistima myrsinites* | falsebox | | |
| *Pellia neesiana* | ring pellia | | |
| *Pentagramma triangularis* | goldenback fern | | |
| *Perideridia gairdneri* | Gairdner's yampah | | |
| *Phlox gracilis* | pink twink | | |
| *Piperia elongata* | tall rein orchid | | |
| *Piperia transversa* | royal rein orchid | | |
| *Plagiobothrys scouleri* | Scouler's popcornflower | | |
| *Plantago bigelovii* | | | |
| *Plantago elongata* | slender plantain | | |
| *Plantago lanceolata* | ribwort plantain | | |
| *Plantago major* | common plantain | | |
| *Plectritis congesta* | sea blush | | |
| *Pleuridium subulatum* | | | |
| *Poa annua* | annual bluegrass | | |
| *Poa pratensis* | Kentucky bluegrass | | |
| *Poa trivialis* | rough bluegrass | | |
| *Polypodium glycyrrhiza* | licorice fern | | |
| *Polystichum munitum* | sword fern | | |
| *Polytrichum juniperinum* | juniper haircap moss | | |

**Continued.**

| Latin | Common Name | Federal Status - COSEWIC and SARA | Provincial Status - CDC |
|---|---|---|---|
| *Polytrichum piliferum* | awned haircap moss | | |
| *Populus tremuloides* | trembling aspen | | |
| *Prunella vulgaris* | self-heal | | |
| *Pseudotsuga menziesii* | Douglas-fir | | |
| *Pteridium aquilinum* | bracken fern | | |
| *Quercus garryana* | Garry oak | | |
| *Racomitrium elongatum* | roadside rock moss | | |
| *Racomitrium lanuginosum* | woolly rock moss | | |
| *Ranunculus occidentalis* | western buttercup | | |
| *Ranunculus orthorhynchus* | straight-beaked buttercup | | |
| *Ranunculus uncinatus* | little buttercup | | |
| *Rhamnus purshiana* | cascara | | |
| *Rhytidiadelphus triquetrus* | electrified cat's-tail moss | | |
| *Riccia sorocarpa* | | | |
| *Rosa gymnocarpa* | bald-hip rose | | |
| *Rosa nutkana* | Nootka rose | | |
| *Rubus discolor* | Himalayan blackberry | | |
| *Rubus laciniatus* | evergreen blackberry | | |
| *Rubus leucodermis* | black-cap raspberry | | |
| *Rubus parviflorus* | thimbleberry | | |
| *Rubus spectabilis* | salmonberry | | |
| *Rubus ursinus* | trailing blackberry | | |
| *Rumex acetosella* | sheep sorrel | | |
| *Sagina sp.* | common pearlwort | | |
| *Salix scouleriana* | Scouler's willow | | |
| *Sambucus racemosa* | red elderberry | | |
| *Sanicula crassicaulis* | Pacific sanicle | | |
| *Saxifraga ferruginea* | Alaska saxifrage | | |
| *Saxifraga integrifolia* | | | |
| *Saxifraga rufidula* | rusty-haired saxifrage | | |

**Continued.**

| Latin | Common Name | Federal Status - COSEWIC and SARA | Provincial Status - CDC |
|---|---|---|---|
| *Sedum spathulifolium* | broad-leaved stonecrop | | |
| *Selaginella wallacei* | Wallace's selaginella | | |
| *Senecio jacobaea* | tansy ragwort | | |
| *Spiranthes romanzoffiana* | hooded ladie's tresses | | |
| *Stellaria crispa* | crisp starwort | | |
| *Symphoricarpos albus* | common snowberry | | |
| *Symphoricarpos hesperius* | trailing snowberry | | |
| *Taraxacum officinale* | common dandelion | | |
| *Tellima grandiflora* | fringecup | | |
| *Thuja plicata* | western redcedar | | |
| *Tiarella laciniata* | cut-leaved foamflower | | |
| *Trachybryum megaptilum* | giant fern moss | | |
| *Trientalis latifolia* | starflower | | |
| *Trifolium microcephalum* | small-headed clover | | |
| *Trifolium microdon* | thimble clover | | |
| *Trifolium variegatum* | white-tipped clover | | |
| *Trifolium willdenowii* | tomcat clover | | |
| *Trillium ovatum* | western trillium | | |
| *Triphysaria pusilla* | dwarf owl-clover | | |
| *Triteleia hyacinthina* | white triteleia | | |
| *Tsuga heterophylla* | western hemlock | | |
| *Urtica dioica var. lyallii* | stinging nettle | | |
| *Vaccinium parvifolium* | red huckleberry | | |
| *Veronica officinalis* | common speedwell | | |
| *Veronica peregrina* | puslane speedwell | | |
| *Veronica serpyllifolia* | thyme-leaved speedwell | | |
| *Vicia lathyroides* | | | |
| *Vicia sativa* | common vetch | | |
| *Viola adunca* | early blue violet | | |
| *Vulpia bromoides* | barren fescue | | |

**Continued.**

| Latin | Common Name | Federal Status - COSEWIC and SARA | Provincial Status - CDC |
|---|---|---|---|
| *Vulpia megalura* | | | |
| *Vulpia microstachys* | small fescue | | |
| *Zigadenus venenosus* | meadow death-camas | | |

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# APPENDIX IV

## Owl Survey Field Forms

# APPENDIX IV. OWL SURVEY FIELD FORMS.

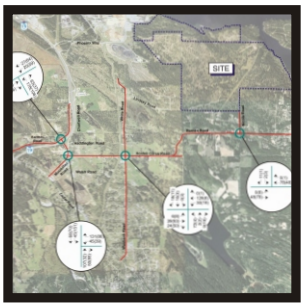
| **Survey Type: Owl Surveys**<br>**Study Area: Cable Bay Trail, near Dodd Narrows** | | | | **Date: June 1, 2005**<br>**Surveyors: Tania Tripp and Trystan Willmott** |
|---|---|---|---|---|
| | **Cl. Cov.** | **Wind** | **Ppt. Class** | **Temp** |
| **Start** | 4 | 1 | N | 16 |
| **End** | 4 | 1 | N | 16 |

| **Stn. #** | **UTM Zone** | **Northing** | **Easting** | **Start (2400 hr)** | **End (2400 hr)** | **Species** | **Sex (M/F)** | **Age Class** | **Call Type** | **Response to CPB?** | **Ambient Noise (1–5)** | **Time of Detection** | **Direction of obs. (degrees)** | **Distance from obs.** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 10U | 0439960 | 5441656 | 1952 | 2000 | | | | | N | 2 | | | |
| 2 | 10U | 0439752 | 5441780 | 2006 | 2021 | | | | | N | 2 | | | |
| 3 | 10U | 0440160 | 5442121 | 2039 | 2050 | | | | | N | 2 | | | |
| 4 | 10U | 0440131 | 5442401 | 2100 | 2112 | | | | | N | 2 | | | |
| 5 | 10U | 0440415 | 5442471 | 2123 | 2135 | | | | | N | 2 | | | |
| 6 | 10U | 0440699 | 5442184 | 2152 | 2222 | BDOW | MF | AJ | ALL | Y-GHOW | 2 | 2216 | 312 | < 50 m |
| 7 | 10U | 0440218 | 5442461 | 2243 | 2302 | | | | | N | 2 | | | |
| 8 | 10U | 0439908 | 5442106 | 2210 | 2233 | | | | | | 2 | | | |
| 9-car | 10U | | | 2250 | | BDOW | M | A | Single | Y-WSOW | 2 | 2250 | 166 | < 50 m |

| Stn. # | Comments |
|---|---|
| 1 | Second growth Fd/Cw. Several Wildlife Trees, with feeding sign from pileated woodpecker. Surveyed for: NPOW. Birds heard: SWTH, AMRO, PSFL, RBNU, CEWA. |
| 2 | Second growth Fd/Cw. Large Fd snags with suitable nesting cavities. Surveyed for: NPOW, NSOW, WSOW. Good alarm-call response from AMRO to WSOW call. |
| 3 | Open meadow under power line, bordered by second growth Fd/Cw. Swifts overhead. WETA also. Surveyed for: NPOW. |
| 4 | Forest road near small swamp area surrounded by second growth Fd/Cw/Hw/Mb. Surveyed for: WSOW. Birds heard/seen: HAWO, BAEA, CONI. Good alarm-call response from AMRO. |
| 5 | Dense second growth adjacent to power line. Fd/Mb/Cw. Surveyed for: NPOW, NSOW, WSOW. |
| 6 | Mixed second growth with veteran Fd snags – adjacent to Narrows (<25 m away). Lower bench along Narrows. <200 m North of DN28, <100 m to eagle nest. All owl species played. At least one juvenile BDOW heard, with 2 adults (overlapping calls). |
| 7 | Gravel pit/turnaround – next to pond. 50 m from DN2. |
| 8 | On road – amongst giant veteran Fd trees – selectively logged – SEI polygon. Path adjacent (Cable Bay Trail). |
| 9 | While playing WSOW calls on the way back, a single-note response from a BDOW was heard approximately 50 m from the car in the parking lot. |

**Cloud Cover** = 1 (clear), 2 (scattered clouds <50%), 3 (scattered clouds >50%), 4 (unbroken clouds);
**Wind** = 0 (calm <2 km/h), 1 (light air 2–5 km/h), 2 (light breeze, leaves rustle 6–12 km/h), 3 (gentle breeze, leaves and twigs constantly move 13–19 km/h), 4 (moderate breeze, small branches move, dust rises), 5 (fresh breeze, small trees sway), 6 (too windy to survey);
**Precipitation Class** = N (none), F (fog), M (misty drizzle), D (drizzle), LR (light rain), HR (hard rain), S (snow);
**Age Class:** A (adult), J (juvenile), UC (unclassified);
**Observation Type:** V (visual), C (calling), S (sign);
**Call Type:** Male Primary Territorial Song (MT), Male Secondary Song (MS), Female Calling/Song (F);
**Distance from Observation Point:** 0–25 m, 26–50 m, 51–100 m, 101–200 m, >200 m, and >500 m.;
**CPB = Call Playback; Owl Species**: BDOW = Barred Owl; BNOW = Barn Owl; GHOW = Great Horned Owl; NPOW = Northern Pygmy Owl; NSOW = Northern Saw-whet Owl; WSOW = Western Screech Owl

# APPENDIX C - TRAFFIC IMPACT ASSESSMENT


City of Nanaimo

# TRAFFIC ASSESSMENT FOR PROPOSED OCEANVIEW GOLF RESORT AND SPA DEVELOPMENT

August 2009
ISSUED FOR USE

EBA File: V31201024

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better solutions

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A DIVISION OF EBA ENGINEERING CONSULTANTS LTD.

OCEANVIEW GOLF RESORT AND SPA

ISSUED FOR USE

# TRAFFIC IMPACT ASSESSMENT FOR OCEANVIEW RESORT
# NANAIMO, BC

V31201024.002

August, 2009

Ward Consulting Group – A Division of EBA Engineering Consultants Ltd.
p. 604.688.8826 • f. 604.688.9562 • Oceanic Plaza, 9th Floor
1066 West Hastings Street • Vancouver, British Columbia V6E 3X2 • CANADA

ward consulting group

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# APPENDICES

# 1.0 INTRODUCTION

Cable Bay Lands Incorporated (CBL) is proposing to develop a large parcel of land to the east of the City of Nanaimo. The proposed development, referred to as Oceanview, will consist of primarily residential units including single family detached units, duplex units, townhouses and multifamily units. The residential units are expected to be occupied by primary owners and retirees. Some of the units will be used for recreational purposes. The proposed Oceanview site is on the boundary of the City of Nanaimo and the Nanaimo Regional District. The location and aerial photograph of the site are shown in Exhibits 1.1 and 1.2 respectively.

This traffic study assesses:

- the potential traffic impacts of the proposed development in the surrounding area,
- the need for any upgrades to existing roads in the general area, and
- the access arrangements for the site

The study area extends to MacMillan Road and Duke Point Highway in the west, Holden Corso Road and Barnes Road in the south and the Northumberland Channel in the east. The study focuses on the impact of site traffic at five intersections in the vicinity of the site:

- Harmac Rd/MacMillan Road;
- Chartwell Rd/MacMillan Road;
- MacMillan Rd/Holden Corso Road;
- White Rd/Holden Corso Road, and
- Barnes Rd/Nicola Road.

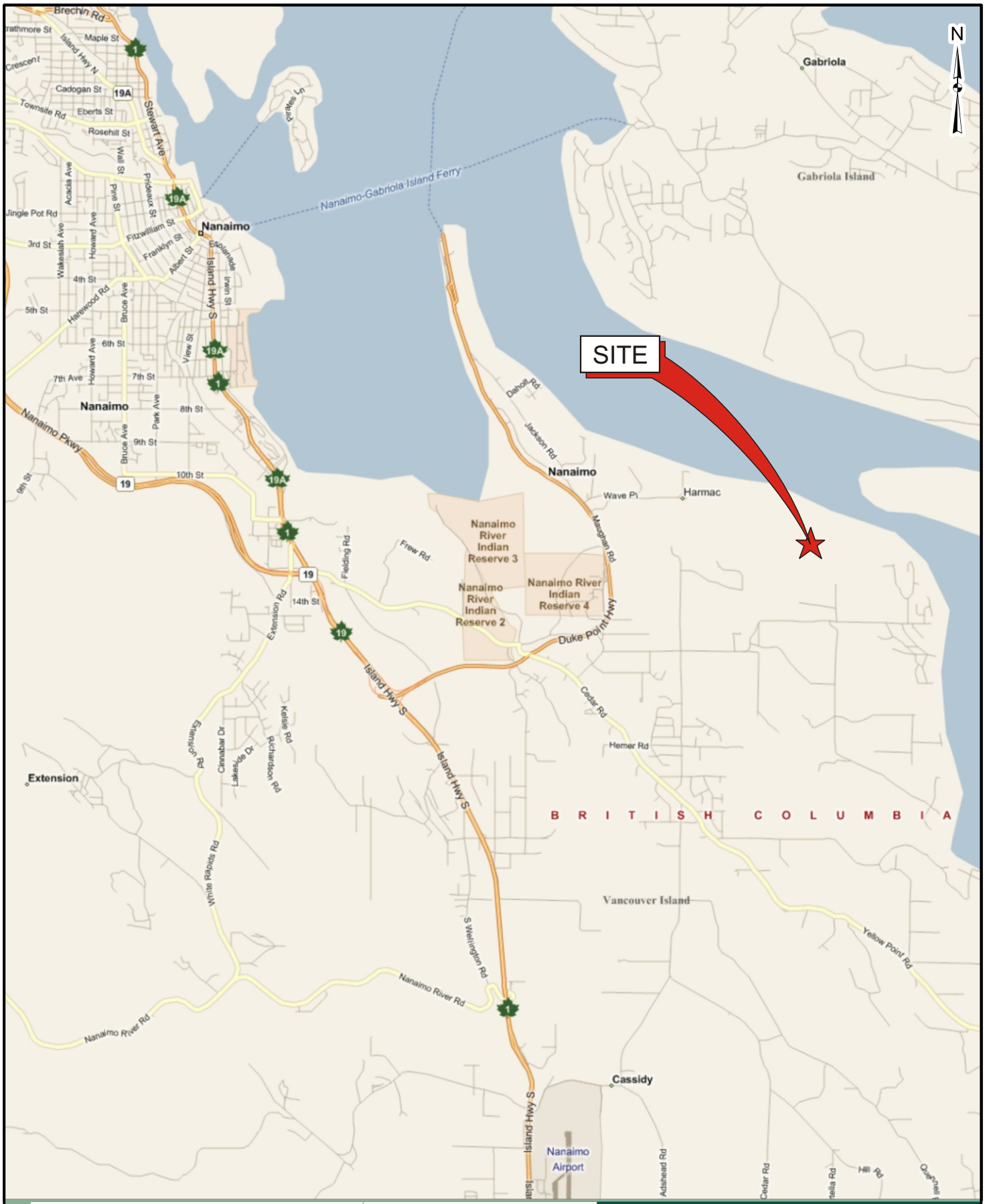
Traffic analysis was undertaken for weekday a.m. and p.m. peak periods. The horizon years selected for the traffic study are 2011, which is the expected opening year of the first phase of the project, 2021, when 50% of the project is expected to be completed and 2031 when build-out of the project is expected.

# 2.0 BACKGROUND

## 2.1 ROAD NETWORK

The roads within the study area, including laning configuration and intersection controls at key intersections are illustrated in Exhibit 2.1. Key roads adjacent to the site are described below.

(a) Highway 19: This four-lane divided highway falls under the jurisdiction of the Ministry of Transportation and has a posted speed of 90 km/h. Between Highway 1 and the Duke Point Ferry Terminal, Highway 19 is approximately 7.5 kilometres in

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**OCEANVIEW GOLF RESORT & SPA, NANAIMO**

## Site Location

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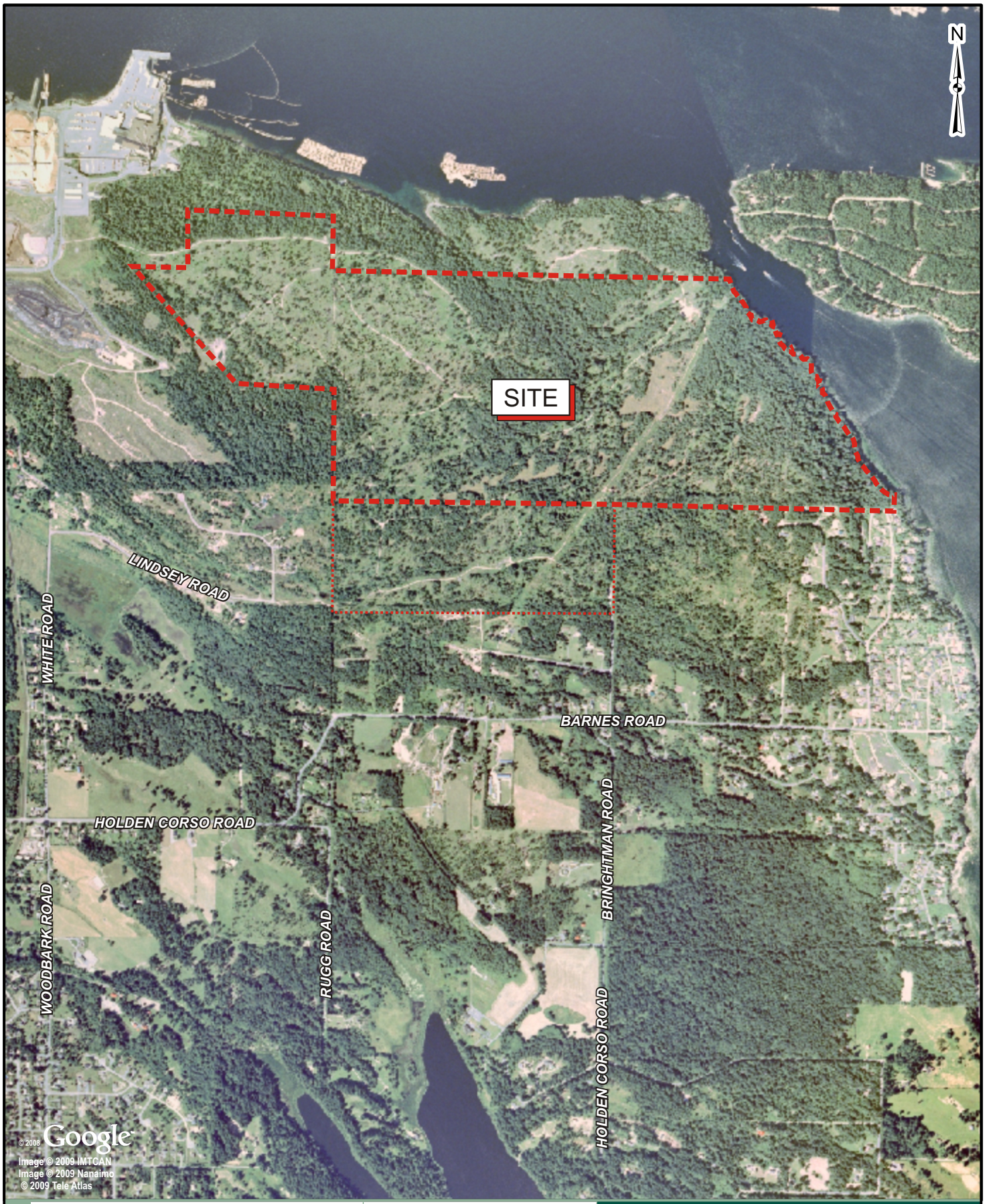
| PROJECT NO. | DATE | |
|---|---|---|
| V31201024 | August 2009 | Exhibit 1.1 |

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**Site Area Aerial Photograph**

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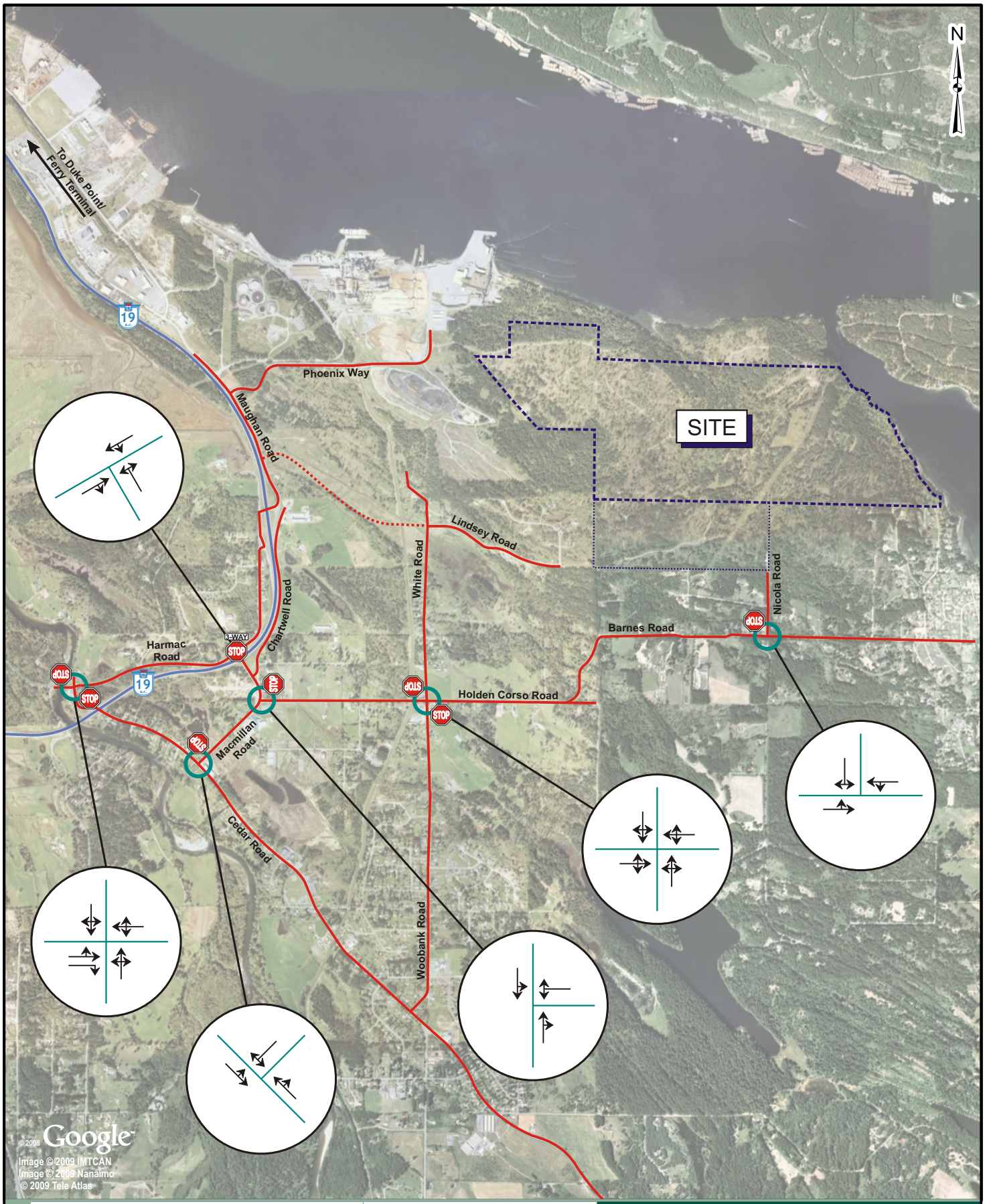
| PROJECT NO. | DATE | |
|---|---|---|
| V31201024 | August 2009 | **Exhibit 1.2** |




**LEGEND**

STOP Stop Controlled Intersection

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**OCEANVIEW GOLF RESORT & SPA, NANAIMO**

**Existing Intersection Configuration and Traffic Controls**

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| PROJECT NO. | DATE | |
|---|---|---|
| V31201024 | August 2009 | Exhibit 2.1 |

length. The southbound direction operates with two lanes, while the northbound operates with two lanes from Highway 1 through to a point approximately 1.0 kilometre south of the Maughan Road/Highway 19 intersection.

Between Highway 1 and the ferry terminal, there are only two accesses points to Highway 19. The first is at Maughan Road approximately 1.4 km south of the terminal. This at-grade unsignalized intersection provides access to industrial developments and other port related activities northeast of Highway 19. The second access is located approximately 2.2 km to the south of the intersection where a half diamond interchange provides on and off-ramps to the Highway oriented to the south.

(b) Harmac Road: Starting at Cedar Road in the west this road travels parallel to Highway 19, and connects with MacMillan Road in the east. It is approximately 1.0 kilometre long. Currently it is a two-lane road with marked shoulders on both sides. The posted speed is 60 km/h.

(c) MacMillan Road: Running in a north-south direction, this starts at Cedar Road in the west and extends to Holden Corso Road in the north where it turns towards Harmac Road then extends north towards Gorden Road. On the approach to Harmac Road, this road has an overpass over Highway 19. This road is a two lane road with rural cross section. Its intersection with Harmac Road is three-way stop controlled.

(d) Holden Corso Road/Barnes Road: This road extends in an east-west direction between MacMillan Road in the west and Brightman Road in the east. At Brightman Road, it turns to the south and connects to the harbour on the Northumberland Channel.

(e) Maughan Road: This two-lane road runs in a north-south direction from Gorden Road in the south to the industrial areas adjacent to Duke Point Ferry Terminal in the north. It falls under the jurisdiction of the City of Nanaimo, and has a rural cross-section with no curb, gutter or paved sidewalks on either side. This road has a 3.7 metre travel lane and a 1.0 metre shoulder on each side. At Gorden Road, it has an overpass over Highway 19 and is connected to Highway 19 via ramps. The profile is undulating with a 4% downhill grade to a creek and a 7% uphill grade towards Phoenix Way. Currently it provides access to developments located on both sides.

(f) Phoenix Way: This two-lane road travels in an east-west direction between Maughan Road and Northumberland Channel, and is primarily used to access the Island Timberland site to the north. Its intersection with Maughan Road is unsignalized with a 'stop' sign on Phoenix Way. East of Maughan Road, it passes over two large pipelines coming from the north.

(g) Cedar Road: Classified as a major road within the City of Nanaimo, this road commences at the Highway 1/Highway 19 intersections in the west, and extends to the city limits in the east. Operating as a two lane road, it crosses the Nanaimo River via a two-lane steel bridge.

(h) Nicola Road: This narrow two lane road operates in a north-south direction from Barnes Road in the south. It terminates at a dead end in the north. The existing pavement is only 5.7 metres wide with no shoulders or sidewalks on either side.

(i) White Road: This is another narrow road connecting Holden Corso Road with Lindsey Road. With a 5.6 metre wide pavement, this road has an undulating profile. There are no shoulders or sidewalks on either side.

(j) Lindsey Road: Running along the hillside, this road has a rock cut side slope along the northern edge. There are no sidewalks on either side of the road and no protecting barrier is provided on the south side of the road. There are a number of tight curves along this road including one curve with an advisory speed of 20 km/h. There are a number of steeper grades on this roadway including a 7.5% uphill grade on the east side. Extension of this road to the west is planned as a main access route to the site.

(k) Chartwell Road: This two lane road runs in the north-south direction starting at MacMillan Road in the south it travels north to areas south of Maughan Road overpass. In the approach to MacMillan Road it has a tight curve.

## 2.2 INTERSECTION CHANNELIZATION

The traffic controls and laning configurations of the five study area intersections are shown in Table 2.1 and in Exhibit 2.1. Four of the five intersections are stop-controlled unsignalized intersections while Harmac Road/MacMillan Road intersection is three-way stop controlled. No additional turn lanes are provided at any of these intersections i.e., the approach lane is shared by all possible movements.

The intersections of Chartwell Road/Macmillan Road and Cedar Road/Macmillan Road are approximately 150 metres apart.

TABLE 2.1: INTERSECTION LANE CONFIGURATION

| | | Eastbound | | | Westbound | | | Northbound | | | Southbound | | | Priority |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E-W Street | N-S Street | L | T | R | L | T | R | L | T | R | L | T | R | |
| Harmac Rd | MacMillan Rd | x | 1 | - | - | 1 | x | - | x | - | x | x | x | 3-way |
| Holden Corso Rd | MacMillan Rd | x | x | x | - | x | - | x | 1 | - | - | 1 | x | N/S |
| Chartwell Rd | MacMillan Rd | x | x | x | - | x | - | x | 1 | - | - | 1 | x | N/S |
| Holden Corso Rd | White Rd | - | 1 | - | - | 1 | - | - | 1 | - | - | 1 | - | E/W |
| Barnes Rd | Nicola Rd | - | 1 | x | x | 1 | - | x | x | x | - | x | - | E/W |

- shared with adjacent lane, x =no such movement exists

## 2.3 EXISTING TRAFFIC VOLUMES

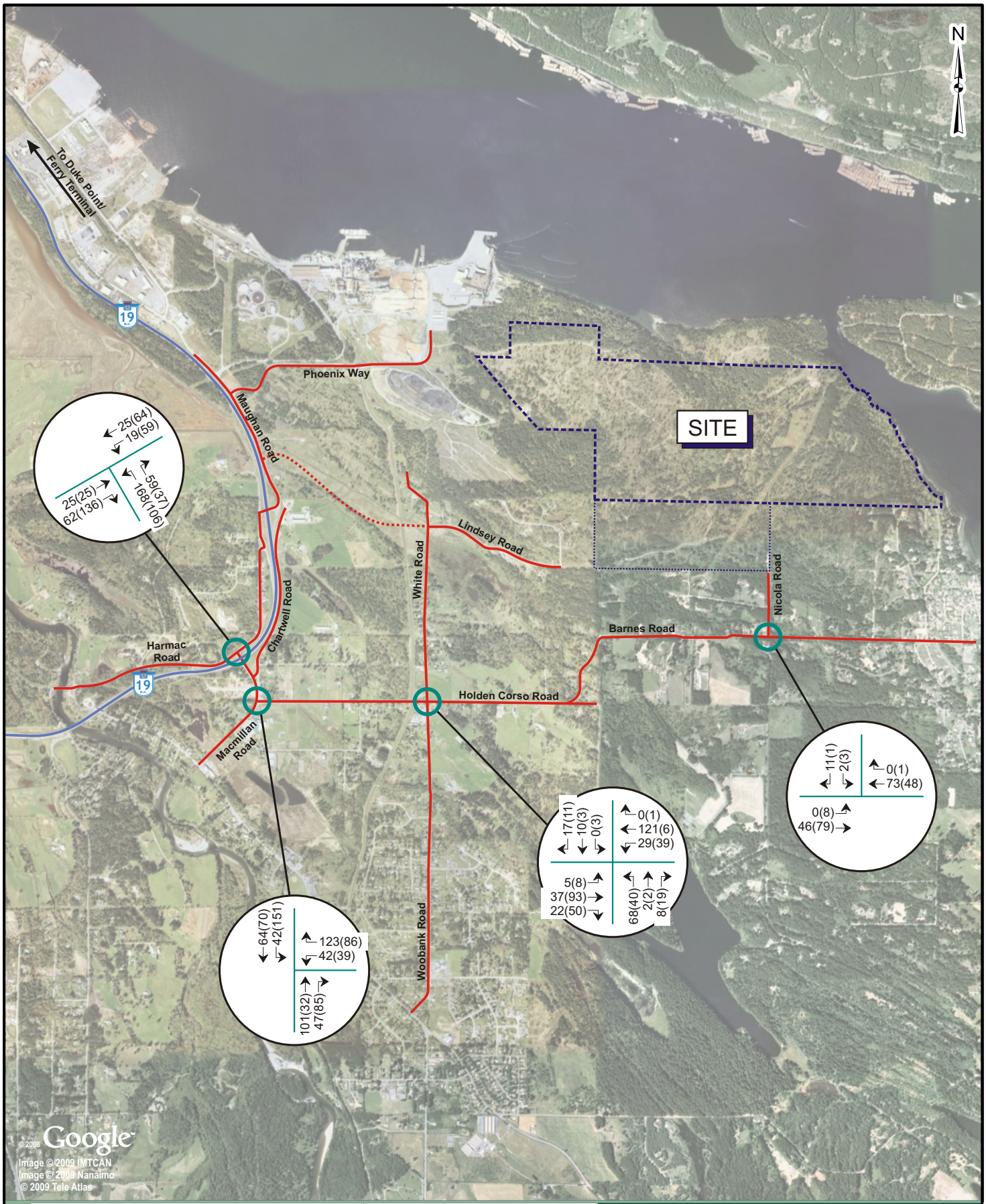
Ward Consulting Group undertook traffic counts at key intersection within the study area in April 2007. The 2007 volumes were factored up with a growth rate of 3% per annum to estimate existing 2009 traffic volumes. The resulting 2009 traffic volumes are shown in Exhibit 2.2. A summary of volumes on key sections of roads within the study area is given in Table 2.2.

TABLE 2.2: 2009 TRAFFIC VOLUMES

| | | 2009 AM Peak hour | | | 2009 PM Peak Hour | | |
|---|---|---|---|---|---|---|---|
| Location | Direction | EB/NB | WB/SB | Two-Way | EB/NB | WB/SB | Two -Way |
| Highway 19 | east of Hwy 1 | 382 | 212 | 594 | 212 | 424 | 637 |
| MacMillan Rd | north of Cedar Rd | 127 | 74 | 202 | 127 | 106 | 233 |
| | south of Harmac Rd | 223 | 85 | 308 | 149 | 191 | 339 |
| | north of Harmac Rd | 85 | 42 | 127 | 64 | 127 | 191 |
| Holden Corso Rd | west of White Rd | 64 | 202 | 265 | 149 | 53 | 202 |
| | east of White Rd | 42 | 149 | 191 | 117 | 32 | 149 |
| Barnes Rd | west of Nicola Rd | 42 | 85 | 127 | 85 | 53 | 138 |
| | east of Nicola Rd | 53 | 74 | 127 | 85 | 53 | 138 |
| White Rd | north of Holden Corso | 11 | 32 | 42 | 11 | 21 | 32 |
| Harmac Rd | west of MacMillan Rd | 85 | 191 | 276 | 159 | 170 | 329 |
| Maughan Rd | south of Phoenix Way | 159 | 106 | 265 | 95 | 276 | 371 |

Following is a brief summary of the 2009 traffic volumes:

- Highway 19 is the busiest road in the area carrying approximately 640 vehicles per hour (veh/h) two-way in the peak hours. The peak direction volume is in the order of 425 veh/h, which is considered well within the capacity of the existing two travel lanes.




**LEGEND**

000 AM Peak Hour Traffic Volume
(000) PM Peak Hour Traffic Volume

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# OCEANVIEW GOLF RESORT & SPA, NANAIMO

## 2009 Traffic Volumes

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| PROJECT NO. | DATE | |
|---|---|---|
| V31201024 | August 2009 | Exhibit 2.2 |

- Maughan Road carries up to 370 veh/h two-way in the afternoon peak hour. The traffic count data show that a high proportion of the volume on this road are trucks (up to 35% in the morning peak hour and 14% in the afternoon peak hour).
- The two-way traffic volume on MacMillan Road South of Harmac Road is approximately 310 veh/h in the a.m. peak hour, with 72% heading to the north while in the p.m. peak, the volume increases to 340 veh/h with a more balanced split between northbound and southbound traffic.
- The two-way volume on Harmac Road west of MacMillan Road in the a.m. and p.m. peak hours is approximately 275 and 330 veh/h respectively.

All of the other roads within the study area carry less than 275 veh/h in both peak hours with peak directional volumes being less than 200 veh/h.

## 2.4 TRANSIT SERVICE

There are two bus routes serving the general area, bus Route #8 and Route #9, both of which operate between the Cedar Neighbourhood from WooBank Road to the City of Nanaimo at a frequency of one bus per hour in the peak hour peak direction. At this level of service, it is unlikely that this will contribute to a reduction in auto volumes associated with the proposed development.

## 2.5 FUTURE NETWORK

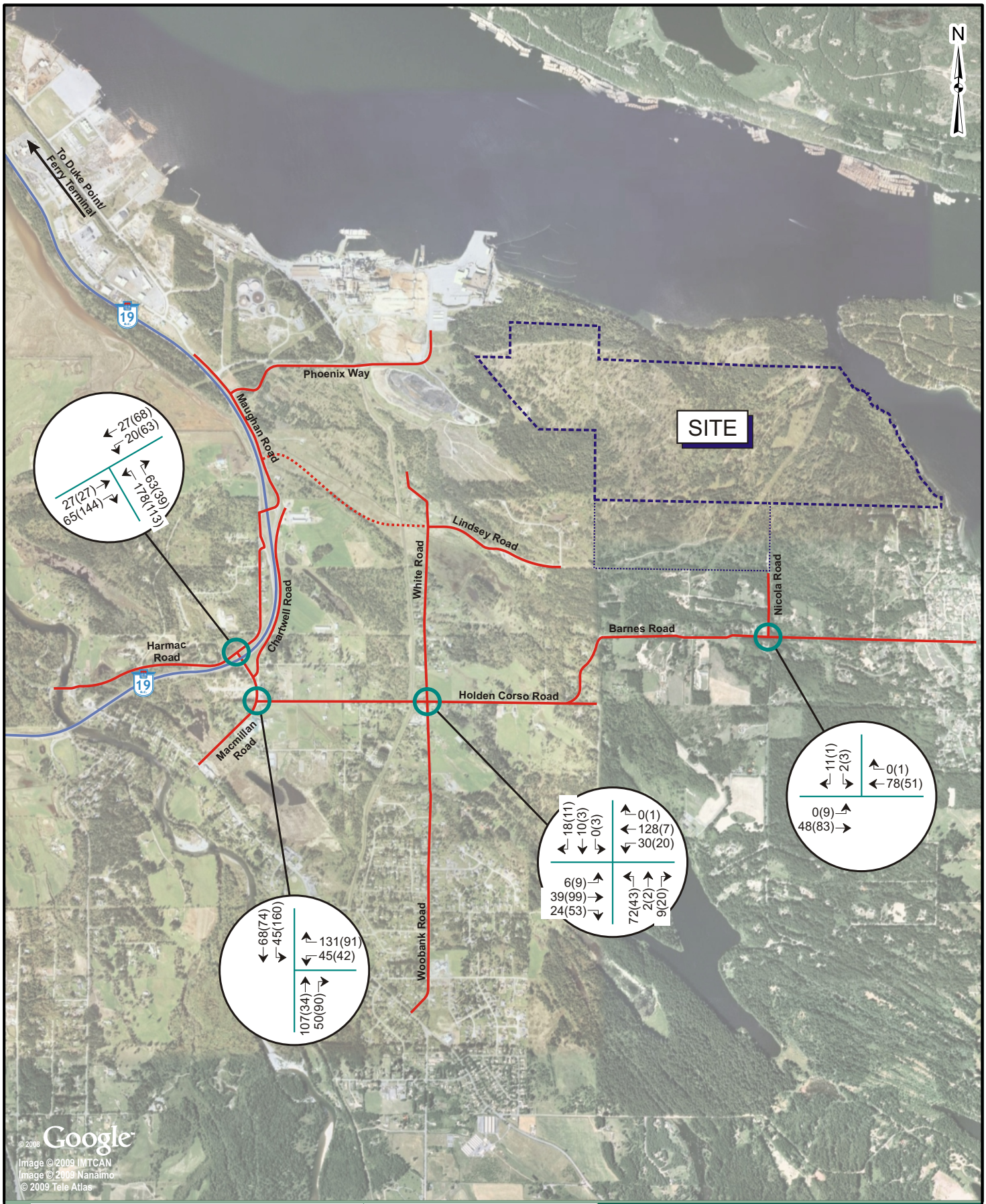
There are no planned major road network improvements in the study area in the near future, other than those proposed in conjunction with the proposed development.

## 2.6 FUTURE BACKGROUND TRAFFIC VOLUMES

Future background traffic volumes, without the proposed development in place, were calculated for the 2011, 2021 and 2031 horizon years. The 2011 and 2021 volumes were computed by factoring the existing traffic volume using a 3% traffic growth rate per year. The 2031 volume was established by factoring the 2021 traffic volume using a 1% traffic growth rate per year (as specified in the Terms of Reference). This translates to an overall growth of over 60% in the total traffic using these roads today over the coming 22 years, i.e. between today and 2031 (the assumed build-out of Oceanview). The future 2011, 2021 and 2031 background traffic volumes are illustrated in Exhibits 2.3, 2.4 and 2.5 respectively.

## 2.7 BACKGROUND TRAFFIC ANALYSIS

The operation of the key intersections was analyzed using the *Highway Capacity Manual* (HCM) methodology for unsignalized intersections. While the HCM methodology provides an overall level of service and delay for an unsignalized intersection, it is commonly left turning movements from minor roads at such intersections which are the primary focus of interest. With only low turning volumes from the minor road, and high through volumes on the main road, delays to turning vehicles can become excessive. As delays increase, turning vehicles will attempt to turn across unacceptable gaps which can present safety concerns.




**LEGEND**

000 AM Peak Hour Traffic Volume
(000) PM Peak Hour Traffic Volume

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**OCEANVIEW GOLF RESORT & SPA, NANAIMO**

## 2011 Background Traffic Volumes

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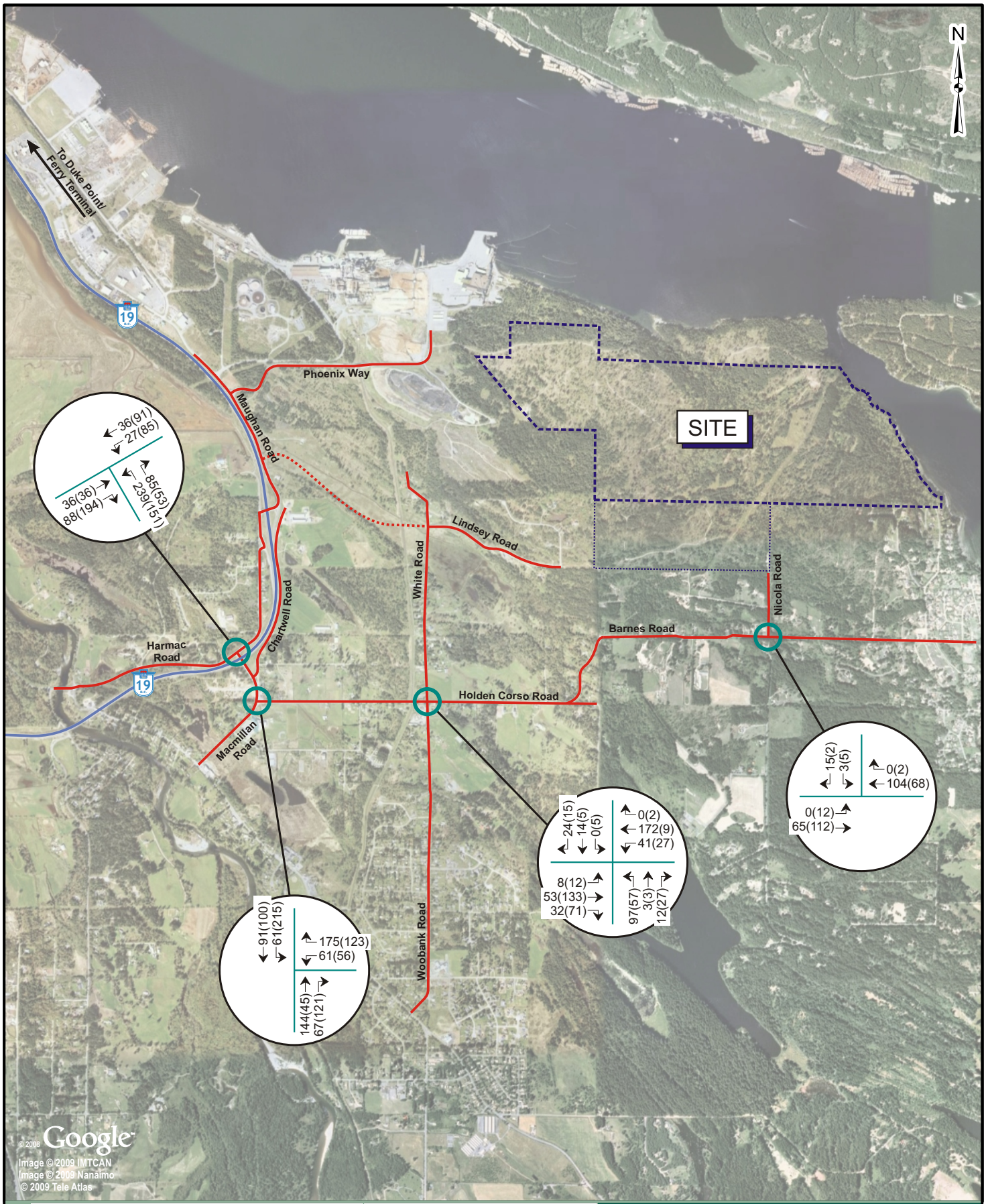
| PROJECT NO. | DATE | |
|---|---|---|
| V31201024 | August 2009 | Exhibit 2.3 |




**LEGEND**

000 AM Peak Hour Traffic Volume
(000) PM Peak Hour Traffic Volume

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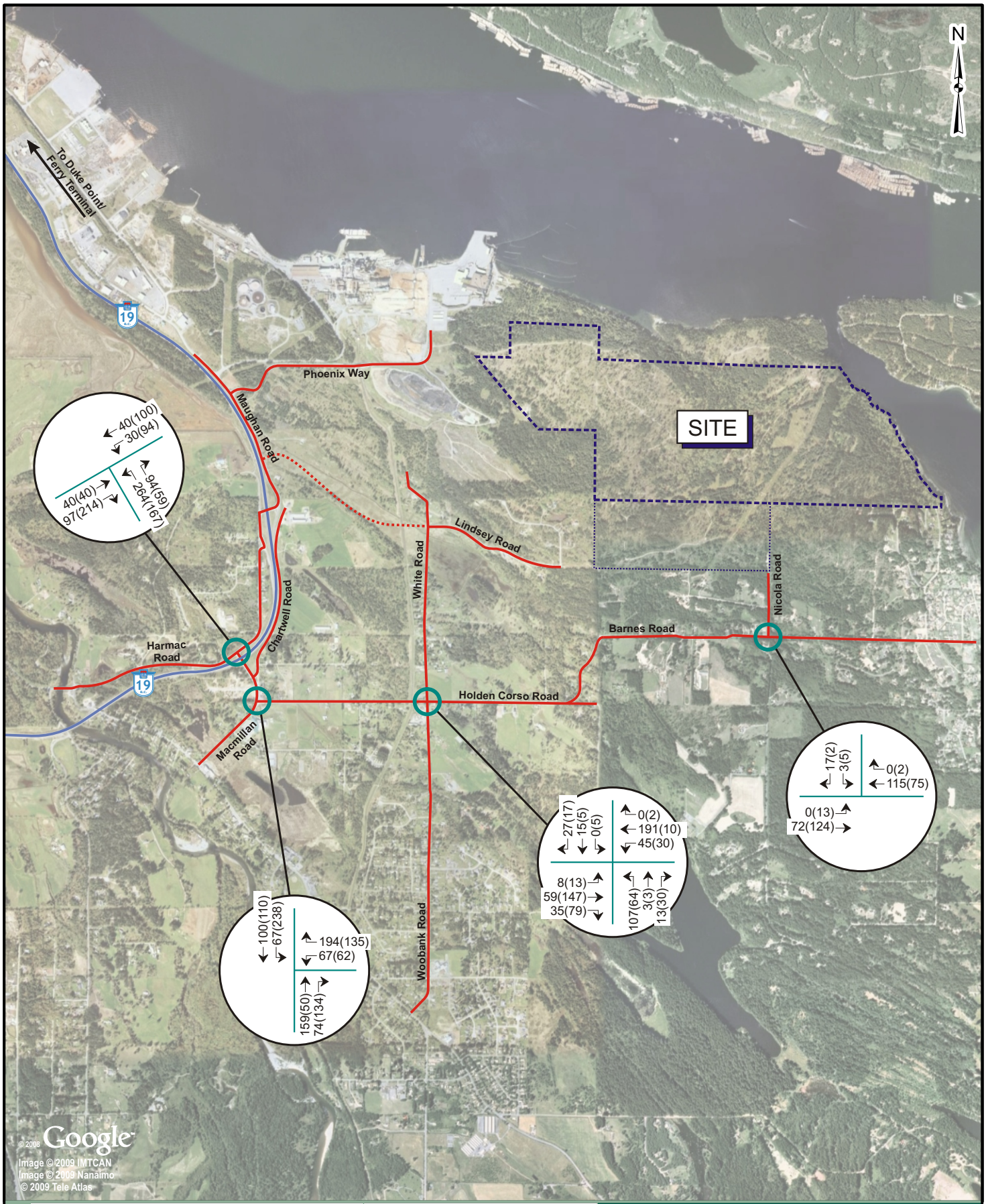
## 2021 Background Traffic Volumes

**ISSUED FOR USE**

| PROJECT NO. | DATE | |
|---|---|---|
| V31201024 | August 2009 | Exhibit 2.4 |




**LEGEND**

000 AM Peak Hour Traffic Volume
(000) PM Peak Hour Traffic Volume

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## 2031 Background Traffic Volumes

**ISSUED FOR USE**

| PROJECT NO. | DATE | |
|---|---|---|
| V31201024 | August 2009 | Exhibit 2.5 |

Traffic signals are often not warranted, or recommended, due to the low volume of turning traffic and the fact that alternative routes are often available via a signalized intersection. The availability of an upstream or downstream signalized intersection can also help traffic exiting a minor street by creating gaps in the major street traffic.

Table 2.3 shows the relationship between level of service and delay.

TABLE 2.3: LEVEL OF SERVICE VS. DELAY

| | Signalized Intersection | | Unsignalized Intersection |
|---|---|---|---|
| LoS | Control Delay/Vehicle (s/veh) | Delays | Control Delay/Vehicle |
| A | ≤ 10.0 | Little or no delay | ≤ 10.0 |
| B | > 10.0 and ≤ 20.0 | Short traffic delays | > 10 and ≤ 15 |
| C | > 20.0 and ≤ 35.0 | Average traffic delays | > 15 and ≤ 25 |
| D | > 35.0 and ≤ 55.0 | Long traffic delays | > 25 and ≤ 35 |
| E | > 55.0 and ≤ 80.0 | Very long traffic delays | > 35 and ≤ 50 |
| F | > 80.0 | Failure | > 50 |

The determination of whether signals should be considered as an unsignalized intersection is typically a function of the level of service for the minor street movements. Where a minor street turn operates at Level of Service E or F, traffic signal warrant analysis is typically carried out. The Institute of Transportation Engineers (ITE) has established guidelines to determine whether traffic signals are warranted. These are based on main line and minor street volumes, the number of lanes available and whether the intersection is an urban or rural setting. In assessing whether signals are warranted, these methods require the use of average four of seven hour volumes that cover both peak and non-peak hours.

The Ministry of Transportation has also developed guidelines for signal warrants. While these are similar to the ITE methods, the Ministry guidelines also include criteria for peak hour volumes and hourly delays during peak hours.

The five intersections in the study area were analyzed for the three horizon years for both the a.m. and p.m. peak hours using Synchro 7. The results are summarized in Table 2.4 and detail analysis results are given in the appendix.

The analysis shows that all of the intersections analyzed will operate within capacity and at acceptable level of service through to 2031 in both the a.m. and p.m. peak periods. All movements are projected to operate at Level of Service C or better. The critical movements at these intersections are predicted to operate with a v/c ratio of 0.50 or less, i.e. all intersections will operate at 50% or less of their capacity. Based on these results, no improvements are considered necessary to accommodate the background traffic volumes without the Oceanview traffic in place.

| TABLE 2.4: BACKGROUND TRAFFIC ANALYSIS | | | | | | |
|---|---|---|---|---|---|---|
| | 2011 | | 2021 | | 2031 | |
| | *v/c | *LoS | *v/c | *LoS | *v/c | *LoS |
| **A.M. Peak Hour** | | | | | | |
| Harmac Road/MacMillan Road | 0.31 | A | 0.43 | B | 0.48 | B |
| Holden Corso Road/ MacMillan Road | 0.23 | B | 0.34 | B | 0.39 | B |
| Chartwell Road/MacMillan Road | 0.01 | B | 0.01 | B | 0.01 | B |
| Holden Corso Road/White Road | 0.14 | B | 0.22 | B | 0.26 | B |
| Barnes road/Nicola Road | 0.01 | A | 0.02 | A | 0.02 | A |
| **P.M. Peak Hour** | | | | | | |
| Harmac Road/MacMillan Road | 0.21 | A | 0.30 | B | 0.35 | B |
| Holden Corso Road/ MacMillan Road | 0.20 | B | 0.32 | B | 0.38 | C |
| Chartwell Road/MacMillan Road | 0.01 | A | 0.01 | B | 0.01 | B |
| Holden Corso Road/White Road | 0.09 | B | 0.14 | B | 0.16 | B |
| Barnes road/Nicola Road | 0.01 | A | 0.01 | A | 0.01 | A |

* v/c ratio and LOS are for the critical movement

# 3.0 SITE TRAFFIC

## 3.1 DEVELOPMENT CONCEPT

The most recent site plan for the proposed development as used in this traffic assessment is shown in Exhibit 3.1. The Oceanview development will primarily be a residential development comprising detached single family houses, duplex units, townhouses, and multifamily apartments. It will also contain a golf course, hotel development and neighbourhood commercial space. At build-out, the Oceanview project will consist of 2,702 residential units, an 80 room hotel, an 18-hole golf course and up to 215,000ft$^2$ of commercial space (including 35,000 ft$^2$ in a golf club house). For the purpose of this assessment, a value of 2,725 units was used in our analysis. The development will be spread over a 20 year period. For the purpose of analysis, a 2031 horizon was chosen for build-out.

The project will be developed in phases. For the purpose of this traffic analysis, the opening year for the development was assumed to be 2011 when 10% of the development traffic is expected to be generated. By 2021 it was assumed to be 50% of the build-out traffic, with full build-out of the project by 2031. Table 3.1 provides a summary of the development types and a break down of the different uses.

N

0 20 50 100 200

NORTHUMBERLAND CHANNEL

CABLE BAY

EXISTING PUBLIC PEDESTRIAN NATURE TRAIL

JOAN POINT PARK

DODD NARROWS

PARK ACCESS

EMERGENCY VEHICLE ACCESS

EMERGENCY VEHICLE ACCESS

ACCESS TO PHOENIX WAY

POND

HOTEL

POND

POND

RIPARIAN BUFFER

PUBLIC PEDESTRIAN NATURE TRAIL

STUART CHANNEL

ESA

LEGEND

- ESTATE DETACHED
- DETACHED
- SMALL DETACHED
- DUPLEX
- TOWNHOUSE
- MULTI FAMILY
- MIXED USE/ VILLAGE CENTRES
- HOTEL BUILDING LOCATION
- CLUBHOUSE BUILDING LOCATION
- PUBLIC TRANSIT STOP

CLUBHOUSE

POND

PARKING

P/G

GOLF ACADEMY

FIRE HALL

PEDESTRIAN TRAILS

EAST OCEANVIEW PARK

SHORE SETBACK

SITE RESERVOIR

POND

PARKING

ENTRY FEATURE

CONNECTION TO LINDSEY ROAD

NICOLA ROAD

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# OCEANVIEW GOLF RESORT & SPA, NANAIMO

## Proposed Site Concept Plan

ISSUED FOR USE

PROJECT NO. V31201024

DATE August 2009

Exhibit 3.1

| TABLE 3.1 : DEVELOPMENT CONCEPT | |
|---|---|
| Development type | units |
| Estate detached | 31 |
| Detached | 234 |
| Small detached | 14 |
| Duplex | 317 |
| Townhouses | 235 |
| Multifamily | 1029 |
| Mixed use Neighborhood commercial centre | 239 |
| Mixed use commercial centre | 603 |
| **Total residential** | **2,702** |
| Golf Course | 18 Holes |
| Hotel | 80 |
| Commercial (Excluding Hotel) | 215,000 ft² |

## 3.2 PROPOSED ACCESS

At present, there is no direct road access to the development area. The closest access point is Nicola Road, which ends a short distance to the south of the southern property line for the Oceanview development. The site plan indicates that ultimately there will be two vehicle accesses to the site. The main access will be to the west of the site via an extension of Lindsey Road and the second will be via an extension of Nicola Road. To discourage traffic from using Nicola Road, traffic calming measures and internal road design treatments will be implemented. Emergency access will also be available via Phoenix Way. For the purpose of this study, this access was not assumed to be accessible by the general public.

An earlier traffic impact assessment for the site assessed alternative alignment options for the extension of Lindsey Road to the west. The three extension options are illustrated in Exhibit 3.2.

(a) Option 1: With this option, referred to as the 'middle' access route, the connector would be located approximately 800 metres north of Holden Corso Road and utilize an existing right-of-way to connect White Road and Chartwell Road.

(b) Option 2: This 'south' option is similar to the first option with the connector located 400 metres to the north of Holden Corso Road.

(c) Option 3: This option involves an extension of Lindsey Road to Maughan Road to the north of the Highway 19 ramp. It would provide a more direct access to Highway 19, as traffic would have the opportunity to access the highway directly from Maughan Road.


**LEGEND**

- Option #1 & #2
- Option #3

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**OCEANVIEW GOLF RESORT & SPA, NANAIMO**

## Lindsey Road Extension Options

**ISSUED FOR USE**

| PROJECT NO. | DATE | |
|---|---|---|
| V31201024 | August 2009 | Exhibit 3.2 |

Based on traffic operations and network connectivity of each option with the local road network, it was concluded that Option 3, which proposes extending Lindsey Road to Maughan Road, is the preferred option. This provides direct access to Highway 19, and has the least impact on the local roads. This traffic impact assessment was based on provision of the Option 3 connection.

## 3.3 COMPOSITION OF RESIDENTIAL POPULATION

The proposed development will contain a mix of retirees, recreational/investment owners and families for whom this is their primary residence. Based on information provided in the previous marketing studies, 29% of the units will be owned by retirees, 26% will be classed as recreational/investment properties and 45% of the owners will be typical residential owners. The distribution of owners between the different types of residential units was based on the proportion of the overall distribution of units throughout the site. The allocation of residents between the various housing types is shown in Table 3.2.

TABLE 3.2: ALLOCATION OF HOUSING TYPES

| | Percentage | Number of Units | Multi-Family | Low Density Detached | Low Density Attached |
|---|---|---|---|---|---|
| Retirees | 29% | 784 | 543 | 81 | 159 |
| Recreation/investment | 26% | 703 | 487 | 73 | 143 |
| Primary housing | 45% | 1216 | 842 | 126 | 248 |
| **Total** | **100%** | **2702** | 1871 | 280 | 550 |

## 3.4 TRIP GENERATION

The traffic generation for the development was calculated based on the Institute of Transportation Engineers (ITE) standard trip generation rates. For the residential component, separate trip rates were applied to the retirees, recreational owners and primary owners. A blended rate was applied to estimate the trip generation from primary owners as opposed to using a standard trip rate for just multi-family or just single-family homes. The ITE regression equations were used to compute trip generation from commercial units. The trip rate for the hotel was based on the standard trip rate for a resort hotel. It should be noted that the trip generation calculation was based on 2,725 residential units.

The commercial development and the golf course are expected to serve primarily residents of the subject site. As such during peak hours, up to 75% of the trips generated by commercial space and 75% of those generated by the Golf Course were assumed to be internal trips. The resulting trip generation results are summarized in Table 3.3.

Without any adjustment for the internal trips, it is projected that at build-out, the site would generate 1,295 veh/h in the a.m. peak hour and 2,380 veh/h in the p.m. peak hour. With adjustments to allow for internal trips, the external trips generated by the development are

projected to be approximately 995 veh/h in the a.m. peak hour and 1,185 veh/h in the p.m. peak hour. At the opening day (2011), the site is projected to generate approximately 100 veh/h in the a.m. peak hour and 120 veh/h in the p.m. peak hour. By 2021, site traffic is projected to be approximately 500 veh/h and 590 veh/h in the a.m. and p.m. peak hours respectively. Majority of the site traffic will be outbound in the a.m. peak hour and inbound in the p.m. peak hour.

TABLE 3.3: SITE GENERATED TRAFFIC

| | | AM Peak Hour | | | | PM Peak Hour | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Size | Rate | Total | In | Out | Rate | Total | In | Out |
| Retirees | 790 | 0.20 | 158 | 60 | 98 | 0.26 | 205 | 125 | 80 |
| Recreation | 709 | 0.16 | 113 | 76 | 37 | 0.26 | 184 | 76 | 109 |
| Primary Housing | 1,226 | 0.57 | 702 | 152 | 550 | 0.71 | 861 | 546 | 315 |
| Hotel | 80 rooms | 0.37 | 30 | 21 | 8 | 0.49 | 39 | 16 | 23 |
| Golf Course | 18 holes | 2.22 | 40 | 32 | 8 | 2.74 | 49 | 22 | 27 |
| Commercial | 215,000 ft2 | Eq'n | 252 | 154 | 98 | Eq'n | 1,041 | 500 | 541 |
| **Unadjusted Trips** | | | 1,295 | 495 | 801 | | 2,380 | 1,285 | 1,095 |
| **Internal Trips** | | | 302 | 151 | 151 | | 1,194 | 597 | 597 |
| **External Traffic Build out (2031)** | | | 993 | 343 | 649 | | 1,185 | 687 | 498 |
| **Phase 1 (2011) - 10%** | | | 99 | 34 | 65 | | 119 | 69 | 50 |
| **Phase 2 (2021) - 50%** | | | 496 | 172 | 325 | | 592 | 344 | 249 |

## 3.5 TRIP DISTRIBUTION

The trip distribution for Oceanview was based on a review of site location relative to the City of Nanaimo and the Duke Point Ferry Terminal. Only 5% of the peak hour traffic generated by the site was assumed to be oriented to the Duke Point Ferry Terminal direction. Up to 10% of the site traffic is expected be oriented to the local area to the north of Cedar Road and east of Highway 19. The remaining 85% of site traffic will be oriented to the west of the Nanaimo River with 50% to the Nanaimo City Centre area, 25% to the areas to the north of Nanaimo and 10% to the south of Nanaimo. A summary of the assumed trip distribution is shown in Table 3.4.

TABLE 3.4: SITE TRAFFIC DISTRIBUTION (BUILD-OUT)

| | | AM Peak Hour | | PM Peak Hour | |
|---|---|---|---|---|---|
| | % | In | Out | In | Out |
| To & from Duke Point | 5% | 17 | 32 | 34 | 25 |
| To & from Nanaimo City | 50% | 172 | 325 | 344 | 249 |
| South | 10% | 34 | 65 | 69 | 50 |
| North | 25% | 86 | 162 | 172 | 124 |

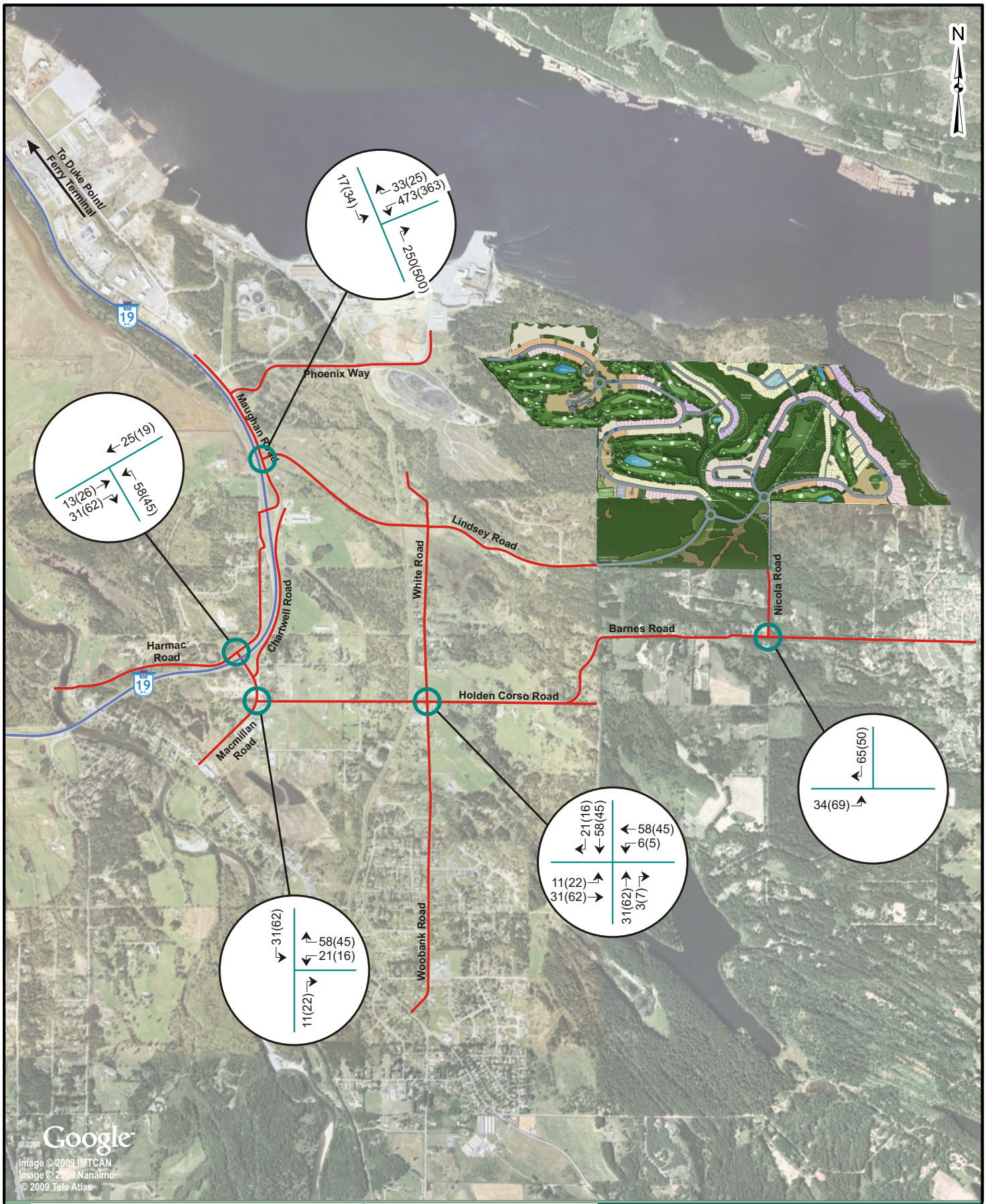
| TABLE 3.4: SITE TRAFFIC DISTRIBUTION (BUILD-OUT) | | | | | |
|---|---|---|---|---|---|
| | | AM Peak Hour | | PM Peak Hour | |
| | % | In | Out | In | Out |
| Local | 10% | 34 | 65 | 69 | 50 |
| **Total** | **100%** | **343** | **649** | **687** | **498** |

## 3.6 TRIP ASSIGNMENT

The site generated traffic was assigned to the adjacent road network based on the trip generation and trip distribution as given above. The assignment assumed that the construction of the Lindsey Road extension to Maughan Road would be completed prior to occupancy. As this new connector gives more direct access to Highway 19, majority of the site traffic (up to 90%) of those heading to the west are expected to use this direct route instead of travelling via the local roads. The resulting site traffic volume at build-out is summarized in Table 3.5 and illustrated in Exhibit 3.3.

| TABLE 3.5: SITE TRAFFIC VOLUMES (BUILD-OUT) | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | AM Peak hour | | | PM Peak Hour | | |
| Location | Direction | EB/NB | WB/SB | Two-Way | EB/NB | WB/SB | Two -Way |
| Highway 19 | east of Hwy 1 | 237 | 448 | 685 | 474 | 343 | 818 |
| MacMillan Rd | south of Harmac Rd | 58 | 31 | 89 | 45 | 62 | 107 |
| | north of Harmac Rd | 13 | 25 | 38 | 26 | 19 | 45 |
| Holden Corso Rd | west of White Rd | 42 | 79 | 121 | 84 | 61 | 145 |
| | east of White Rd | 34 | 65 | 89 | 69 | 50 | 119 |
| Barnes Rd | west of Nicola Rd | 34 | 65 | 89 | 69 | 50 | 119 |
| White Rd | north of Holden Corso | 42 | 79 | 121 | 84 | 61 | 145 |
| Lindsey Road | east of White Road | 309 | 584 | 893 | 618 | 448 | 1066 |
| | west of White Road | 267 | 505 | 773 | 535 | 387 | 922 |
| Maughan Road | south of Lindsey connector | 250 | 473 | 723 | 500 | 363 | 863 |

At build-out, site traffic on Highway 19 east of Highway 1 is projected to be approximately 685 veh/h two-way in the a.m. peak hour and 820 veh/h two-way in the p.m. peak hour. Site traffic using Maughan Road to the south of the new connector is projected to be approximately 725 veh/h two-way in the a.m. peak hour and 865 veh/h two-way in the p.m. peak hour, while the new connector itself, is estimated to carry 775 veh/h two-way in the a.m. peak hour and 920 veh/h two-way in the p.m. peak hour. With this access arrangement, the increase in volume due to site traffic on all other local roads with the exception of Lindsey Road, Maughan Road and Highway 19 is projected to be less than 150 veh/h two-way in both peak hours.




**LEGEND**

000 AM Peak Hour Traffic Volume
(000) PM Peak Hour Traffic Volume

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# OCEANVIEW GOLF RESORT & SPA, NANAIMO

## Site Traffic Volumes

**ISSUED FOR USE**

| PROJECT NO. | DATE | |
|---|---|---|
| V31201024 | August 2009 | Exhibit 3.3 |

# 4.0 COMBINED TRAFFIC CONDITIONS AND TRAFFIC IMPACT

The combined traffic conditions were analyzed to assess the impact of the site generated traffic on the adjacent road network.

## 4.1 COMBINED TRAFFIC VOLUME

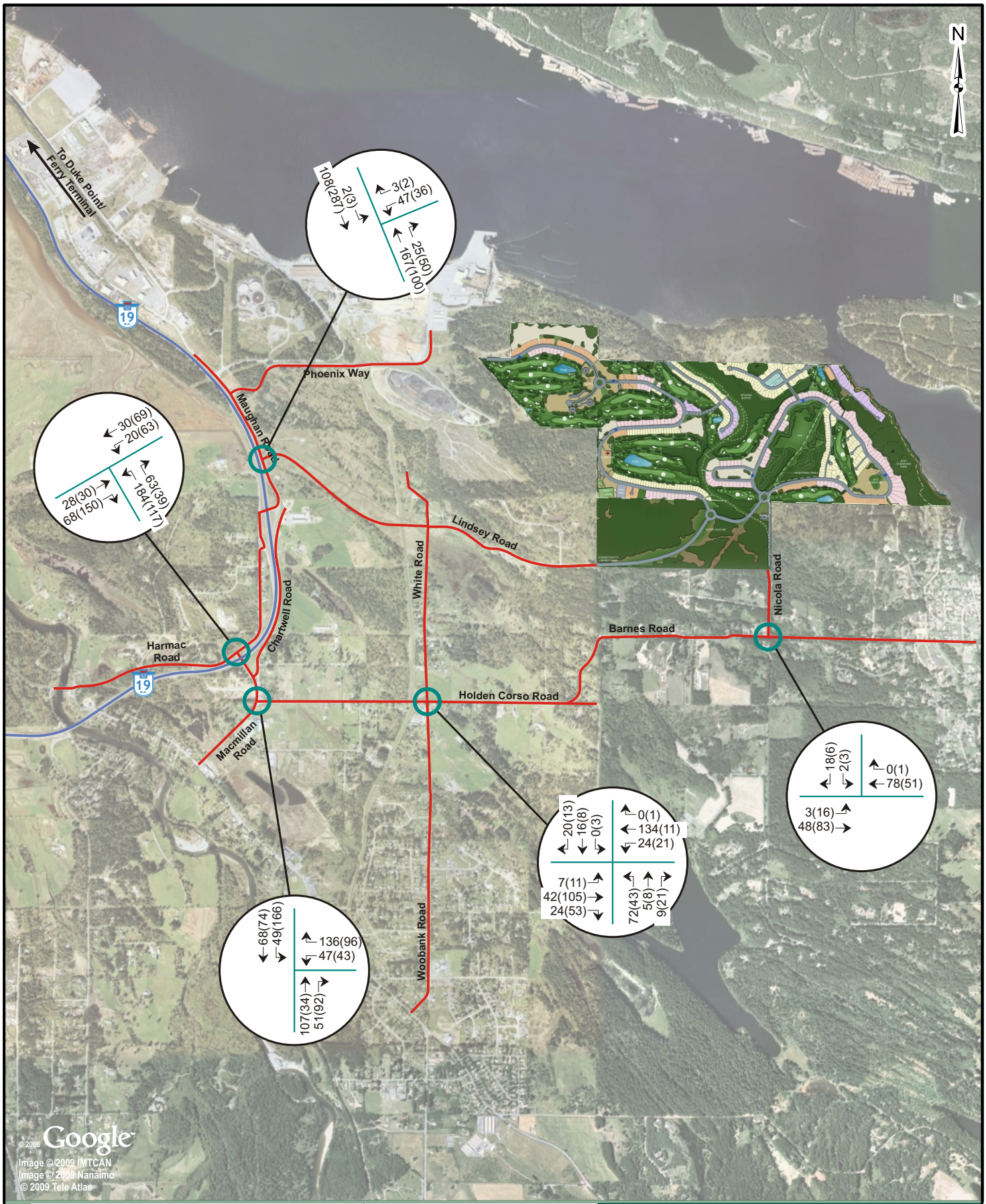
The combined traffic volumes for the 2011, 2021 and 2031 horizon years were calculated by superimposing the site traffic volume given in Exhibit 3.2 onto the projected background traffic volume for the 2011, 2021 and 2031 horizon years. The resulting combined traffic volumes for the 2011, 2021 and 2031 horizon years are shown in Exhibit 4.1, 4.2 and 4.3 respectively.

## 4.2 COMBINED INTERSECTION ANALYSIS

The five intersections analyzed under the background conditions were re-analyzed under the combined traffic conditions in order to assess the impact of site traffic and their performances. A summary of the analysis results for the combined traffic conditions in comparison to the background condition is given in Table 4.1. Detailed analysis results are given in Appendix B.

With the new connector between Lindsey Road and Maughan Road and with the site fully developed, all five intersections analyzed under the background traffic condition are predicted to operate at an acceptable level of service and within their capacity, i.e. at less than 60% of their capacity through to 2031.

This is not a surprise, since the connection of Lindsey Road to Maughan Road will provide direct access to Highway 19 and the majority of traffic heading to the west to the City of Nanaimo and north of Nanaimo is expected to use Maughan Road and Highway 19. Only a small amount of site traffic will use the local roads such as White Road, Holden Corso Road, Chartwell Road and MacMillan Road and as a result the study area intersections will only be marginally impacted by site traffic. At present all these intersections have adequate spare capacity to accommodate additional traffic, i.e. they are currently operating at less than 50% of their capacity. Given this, with Lindsey Road connected to Maughan Road, no improvements to these five intersections are required to accommodate traffic at the full build-out of the site.




**LEGEND**

000 AM Peak Hour Traffic Volume
(000) PM Peak Hour Traffic Volume

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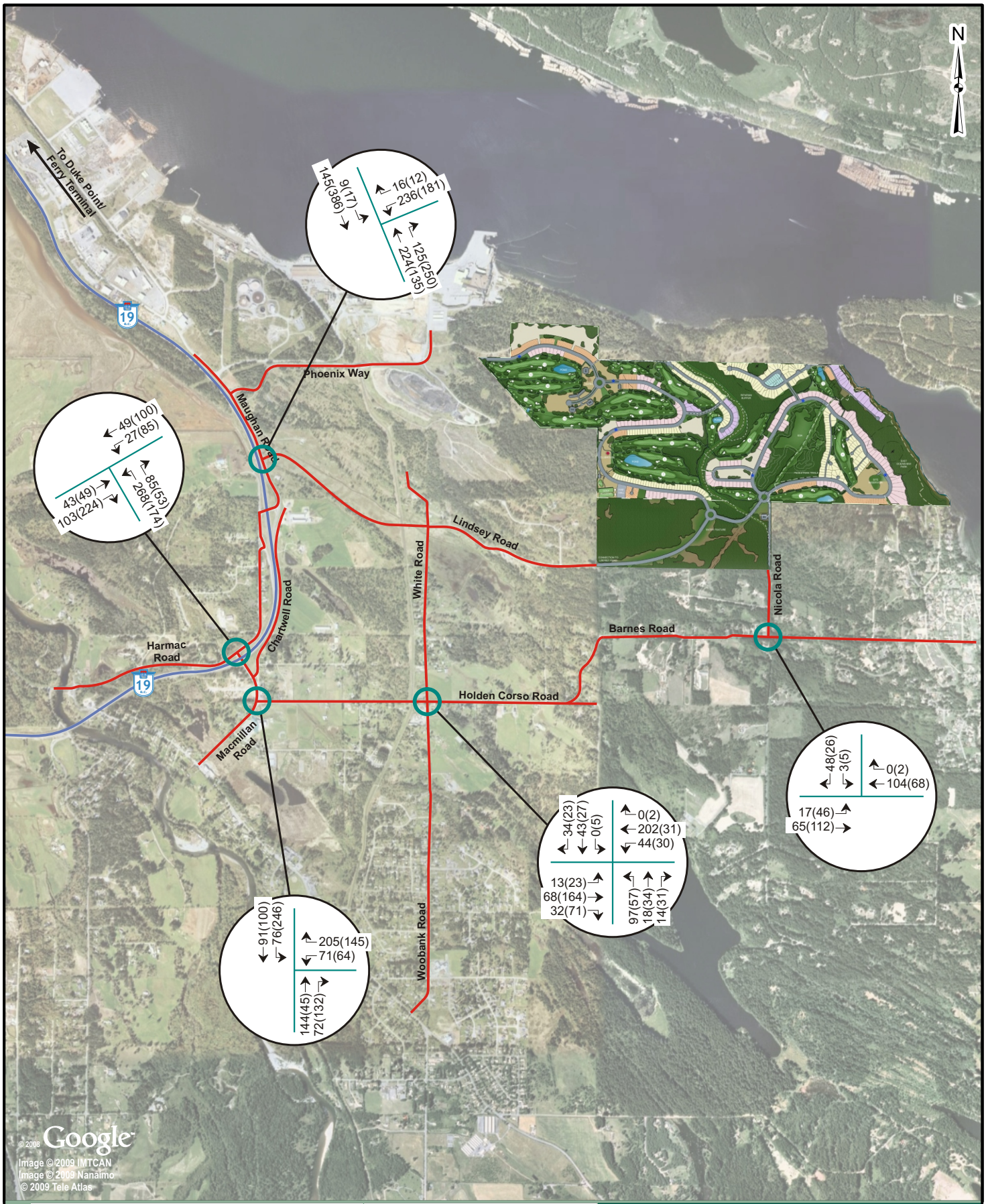
# OCEANVIEW GOLF RESORT & SPA, NANAIMO

## 2011 Combined Traffic Volumes

**ISSUED FOR USE**

| PROJECT NO. | DATE | |
|---|---|---|
| V31201024 | August 2009 | Exhibit 4.1 |




**LEGEND**

000 AM Peak Hour Traffic Volume
(000) PM Peak Hour Traffic Volume

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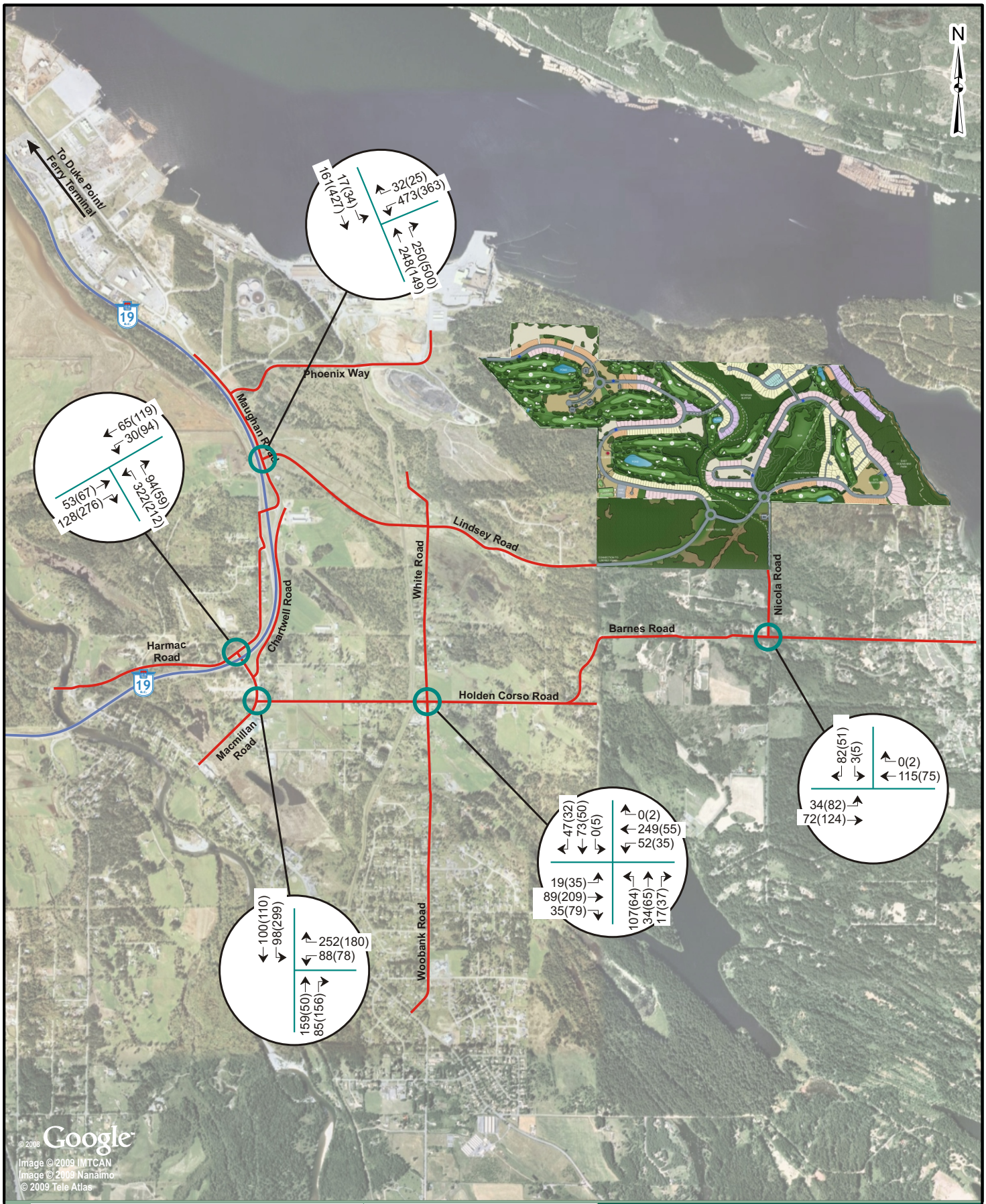
# OCEANVIEW GOLF RESORT & SPA, NANAIMO

## 2021 Combined Traffic Volumes

**ISSUED FOR USE**

| PROJECT NO. | DATE | |
|---|---|---|
| V31201024 | August 2009 | Exhibit 4.2 |




**LEGEND**

000 AM Peak Hour Traffic Volume
(000) PM Peak Hour Traffic Volume

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# OCEANVIEW GOLF RESORT & SPA, NANAIMO

## 2031 Combined Traffic Volumes

**ISSUED FOR USE**

| PROJECT NO. | DATE | |
|---|---|---|
| V31201024 | August 2009 | Exhibit 4.3 |

| TABLE 4.1: COMBINED TRAFFIC ANALYSIS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Intersection | 2011 | | | | 2021 | | | | 2031 | | | |
| | background | | combined | | background | | combined | | background | | combined | |
| | v/c | LoS | v/c | LoS | v/c | LoS | v/c | LoS | v/c | LoS | v/c | LoS |
| A.M. peak Hour | | | | | | | | | | | | |
| Harmac Road/MacMillan Road | 0.31 | A | 0.32 | A | 0.43 | B | 0.48 | B | 0.48 | B | 0.59 | C |
| Holden Corso Road/ MacMillan Road | 0.23 | B | 0.24 | B | 0.34 | B | 0.41 | B | 0.39 | B | 0.54 | C |
| Chartwell Road/MacMillan Road | 0.01 | B | 0.01 | B | 0.01 | B | 0.01 | B | 0.01 | B | 0.01 | B |
| Holden Corso Road/White Road | 0.14 | B | 0.15 | B | 0.22 | B | 0.31 | C | 0.26 | B | 0.49 | D |
| Barnes Road/Nicola Road | 0.01 | A | 0.02 | A | 0.02 | A | 0.06 | A | 0.02 | A | 0.10 | A |
| P.M. peak Hour | | | | | | | | | | | | |
| Harmac Road/MacMillan Road | 0.21 | A | 0.22 | A | 0.30 | B | 0.35 | B | 0.35 | B | 0.45 | B |
| Holden Corso Road/ MacMillan Road | 0.20 | B | 0.21 | B | 0.32 | B | 0.40 | C | 0.38 | C | 0.58 | C |
| Chartwell Road/MacMillan Road | 0.01 | A | 0.01 | A | 0.01 | B | 0.01 | B | 0.01 | B | 0.01 | B |
| Holden Corso Road/White Road | 0.09 | B | 0.11 | B | 0.14 | B | 0.23 | B | 0.16 | B | 0.39 | C |
| Barnes Road/Nicola Road | 0.01 | A | 0.01 | A | 0.01 | A | 0.04 | A | 0.01 | A | 0.07 | A |

## 4.3 PERFORMANCE OF NEW CONNECTOR AND MAUGHAN ROAD

The performance of the new connector between Lindsey Road and Maughan road as well as the performance of Maughan Road between the new connector and Highway 19 was reviewed by considering the combined peak hour traffic volumes at 2031. Results of this analysis are summarized in Table 4.2.

At build-out, the combined p.m. peak hour volume on Maughan Road south of the proposed connection is projected to be 1,440 veh/h two-way with the peak direction volume 790 veh/h. Under the 2031 combined traffic condition, the two-way peak hour volumes on the new connector is projected to be 775 veh/h in the a.m. peak hour and 920 veh/h in the p.m. peak hour while the peak direction volume is approximately 505 veh/h in the a.m. peak hour and 535 veh/h in the p.m. peak hour.

| TABLE 4.2: BUILD-OUT COMBINED TRAFFIC VOLUMES | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | A.M. Peak hour | | | P.M. Peak Hour | | |
| Location | Direction | EB/NB | WB/SB | Two-Way | EB/NB | WB/SB | Two -Way |
| New Connector | west of White Road | 267 | 505 | 773 | 535 | 387 | 922 |
| Maughan Rd | south of new access | 498 | 634 | 1,131 | 649 | 789 | 1,438 |

Analysis of the link performance of the new connector and Maughan Road was based on the Highway Capacity Manual (HCM) operational methodology for two-lane Highways as implemented in Highway Capacity Software (HCS). The performance analysis results are summarized in Table 4.3.

TABLE 4.3: LINK PERFORMANCE BASED ON HCS - 2031 COMBINED

| | New Connector | | Maughan Road | |
|---|---|---|---|---|
| | v/c | LoS | v/c | LoS |
| AM peak hour | 0.34 | C | 0.46 | D |
| PM peak hour | 0.38 | C | 0.59 | D |

With the site fully developed, and one lane in each direction, the new connector is predicted to operate with a v/c ratio of 0.34 and at Level of Service C in the a.m. peak hour and with a v/c ratio of 0.38 and a Level of service C in the p.m. peak hour. Given this, one lane per direction on the new connector is considered adequate to accommodate the projected site traffic. Local widening at the key intersections may be required subject to detailed assessment.

Maughan Road south of the new connector is predicted to operate at 59% of capacity and a Level of Service D in the critical p.m. peak hour. By 2031, in order to improve the Level of Service of Maughan Road to Level of Service C or better, widening the section of Maughan Road between Highway 19 and the new connector may be required.

The Maughan overpass over Highway 19 has one lane per direction. Widening the overpass to two lanes per direction will be expensive. It should however be noted that the above analysis was based on an aggressive background traffic growth rate of 3% through to 2021 and a 1% through to 2031. Taking into account this optimistic traffic estimation, the physical restraint on the overpass, the overall performance on the link and the length of the road section affected, one lane per direction is considered adequate. However, it is recommended that regular monitoring of traffic volumes on Maughan Road take place.

## 4.4 MAUGHAN ROAD/LINDSEY ROAD INTERSECTION CONFIGURATION

The operational performance of the Maughan Road/Lindsey Road intersection (a three-legged intersection) was analyzed for the 2021 and 2031 combined traffic conditions. The analysis considered various traffic control options, with results summarized in Table 4.4. With a single approach lane on Maughan Road and two exit lanes on the new connector, and westbound traffic controlled by a stop sign, the intersection will operate satisfactorily through to 2021. By 2031, when the site is fully developed, this unsignalized intersection will operate at Level of Service F if it continues to operate as a standard unsignalized intersection.

To provide an acceptable level of service in the long run will require improvements. Three improvement options were considered:

- Roundabout
- Traffic signal
- Protected left turn lane

A protected left turn intersection is an unsignalized intersection in which a separate storage lane and acceleration lane is provided for the left turn movement from the minor leg. This allows traffic exiting the minor road to cross the major road in two stages. The first involves waiting for a suitable gap in one direction of travel. Traffic then merges with through traffic in the second direction. A diagrammatic illustration of this option is provided in Appendix C. This arrangement can considerably reduce delays for vehicles turning from the minor street, and allows the intersection to continue operating as an unsignalized intersection.

TABLE 4.4: 2031 COMBINED ANALYSIS OF MAUGHAN ROAD/NEW CONNECTOR

| | 2021 | | 2031 | |
|---|---|---|---|---|
| | v/c | LoS | v/c | LoS |
| *Maughan Road as two lane Road - Unsignalized (WB stop)* | | | | |
| AM peak hour | 0.48 | C | 1.16 | F |
| PM peak hour | 0.52 | C | 1.47 | F |
| *Maughan Road as four lane Road -Unsignalized (WB stop)* | | | | |
| AM peak hour | 0.45 | C | 0.90 | E |
| PM peak hour | 0.42 | C | 0.79 | D |
| *Maughan Road as two/four lane Road -Unsignalized (SB stop)* | | | | |
| AM peak hour | | | 0.47 | C |
| PM peak hour | | | 0.96 | F |
| *Maughan Road/new connector - protected left turn intersection* | | | | |
| AM peak hour | | | 0.76 | D |
| PM peak hour | | | 0.55 | C |
| *Maughan Road/new connector – signal* | | | | |
| AM peak hour | | | 0.73 | B |
| PM peak hour | | | 0.64 | B |
| **Maughan Road/new connector – roundabout* | | | | |
| AM peak hour | | | 0.49 | |
| PM peak hour | | | 0.52 | |

* Based on synchro analysis

The pros and cons of the three improvements scenarios are as follows:

- The design elements of a roundabout require drivers to reduce their approach speeds which helps reduce the potential for the severity of collisions.
- Compared to a signalized intersection, a roundabout has fewer conflict points, which translates to fewer potential collisions.
- Roundabouts present opportunities for enhanced aesthetics by adding landscaping.
- Additional construction costs for a roundabout can be off-set by not requiring signal equipment, which also translates to reduced maintenance costs and savings in power consumption.
- Modern roundabouts (as opposed to traffic circles) typically require a greater area, particularly if it is necessary to accommodate large trucks (up to a 60 metre diameter).
- It is not desirable to install roundabouts where there is a high volume of trucks, or pedestrians. Traffic count data indicates high truck volume on Maughan Road, associated with industrial operations.
- Realignment of Maughan Road may be required in the vicinity of the intersection in order to construct a roundabout. Since Maughan Road is close to Highway 19, land acquisition may be required to achieve this.
- Drivers in this area may not be familiar with roundabout operation, which could cause confusion and safety issues

Given the above, installing a roundabout to control traffic flow through this intersection is not recommended.

The advantages of a protected left turn intersection relative to the other traffic control options are:

- Compared to a signalized intersection or a roundabout, overall construction and maintenance cost for the intersection is lower,
- Ongoing cost saving in power and maintenance can be realized relative to a signalized intersection,
- Delays to through traffic are minimized;

Taking into account the pros and cons of the three traffic control options, a protected left turn intersection is the preferred solution. To accommodate a protected left turn intersection requires a minimum of 75 metres storage lane and 55 metres for the merging section, a total of 130 metres on the downstream side. The distance between the new intersection and the curve prior to the overpass on Maughan Road is greater than 250 metres. As such, there will be sufficient distance to accommodate a protected left turn intersection north of the overpass.

## 4.5 RECOMMENDED NETWORK IMPROVEMENTS

At build out, the following improvements are considered necessary to accommodate traffic generated by the Oceanview development.

(a) Nicola Road: Currently the paved width on this road is not sufficient to allow two vehicles to pass at the same time. This road is proposed to provide a secondary access to developments on the east side of the site. While site traffic using this road is expected to be low (less than 150 veh/h two-way at build-out), it is recommended to upgrade this road to a standard two lane road.

(b) Lindsey Road: Currently this road has a steep side slope on the south side and a fairly narrow paved width with no shoulders. The grade of this road is undulating, and the horizontal alignment is winding. In order to provide a safe access to the site through this road, upgrading of the paved width and installation of safety barriers on the south side are required. It is recommended that a minimum pavement width of 9.2 metres is provided for this road, plus allowance for the safety barriers on the south side. The 9.2 width allows for two 3.6 metre travel lanes and a minimum of 1.0 metre paved shoulder on each side. The paved 1.0 metre shoulder will also serve as a pedestrian/bike refuge for this road. To achieve this cross-section width is likely to require cutting into rock on the north side of the road.

(c) White Road: The use of White Road by site traffic will depend primarily on the timing for the extension of Lindsey Road to Maughan Road. With the extension in place, and Nicola Road upgraded, as recommended above, it is unlikely that much traffic will need to use White Road; hence no upgrading is necessary. Without the Lindsey Road extension, it is recommended that this road is upgraded to provide sufficient width for two vehicles to travel along this road and, with additional space for shoulders.

(d) Lindsey Road Extension: The peak hour volume on this road can be accommodated with one travel lane per direction. Similar to Lindsey Road, it is recommended that a minimum pavement width of 9.2 metres is provided for this road. A 20 metre right of way is considered appropriate for this new road. This will provide sufficient width to accommodate one travel lane in each direction, with lanes being sufficiently wide to safely accommodate bicycles. This provides sufficient right-of-way to accommodate one additional turn lane at key intersections, such as Maughan Road.

## 4.6 TIMING FOR IMPROVEMENTS

At full build-out, there are a number of improvements that will be required to mitigate the impact of site traffic. The specific improvements are:

- Upgrading of Nicola Road to accommodate two-way traffic
- Upgrading of the existing Lindsey Road between the site and White Road

- Construction of the Lindsey Road extension from White Road to Maughan Road
- Upgrading the intersection of Lindsey Road/Maughan Road to accommodate a protected left turn slot on Maughan Road.

The upgrading White Road between Lindsey Road and Holdon Corso Road is dependent on the timing for construction of the Lindsey Road extension. As noted above, if the Lindsey Road extension is in place from opening day, upgrading of White Road is not considered necessary.

Following is a discussion of the triggers for each of the improvements.

(a) Nicola Road – While Nicola Road will provide only a secondary access to the site, the upgrading of this road to a standard two lane road should be completed in conjunction with the opening of the development.

(b) Lindsey Road – It is also recommended that upgrading of this road, as identified above, also be completed by opening day of the Oceanview development.

(c) Lindsey Road Extension - The key improvement required to accommodate site traffic is the extension of Lindsey Road between the site and Maughan Road as a means of creating a second access route to and from the site. From a traffic volume perspective, this improvement is not considered necessary until the site reaches 300 units. However, it is understood the extension of Lindsey Road is required to accommodate services for the site, and could be available from opening day.

(d) Lindsey Road/Maughan Road – The timing for upgrading of this intersection will depend in part on the rate of development of the Oceanview site. As a standard unsignalized intersection and with priority to traffic on Maughan Road, the intersection should have sufficient capacity to accommodate 50% of the site traffic (approximately 1,300 homes and 100,000 $ft^2$ of commercial space). This was assumed to occur by 2021.

From a traffic capacity perspective, upgrading to a protected left turn intersection will therefore not be required until after 2021; however, in order to minimize disruption to both site and non-site traffic, incorporating the upgrading into the completion of the Lindsey Road extension would be preferred. This may also result in some cost savings over the long term by avoiding the need for remobilization of resources just for the intersection upgrading. It is therefore recommended that upgrading of this intersection be completed at the same time Lindsey Road is extended.

A summary of the recommended timing for the various upgrades is shown in Table 4.5.

TABLE 4.5: TIMING FOR IMPROVEMENTS

| Location | Upgrade | Timing (Traffic Volume) | Alternative Timing |
|---|---|---|---|
| Lindsey Road Extension | New link with minimum 9.2 metres pavement | Deferred to 300 units | Opening Day |
| Nicola Road | Widen to accommodate two-way traffic | Opening Day | Opening Day |
| Lindsey Road (existing) | Widen to minimum 9.2 metres pavement | Opening Day | Opening Day |
| Lindsay Road/Maughan Road | Protected T intersection | 50% development | Opening Day |
| White Road | Widen to minimum 9.2 metres pavement | Opening Day | Not required if Lindsey extension in place on opening day |

# 5.0 CONCLUSIONS

The following are the conclusions and recommendations from this traffic review.

## 5.1 BACKGROUND

- The background traffic analysis shows the study area intersections analyzed will operate within acceptable capacity and at acceptable level of service through to 2031.
- The proposed Oceanview development will consist of 2,702 residential units, up to 80 hotel units, an 18-hole golf course and approximately 215,000 $ft^2$ of commercial space.

## 5.2 SITE TRAFFIC

- The full build-out of Oceanview is expected to be spread over 20 years, with opening year for the development expected to be 2011. Opening day traffic volumes were assumed to be 10% of the build-out level.
- Residents of the development will be split between retirees (29%), primary owners (45%) and recreational users and families (26%).
- The site plan for the development proposes two access points - one via Nicola Road, the other via an extension of Lindsey Road to Maughan Road.
- A previous traffic impact study for the site assessed three options for the extension of Lindsey Road to the west. Based on traffic operations, network connectivity and the impact of site traffic on local roads, extending Lindsey Road to Maughan Road was identified as the preferred option.

- The commercial uses on the site will be used primarily by residents in the development and will only generate a small amount of external traffic.
- Allowing for internal trips, at build-out the site will generate 995 two-way vehicle trips during the weekday a.m. peak hour and 1,185 two-way trips during the p.m. peak hours. Traffic will be primarily outbound in the a.m. peak and inbound in the p.m. peak.
- Majority of the site traffic (up to 85%) is expected to be oriented to the west of the Nanaimo River, with 50% oriented to the City of Nanaimo.

## 5.3 ACCESS VOLUMES

- With the extension of Lindsey Road to Maughan Road, site traffic volumes on Maughan Road south of the new connection point are projected to be approximately 725 veh/h in the a.m. peak hour and 865 veh/h in the p.m. peak hour. The new connector is projected to carry 775 veh/h two-way in the a.m. peak hour and 920 veh/h two-way in the p.m. peak hour.
- With the new connector between Lindsey Road and Maughan Road in place and with the site fully developed, all five existing intersections analyzed in this assessment are predicted to operate with acceptable level of service and within capacity, i.e. at less than 60% of their capacity through to 2031.
- Designing the new connector between Lindsey Road and Maughan Road as two-lane road will be adequate to serve site traffic. The paved section of this road should be a minimum 9.2 metres which will allow for a 1.0 metre paved shoulder on each side. This can be achieved with a 20 metre right-of-way.
- Based on traffic performance and the existing physical restraint in the area, designing the section of Maughan Road between the new connector and Highway 19 as a two lane road is considered adequate.
- The extension of Lindsey Road will require a new intersection to be constructed on Maughan Road. From a construction cost, traffic performance and safety perspective, it is recommended that this be constructed as a 'protected left turn' intersection.

## 5.4 RECOMMENDED IMPROVEMENTS

- Upgrading of Nicola Road to accommodate simultaneous two-way traffic is considered necessary for opening day of the development.
- In conjunction with the opening of Oceanview, the existing Lindsey Road should be upgraded to provide a minimum pavement width of 9.2 metres. This will allow for two 3.6 metre travel lanes and a minimum of 1.0 metre paved shoulder on each side. The paved 1.0 metre shoulder will also serve as a pedestrian/bike refuge for this road. At selected location with steep side slopes, roadside barriers will be required.
- From a traffic capacity perspective, the extension of Lindsey Road is not considered necessary until the site is developed with 300 units.

- If construction of the Lindsey Road extension is deferred, it is recommended that White Road is upgraded to allow for 3.6m lanes in each direction plus at least a 1.0 metre paved shoulder.
- The extension of Lindsey Road will require a new intersection to be constructed on Maughan Road. From a construction cost, traffic performance and safety perspective, it is recommended that this be constructed as a 'protected left turn' intersection.
- While upgrading of the Maughan Road/Lindsey Road intersection is not required until the site is 50% developed, there may be efficiencies in constructing this intersection to its ultimate design in conjunction with the extension of Lindsey Road.

The recommended improvements are illustrated in Exhibit 5.1.

## 6.0 CLOSURE

We trust this report meets your present requirements. Should you have any questions or comments, please contact the undersigned at your convenience.

Yours truly,

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# APPENDIX A

## APPENDIX A EBA'S GENERAL CONDITIONS AND LIMITATIONS OF REPORT

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# APPENDIX B

## APPENDIX B DETAILED ANALYSIS RESULTS

TABLE A1: HOLDEN CORSO ROAD/ WHITE ROAD INTERSECTION _UNSIGNALIZED

| | | Eastbound | | | Westbound | | | Northbound | | | Southbound | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | R | L | T | R | L | T | R | L | T | R |
| 2011 a.m. | v/c | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.0 | 0.14 | 0.14 | 0.14 | 0.00 | 0.04 | 0.04 |
| | delay | 0.0 | 0.7 | 0.7 | 0.2 | 1.5 | 0.0 | 11.5 | 11.5 | 11.5 | 0 | 9.9 | 9.9 |
| | LOS | A | A | A | A | A | A | B | B | B | A | A | A |
| | queue | 0 | 0 | 0 | 1 | 1 | 1 | 4 | 4 | 4 | 0 | 1 | 1 |
| w dev | v/c | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.01 | 0.15 | 0.15 | 0.15 | 0.01 | 0.05 | 0.05 |
| | delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | LOS | A | A | A | A | A | A | B | B | B | A | B | B |
| | queue | 0 | 0 | 0 | 1 | 1 | 0 | 4 | 4 | 4 | 0 | 1 | 1 |
| 2011 p.m. | v/c | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.0 | 0.09 | 0.09 | 0.09 | 0.02 | 0.02 | 0.02 |
| | delay | 0.0 | 0.5 | 0.5 | 0.2 | 5.5 | 5.5 | 10.2 | 10.2 | 10.2 | 9.1 | 9.1 | 9.1 |
| | LOS | A | A | A | A | A | A | B | B | B | A | A | A |
| | queue | 0 | 0 | 0 | 1 | 1 | 1 | 2 | 2 | 2 | 1 | 1 | 1 |
| with dev | v/c | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.02 | 0.11 | 0.11 | 0.11 | 0.03 | 0.03 | 0.03 |
| | delay | 0.5 | 0.5 | 0.5 | 4.9 | 4.9 | 4.9 | 10.5 | 10.5 | 10.5 | 9.5 | 9.5 | 9.5 |
| | LOS | A | A | A | A | A | A | B | B | B | A | A | A |
| | queue | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 3 | 1 | 1 | 1 |
| 2021 a.m. | v/c | 0.01 | 0.01 | 0.01 | 0.03 | 0.03 | 0.0 | 0.22 | 0.22 | 0.22 | 0.00 | 0.06 | 0.06 |
| | delay | 0.1 | 0.7 | 0.7 | 0.2 | 1.6 | 0.0 | 13.5 | 13.5 | 13.5 | 0 | 10.5 | 10.5 |
| | LOS | A | A | A | A | A | A | B | B | B | A | B | B |
| | queue | 0 | 0 | 0 | 1 | 1 | 1 | 7 | 7 | 7 | 0 | 1 | 1 |
| w dev | v/c | 0.01 | 0.01 | 0.01 | 0.03 | 0.03 | 0.01 | 0.31 | 0.31 | 0.31 | 0.14 | 0.14 | 0.14 |
| | delay | 1.0 | 1.0 | 1.0 | 1.6 | 1.6 | | 16.5 | 16.5 | 16.5 | 12.1 | 12.1 | 12.1 |
| | LOS | A | A | A | A | A | A | C | C | C | B | B | B |
| | queue | 0 | 0 | 0 | 1 | 1 | 0 | 10 | 10 | 10 | 4 | 4 | 4 |
| 2021 p.m. | v/c | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.0 | 0.14 | 0.14 | 0.14 | 0.03 | 0.03 | 0.03 |
| | delay | 0.0 | 0.5 | 0.5 | 0.2 | 5.5 | 5.5 | 11.1 | 11.1 | 11.1 | 9.6 | 9.6 | 9.6 |
| | LOS | A | A | A | A | A | A | B | B | B | A | A | A |
| | queue | 0 | 0 | 0 | 1 | 1 | 1 | 4 | 4 | 4 | 1 | 1 | 1 |
| w dev | v/c | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.23 | 0.23 | 0.23 | 0.09 | 0.09 | 0.09 |
| | delay | 0.8 | 0.8 | 0.8 | 3.8 | 3.8 | 3.8 | 13.2 | 13.2 | 13.2 | 11.1 | 11.1 | 11.1 |
| | LOS | A | A | A | A | A | A | B | B | B | B | B | B |
| | queue | 0 | 0 | 0 | 1 | 1 | 1 | 7 | 7 | 7 | 2 | 2 | 2 |

| | | Eastbound | | | Westbound | | | Northbound | | | Southbound | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | R | L | T | R | L | T | R | L | T | R |
| 2031 a.m. | v/c | 0.01 | 0.01 | 0.01 | 0.03 | 0.03 | 0.0 | 0.26 | 0.26 | 0.26 | 0.00 | 0.07 | 0.07 |
| | delay | 0.1 | 0.7 | 0.7 | 0.3 | 1.7 | 0.0 | 14.6 | 14.6 | 14.6 | 0 | 10.7 | 10.7 |
| | LOS | A | A | A | A | A | A | B | B | B | A | B | B |
| | queue | 0 | 0 | 0 | 1 | 1 | 1 | 8 | 8 | 8 | 0 | 2 | 2 |
| w dev | v/c | 0.02 | 0.02 | 0.02 | 0.04 | 0.04 | 0.01 | 0.49 | 0.49 | 0.49 | 0.01 | 0.26 | 0.26 |
| | delay | 1.2 | 1.2 | 1.2 | 1.6 | 1.6 | | 25.1 | 25.1 | 25.1 | | 14.6 | 14.6 |
| | LOS | A | A | A | A | A | A | D | D | D | B | B | B |
| | queue | 0 | 0 | 0 | 1 | 1 | 0 | 20 | 20 | 20 | 0 | 8 | 8 |
| 2031 p.m. | v/c | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.04 | 0.16 | 0.16 | 0.16 | 0.04 | 0.04 | 0.04 |
| | delay | 0.0 | 0.5 | 0.5 | 0.2 | 5.6 | 5.6 | 11.6 | 11.6 | 11.6 | 9.7 | 9.7 | 9.7 |
| | LOS | A | A | A | A | A | A | B | B | B | A | A | A |
| | queue | 0 | 0 | 0 | 1 | 1 | 1 | 4 | 4 | 4 | 1 | 1 | 1 |
| w dev | v/c | 0.02 | 0.02 | 0.02 | 0.03 | 0.03 | 0.03 | 0.39 | 0.39 | 0.39 | 0.18 | 0.18 | 0.18 |
| | delay | 1.0 | 1.0 | 1.0 | 3.2 | 3.2 | 3.2 | 17.8 | 17.8 | 17.8 | 13.1 | 13.1 | 13.1 |
| | LOS | A | A | A | A | A | A | C | C | C | B | B | B |
| | queue | 1 | 1 | 1 | 1 | 1 | 1 | 14 | 14 | 14 | 5 | 5 | 5 |

TABLE A2: MACMILLAN ROAD/ HARMAC ROAD INTERSECTION _UNSIGNALIZED

| | | Eastbound | | | Westbound | | | Northbound | | | Southbound | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | R | L | T | R | L | T | R | L | T | R |
| 2011 a.m. | v/c | | 0.12 | 0.12 | 0.07 | 0.07 | | 0.31 | | 0.31 | | | |
| | delay | | 7.7 | 7.7 | 8.1 | 8.1 | | 9.2 | | 9.2 | | | |
| | LOS | | A | A | A | A | | A | | A | | | |
| | queue | | | | | | | | | | | | |
| w dev | v/c | | 0.12 | 0.12 | 0.07 | 0.07 | | 0.32 | | 0.32 | | | |
| | delay | | 7.8 | 7.8 | 8.1 | 8.1 | | 9.3 | | 9.3 | | | |
| | LOS | | A | A | A | A | | A | | A | | | |
| | queue | | | | | | | | | | | | |
| 2011 p.m. | v/c | | 0.21 | 0.21 | 0.18 | 0.18 | | 0.21 | | 0.21 | | | |
| | delay | | 8.1 | 8.1 | 8.7 | 8.7 | | 8.9 | | 8.9 | | | |
| | LOS | | A | A | A | A | | A | | A | | | |
| | queue | | | | | | | | | | | | |
| with dev | v/c | | 0.22 | 0.22 | 0.19 | 0.19 | | 0.22 | | 0.22 | | | |
| | delay | | 8.2 | 8.2 | 8.7 | 8.7 | | 9.0 | | 9.0 | | | |
| | LOS | | A | A | A | A | | A | | A | | | |
| | queue | | | | | | | | | | | | |
| 2021 a.m. | v/c | | 0.17 | 0.17 | 0.10 | 0.10 | | 0.43 | | 0.43 | | | |

| | | Eastbound | | | Westbound | | | Northbound | | | Southbound | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | R | L | T | R | L | T | R | L | T | R |
| | delay | | 8.3 | 8.3 | 8.6 | 8.6 | | 10.7 | | 10.7 | | | |
| | LOS | | A | A | A | A | | B | | B | | | |
| | queue | | | | | | | | | | | | |
| w dev | v/c | | 0.20 | 0.20 | 0.12 | 0.12 | | 0.48 | | 0.48 | | | |
| | delay | | 8.7 | 8.7 | 8.8 | 8.8 | | 11.7 | | 11.7 | | | |
| | LOS | | A | A | A | A | | B | | B | | | |
| | queue | | | | | | | | | | | | |
| 2021 p.m. | v/c | | 0.30 | 0.30 | 0.26 | 0.26 | | 0.30 | | 0.30 | | | |
| | delay | | 9.0 | 9.0 | 9.6 | 9.6 | | 10.1 | | 10.1 | | | |
| | LOS | | A | A | A | A | | B | | B | | | |
| | queue | | | | | | | | | | | | |
| w dev | v/c | | 0.36 | 0.36 | 0.28 | 0.28 | | 0.35 | | 0.35 | | | |
| | delay | | 9.9 | 9.9 | 10.0 | 10.0 | | 10.8 | | 10.8 | | | |
| | LOS | | A | A | B | B | | B | | B | | | |
| | queue | | | | | | | | | | | | |
| 2031 a.m. | v/c | | 0.19 | 0.19 | 0.11 | 0.11 | | 0.48 | | 0.48 | | | |
| | delay | | 8.6 | 8.6 | 8.8 | 8.8 | | 11.6 | | 11.6 | | | |
| | LOS | | A | A | A | A | | B | | B | | | |
| | queue | | | | | | | | | | | | |
| w dev | v/c | | 0.26 | 0.26 | 0.16 | 0.16 | | 0.59 | | 0.59 | | | |
| | delay | | 9.5 | 9.5 | 9.4 | 9.4 | | 14.4 | | 14.4 | | | |
| | LOS | | A | A | A | A | | B | | B | | | |
| | queue | | | | | | | | | | | | |
| 2031 p.m. | v/c | | 0.34 | 0.34 | 0.29 | 0.29 | | 0.35 | | 0.35 | | | |
| | delay | | 9.6 | 9.6 | 10.1 | 10.1 | | 10.7 | | 10.7 | | | |
| | LOS | | A | A | B | B | | B | | B | | | |
| | queue | | | | | | | | | | | | |
| w dev | v/c | | 0.48 | 0.48 | 0.35 | 0.35 | | 0.45 | | 0.45 | | | |
| | delay | | 12.0 | 12.0 | 11.2 | 11.2 | | 12.7 | | 12.7 | | | |
| | LOS | | B | B | B | B | | B | | B | | | |
| | queue | | | | | | | | | | | | |

| TABLE A3: MACMILLAN ROAD/ CHARTWELL ROAD INTERSECTION _UNSIGNALIZED | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Eastbound | | | Westbound | | | Northbound | | | Southbound | | |
| | | L | T | R | L | T | R | L | T | R | L | T | R |
| 2011 a.m. | v/c | | | | 0.01 | | 0.01 | | 0.15 | 0.15 | 0.0 | 0.05 | |
| | delay | | | | 10.1 | | 10.1 | | 0 | 0 | 7.8 | 0.0 | |
| | LOS | | | | B | | B | | A | A | A | A | |
| | queue | | | | | | | | | | | | |
| w dev | v/c | | | | 0.01 | | 0.01 | | 0.16 | 0.16 | 0.0 | 0.06 | |
| | delay | | | | 10.2 | | 10.2 | | 0.0 | 0.0 | 7.8 | 0.0 | |
| | LOS | | | | B | | B | | A | A | A | A | |
| | queue | | | | | | | | | | | | |
| 2011 p.m. | v/c | | | | 0.01 | | 0.01 | | 0.08 | 0.08 | 0.0 | 0.13 | |
| | delay | | | | 9.8 | | 9.8 | | 0 | 0 | 7.5 | 0.0 | |
| | LOS | | | | A | | A | | A | A | A | A | |
| | queue | | | | | | | | | | | | |
| with dev | v/c | | | | 0.01 | | 0.01 | | 0.08 | 0.08 | 0.0 | 0.14 | |
| | delay | | | | 9.9 | | 9.9 | | 0.0 | 0.0 | 7.5 | 0.0 | |
| | LOS | | | | A | | A | | A | A | A | A | |
| | queue | | | | | | | | | | | | |
| 2021 a.m. | v/c | | | | 0.01 | | 0.01 | | 0.21 | 0.21 | 0.0 | 0.07 | |
| | delay | | | | 10.9 | | 10.9 | | 0 | 0 | 8.0 | 0.0 | |
| | LOS | | | | B | | B | | A | A | A | A | |
| | queue | | | | | | | | | | | | |
| w dev | v/c | | | | 0.01 | | 0.01 | | 0.22 | 0.22 | 0.0 | 0.08 | |
| | delay | | | | 11.3 | | 11.3 | | 0.0 | 0.0 | 8.1 | 0.0 | |
| | LOS | | | | B | | B | | A | A | A | A | |
| | queue | | | | | | | | | | | | |
| 2021 p.m. | v/c | | | | 0.01 | | 0.01 | | 0.11 | 0.11 | 0.0 | 0.18 | |
| | delay | | | | 10.5 | | 10.5 | | 0 | 0 | 7.6 | | |
| | LOS | | | | A | | A | | A | A | A | A | |
| | queue | | | | | | | | | | | | |
| w dev | v/c | | | | 0.01 | | 0.01 | | 0.12 | 0.12 | 0.0 | 0.20 | |
| | delay | | | | 10.8 | | 10.8 | | 0.0 | 0.0 | 7.6 | 0.0 | |
| | LOS | | | | B | | B | | A | A | A | A | |
| | queue | | | | | | | | | | | | |
| 2031 a.m. | v/c | | | | 0.01 | | 0.01 | | 0.23 | 0.23 | 0.0 | 0.08 | |
| | delay | | | | 11.3 | | 11.3 | | 0 | 0 | 8.1 | 0.0 | |
| | LOS | | | | B | | B | | A | A | A | A | |
| | queue | | | | | | | | | | | | |
| w dev | v/c | | | | 0.01 | | 0.01 | | 0.26 | 0.26 | 0.0 | 0.10 | |

| | | Eastbound | | | Westbound | | | Northbound | | | Southbound | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | R | L | T | R | L | T | R | L | T | R |
| | delay | | | | 12.0 | | 12.0 | | 0.0 | 0.0 | 8.2 | 0.0 | |
| | LOS | | | | B | | B | | A | A | A | A | |
| | queue | | | | | | | | | | | | |
| 2031 p.m. | v/c | | | | 0.01 | | 0.01 | | 0.12 | 0.12 | 0.0 | 0.20 | |
| | delay | | | | 10.8 | | 10.8 | | 0 | 0 | 7.6 | 0.0 | |
| | LOS | | | | A | | A | | A | A | A | A | |
| | queue | | | | | | | | | | | | |
| w dev | v/c | | | | 0.01 | | 0.01 | | 0.15 | 0.15 | 0.0 | 0.24 | |
| | delay | | | | 11.5 | | 11.5 | | 0.0 | 0.0 | 7.7 | 0.0 | |
| | LOS | | | | B | | B | | A | A | A | A | |
| | queue | | | | | | | | | | | | |

TABLE A4: HOLDEN CORSO ROAD / MACMILLAN ROAD INTERSECTION _UNSIGNALIZED

| | | Eastbound | | | Westbound | | | Northbound | | | Southbound | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | R | L | T | R | L | T | R | L | T | R |
| 2011 a.m. | v/c | | | | 0.23 | | 0.23 | | 0.10 | 0.10 | 0.03 | 0.03 | |
| | delay | | | | 10.7 | | 10.7 | | 0 | 0 | 0.3 | 3.2 | |
| | LOS | | | | B | | B | | A | A | A | A | |
| | queue | | | | 7 | | 7 | | 0 | 0 | 1 | 1 | |
| w dev | v/c | | | | 0.24 | | 0.24 | | 0.10 | 0.10 | 0.04 | 0.04 | |
| | delay | | | | 10.8 | | 10.8 | | 0.0 | 0.0 | 3.3 | 3.3 | |
| | LOS | | | | B | | B | | A | A | A | A | |
| | queue | | | | 7 | | 7 | | 0 | 0 | 1 | 1 | |
| 2011 p.m. | v/c | | | | 0.20 | | 0.20 | | 0.08 | 0.08 | 0.12 | 0.12 | |
| | delay | | | | 11.3 | | 11.3 | | 0 | 0 | 1.0 | 5.7 | |
| | LOS | | | | B | | B | | A | A | A | A | |
| | queue | | | | 6 | | 6 | | 0 | 0 | 3 | 3 | |
| with dev | v/c | | | | 0.21 | | 0.21 | | 0.08 | 0.08 | 0.12 | 0.12 | |
| | delay | | | | 11.4 | | 11.4 | | 0.0 | 0.0 | 5.7 | 5.7 | |
| | LOS | | | | B | | B | | A | A | A | A | |
| | queue | | | | 6 | | 6 | | 0 | 0 | 3 | 3 | |
| 2021 a.m. | v/c | | | | 0.34 | | 0.34 | | 0.13 | 0.13 | 0.05 | 0.05 | |
| | delay | | | | 12.3 | | 12.3 | | 0 | 0 | 0.04 | 3.4 | |
| | LOS | | | | B | | B | | A | A | A | A | |
| | queue | | | | 12 | | 12 | | 0 | 0 | 1 | 1 | |
| w dev | v/c | | | | 0.41 | | 0.41 | | 0.14 | 0.14 | 0.06 | 0.06 | |
| | delay | | | | 13.3 | | 13.3 | | 0.0 | 0.0 | 3.9 | 3.9 | |
| | LOS | | | | B | | B | | A | A | A | A | |

| | | Eastbound | | | Westbound | | | Northbound | | | Southbound | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | R | L | T | R | L | T | R | L | T | R |
| | queue | | | | 15 | | 15 | | 0 | 0 | 2 | 2 | |
| 2021 p.m. | v/c | | | | 0.32 | | 0.32 | | 0.11 | 0.11 | 0.17 | 0.17 | |
| | delay | | | | 13.7 | | 13.7 | | 0 | 0 | 1.4 | 6.0 | |
| | LOS | | | | B | | B | | A | A | A | A | |
| | queue | | | | 11 | | 11 | | 0 | 0 | 5 | 5 | |
| w dev | v/c | | | | 0.40 | | 0.40 | | 0.11 | 0.11 | 0.19 | 0.19 | |
| | delay | | | | 15.6 | | 15.6 | | 0.0 | 0.0 | 6.3 | 6.3 | |
| | LOS | | | | C | | C | | A | A | A | A | |
| | queue | | | | 15 | | 15 | | 0 | 0 | 5 | 5 | |
| | | | | | | | | | | | | | |
| 2031 a.m. | v/c | | | | 0.39 | | 0.39 | | 0.15 | 0.15 | 0.06 | 0.06 | |
| | delay | | | | 13.2 | | 13.2 | | 0 | 0 | 0.5 | 3.5 | |
| | LOS | | | | B | | B | | A | A | A | A | |
| | queue | | | | 14 | | 14 | | 0 | 0 | 1 | 1 | |
| w dev | v/c | | | | 0.54 | | 0.54 | | 0.16 | 0.16 | 0.08 | 0.08 | |
| | delay | | | | 16.3 | | 16.3 | | 0.0 | 0.0 | 4.3 | 4.3 | |
| | LOS | | | | C | | C | | A | A | A | A | |
| | queue | | | | 25 | | 25 | | 0 | 0 | 2 | 2 | |
| 2031 p.m. | v/c | | | | 0.38 | | 0.38 | | 0.12 | 0.12 | 0.19 | 0.19 | |
| | delay | | | | 15.4 | | 15.4 | | 0 | 0 | 1.7 | 6.2 | |
| | LOS | | | | C | | C | | A | A | A | A | |
| | queue | | | | 14 | | 14 | | 0 | 0 | 5 | 5 | |
| w dev | v/c | | | | 0.58 | | 0.58 | | 0.13 | 0.13 | 0.24 | 0.24 | |
| | delay | | | | 22.3 | | 22.3 | | 0.0 | 0.0 | 6.8 | 6.8 | |
| | LOS | | | | C | | C | | A | A | A | A | |
| | queue | | | | 28 | | 28 | | 0 | 0 | 7 | 7 | |
| | | | | | | | | | | | | | |

TABLE A5: BARNES ROAD / NICOLA ROAD INTERSECTION _UNSIGNALIZED

| | | Eastbound | | | Westbound | | | Northbound | | | Southbound | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | R | L | T | R | L | T | R | L | T | R |
| 2011 a.m. | v/c | 0.00 | 0.03 | | | 0.05 | 0.0 | | | | 0.01 | | 0.01 |
| | delay | 0.0 | 0.0 | | | 0.0 | 0.0 | | | | 8.8 | | 8.8 |
| | LOS | A | A | | | A | A | | | | A | | A |
| | queue | 0 | 0 | | | | | | | | 0 | | 0 |
| w dev | v/c | 0.0 | 0.03 | | | 0.05 | 0.01 | | | | 0.02 | | 0.02 |
| | delay | 7.4 | 0.0 | | | 0.0 | 0.0 | | | | 8.8 | | 8.8 |

| | | Eastbound | | | Westbound | | | Northbound | | | Southbound | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | R | L | T | R | L | T | R | L | T | R |
| | LOS | A | A | | | A | A | | | | A | | A |
| | queue | 0 | 0 | | | 0 | 0 | | | | 1 | | 1 |
| 2011 p.m. | v/c | 0.01 | 0.05 | | | 0.03 | 0.03 | | | | 0.01 | | 0.01 |
| | delay | 7.3 | 0.0 | | | 0.0 | 0.0 | | | | 9.2 | | 9.2 |
| | LOS | A | A | | | A | A | | | | A | | A |
| | queue | 0 | 0 | | | | | | | | 0 | | 0 |
| with dev | v/c | 0.01 | 0.05 | | | 0.03 | 0.03 | | | | 0.01 | | 0.01 |
| | delay | 7.4 | 0.0 | | | 0.0 | 0.0 | | | | 8.9 | | 8.9 |
| | LOS | A | A | | | A | A | | | | A | | A |
| | queue | 0 | 0 | | | 0 | 0 | | | | 0 | | 0 |
| 2021 a.m. | v/c | 0.00 | 0.04 | | | 0.07 | 0.0 | | | | 0.02 | | 0.02 |
| | delay | 0.0 | 0.0 | | | 0.0 | 0.0 | | | | 9.0 | | 9.0 |
| | LOS | A | A | | | A | A | | | | A | | A |
| | queue | 0 | 0 | | | | | | | | 0 | | 0 |
| w dev | v/c | 0.01 | 0.04 | | | 0.07 | 0.01 | | | | 0.06 | | 0.06 |
| | delay | 7.5 | 0.0 | | | 0.0 | 0.0 | | | | 9.1 | | 9.1 |
| | LOS | A | A | | | A | A | | | | A | | A |
| | queue | 0 | 0 | | | 0 | 0 | | | | 1 | | 1 |
| 2021 p.m. | v/c | 0.01 | 0.07 | | | 0.04 | 0.04 | | | | 0.01 | | 0.01 |
| | delay | 7.4 | 0.08 | | | 0.0 | 0.0 | | | | 9.5 | | 9.5 |
| | LOS | A | A | | | A | A | | | | A | | A |
| | queue | 0 | 0 | | | | | | | | 0 | | 0 |
| w dev | v/c | 0.03 | 0.07 | | | 0.04 | 0.04 | | | | 0.04 | | 0.04 |
| | delay | 7.4 | 0.0 | | | 0.0 | 0.0 | | | | 9.1 | | 9.1 |
| | LOS | A | A | | | A | A | | | | A | | A |
| | queue | 1 | 0 | | | 0 | 0 | | | | 1 | | 1 |
| 2031 a.m. | v/c | 0.00 | 0.05 | | | 0.07 | 0.0 | | | | 0.02 | | 0.02 |
| | delay | 0.0 | 0.0 | | | 0.0 | 0.0 | | | | 9.1 | | 9.1 |
| | LOS | A | A | | | A | A | | | | A | | A |
| | queue | 0 | 0 | | | | | | | | 1 | | 1 |
| w dev | v/c | 0.03 | 0.05 | | | 0.07 | 0.01 | | | | 0.10 | | 0.10 |
| | delay | 7.5 | 0.0 | | | 0.0 | 0.0 | | | | 9.4 | | 9.4 |
| | LOS | A | A | | | A | A | | | | A | | A |
| | queue | 1 | 0 | | | 0 | 0 | | | | 3 | | 3 |
| 2031 p.m. | v/c | 0.01 | 0.08 | | | 0.05 | 0.05 | | | | 0.01 | | 0.01 |
| | delay | 7.4 | 0.08 | | | 0.0 | 0.0 | | | | 9.6 | | 9.6 |
| | LOS | A | A | | | A | A | | | | A | | A |
| | queue | 0 | 0 | | | | | | | | 0 | | 0 |
| w dev | v/c | 0.06 | 0.08 | | | 0.05 | 0.05 | | | | 0.07 | | 0.07 |
| | delay | 7.5 | 0.0 | | | 0.0 | 0.0 | | | | 9.2 | | 9.2 |

| | | Eastbound | | | Westbound | | | Northbound | | | Southbound | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | R | L | T | R | L | T | R | L | T | R |
| | LOS | A | A | | | A | A | | | | A | | A |
| | queue | 1 | 0 | | | 0 | 0 | | | | 2 | | 2 |

# APPENDIX C

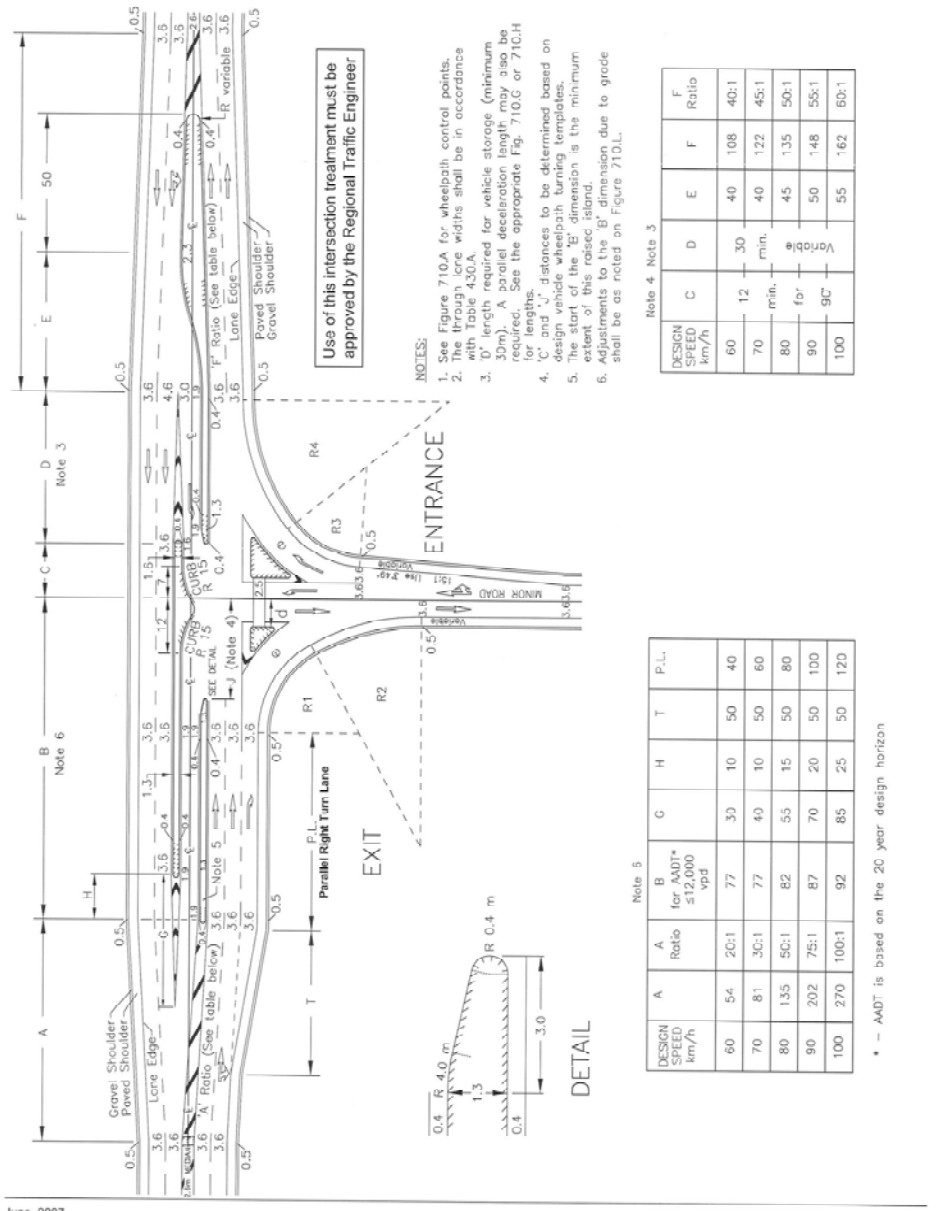
## APPENDIX C PROTECTED LEFT TURN INTERSECTION DIAGRAM

SUPPLEMENT TO TAC GEOMETRIC DESIGN GUIDE **BC MoT**

| MoT Section | 710 | | TAC Section | Not Applicable |
|---|---|---|---|---|

**Figure 710.D.1 Protected Left Turn Intersection (for AADT ≤ 12,000 v.p.d.)**

N.T.S.




| DESIGN SPEED km/h | C | D | E | F | F Ratio |
|---|---|---|---|---|---|
| 60 | 12 min. for 90° | 30 min. Variable | 40 | 108 | 40:1 |
| 70 | | | 40 | 122 | 45:1 |
| 80 | | | 45 | 135 | 50:1 |
| 90 | | | 50 | 148 | 55:1 |
| 100 | | | 55 | 162 | 60:1 |

| DESIGN SPEED km/h | A | A Ratio | B for AADT* ≤12,000 vpd | G | H | T | P.L. |
|---|---|---|---|---|---|---|---|
| 60 | 54 | 20:1 | 77 | 30 | 10 | 50 | 40 |
| 70 | 81 | 30:1 | 77 | 40 | 10 | 50 | 60 |
| 80 | 135 | 50:1 | 82 | 55 | 15 | 50 | 80 |
| 90 | 202 | 75:1 | 87 | 70 | 20 | 50 | 100 |
| 100 | 270 | 100:1 | 92 | 85 | 25 | 50 | 120 |

May 5, 2009 EBA File: V31201024.002

Cable Bay Lands Inc.
400, 7015 Macleod Trail S
Calgary, Alberta T2J 2K6

Email:gbrower@canadianpropertyinvestments.ca

Attention: Mr Glenn Brower
Project Manager

Dear Glenn:

**Subject: Addendum to Traffic Impact Assessment Study Report**
**Oceanview Golf Resort and Spa Development, Nanaimo, BC**

As you are aware, Ward Consulting Group has been retained to provide traffic engineering input to the proposed Ocanview Golf Resort and Spa development in the City of Nanaimo, BC (previously referred to as Cable Bay Lands). Since preparing our updated Traffic Impact Assessment (TIA) for the site, there were a number of revisions to the site plan as well as the land use statistics of the proposed site. For the purpose of the updated TIA report, one set of site plan and development land use was selected and the analyses and the conclusions were referenced to that plan and land use.

At the end of April 2009, while we were finalizing the traffic impact assessment study report, we were advised that the final site plan and the associated land use statistics for submission had been revised since the study started. This addendum was therefore prepared to identify the differences between the currently proposed land use with those used in the TIA as well as the traffic implications from this proposal.

## 1.0 PROPOSED OCEANVIEW GOLF RESORT AND SPA DEVELOPMENT

In the TIA report, the subject site was referred to as "Cable Bay Lands". The adjacent land on the north side of Cable Bay Lands, i.e. the Island Timberland site, was included in the analysis but there was no commitment of development at that time. The site is now named the Oceanview Golf Resort and Spa Development, and the adjacent land to the north is now confirmed to be part of the proposed development.

The current site concept plan is shown in Exhibit 1. A comparison of the development statistics for the current proposal and that used in the TIA is presented in Table 1. The total number of residential units for the current proposal is 3,220 units which is approximately 270 units fewer than used in the TIA. Offsetting this is an increase in the overall commercial/retail floor area, which has increased significantly by 160,000 $ft^2$ to a total of 210,000 $ft^2$.



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The mix of the proposed residential development was assumed to be the same as shown in the TIA report. Similarly access to the site will be via the same three proposed development access routes as reported in the TIA report.

| TABLE 1 : DEVELOPMENT CONCEPT – CURRENT VS TIA | | | |
|---|---|---|---|
| | Previous | Current | Current vs Previous |
| Type of Development | Cable Bay Lands | Adjacent Projects | Difference |
| Residential Units | 3493 units | 3220 units | -273 units |
| Hotel | 120 rooms | 120 rooms | No change |
| Commercial | 50,000ft² | 210,000ft² | -160,000ft² |
| Golf Course | 18 holes | 18 holes | No change |

## 2.0 COMPARISON OF TRAFFIC GENERATION

The traffic generation for the current site plan was estimated using the same assumptions as previously used. Based on the new site plan, at full build-out, the development will generate a total of 1,490 two-way trips in the morning peak hour and 2,630 trips in the afternoon peak hour. Allowing for internal trips that will stay within the subject site; the resultant external trips will be 1,080 and 1,370 two-way trips in the two peak hours respectively, as shown in Table 2.

| TABLE ??: SITE GENERATED TRAFFIC (BASED ON CURRENT DEVELOPMENT STATISTICS) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | AM Peak Hour | | | | PM Peak Hour | | | |
| | Size | Rate | Total | In | Out | Rate | Total | In | Out |
| Retirees | 934 | 0.20 | 187 | 71 | 116 | 0.26 | 243 | 148 | 95 |
| Recreation | 837 | 0.16 | 134 | 90 | 44 | 0.26 | 218 | 89 | 128 |
| Primary Housing | 1,449 | 0.58 | 839 | 183 | 657 | 0.71 | 1033 | 654 | 379 |
| Hotel | 120 rooms | 0.37 | 44 | 32 | 12 | 0.49 | 59 | 25 | 34 |
| Golf Course | 18 holes | 2.22 | 40 | 32 | 8 | 2.74 | 49 | 22 | 28 |
| Commercial | 210,000 ft² | Eq'n | 249 | 152 | 97 | Eq'n | 1025 | 492 | 533 |
| Unadjusted Trips | | | 1493 | 559 | 934 | | 2626 | 1430 | 1196 |
| *Internal Trips* | | | | | | | | | |
| *From residential to golf* | *75%* | | *30* | *24* | *6* | | *37* | *16* | *21* |
| *From golf to residential* | | | *30* | *6* | *24* | | *37* | *21* | *16* |
| *From residential to commercial* | *75%* | | *187* | *114* | *73* | | *603* | *323* | *280* |
| *From commercial to residential* | | | *187* | *73* | *114* | | *603* | *280* | *323* |
| ***External Traffic Build out (2031)*** | | | ***1075*** | ***347*** | ***728*** | | ***1365*** | ***801*** | ***564*** |
| Phase 1 (2011) - 10% | | | 107 | 35 | 73 | | 137 | 80 | 56 |
| Phase 2 (2021) - 50% | | | 537 | 173 | 364 | | 683 | 401 | 282 |

A comparison of trip generation is given in Table 3. The projected generation of the external trips from the current development plan is now **lower** than estimated in the TIA report by 155 trips in the morning peak hour and 90 trips in the afternoon peak hour.

TABLE 3: TRIP GENERATION COMPARISON

| | AM Peak Hour | | | PM Peak Hour | | |
|---|---|---|---|---|---|---|
| | Total | In | Out | Total | In | Out |
| Previous | 1230 | 391 | 839 | 1455 | 870 | 586 |
| Current | 1075 | 347 | 729 | 1365 | 801 | 564 |
| ***Current – Previous*** | ***-155*** | ***-44*** | ***-110*** | ***-91*** | ***-69*** | ***-22*** |

## 3.0 TRAFFIC IMPACTS

The site traffic with the new plan was assigned to the adjacent road network using the same traffic distribution as defined in the TIA study. The projected two-way volumes on key road links are presented in Table 4, along with a comparison with the projected traffic in the TIA report.

TABLE 4: SITE TRAFFIC TWO-WAY VOLUMES (BUILD-OUT) – CURRENT DEVELOPMENT VS TIA REPORT

| | | AM Peak hour | | | PM Peak Hour | | |
|---|---|---|---|---|---|---|---|
| Location | Direction | TIA report | Current | Current - TIA | TIA report | Current | Current - TIA |
| Highway 19 | East of Hwy 1 | 849 | 742 | -107 | 1004 | 942 | -62 |
| MacMillan Rd | South of Harmac Rd | 110 | 96 | -14 | 130 | 122 | -8 |
| | North of Harmac Rd | 47 | 41 | -6 | 55 | 52 | -3 |
| Holden Corso Rd | West of White Rd | 150 | 131 | -19 | 177 | 166 | -11 |
| | East of White Rd | 185 | 161 | -24 | 218 | 205 | -13 |
| White Rd | North of Holden Corso | 88 | 77 | -11 | 130 | 98 | -32 |
| Harmac Rd | West of MacMillan Rd | 187 | 138 | -49 | 186 | 175 | -11 |
| Maughan Rd | South of new access | 896 | 783 | -113 | 1060 | 994 | -66 |
| Lindsey Road | East of White Road | 861 | 752 | -109 | 1019 | 956 | -63 |
| | West of White Road | 773 | 675 | -98 | 914 | 858 | -56 |

On all key links, the projected site traffic volumes with the current development plan are similar or lower than in the TIA with the difference ranging from between 3 and 113 two-way trips. It is therefore concluded that the traffic volumes as used in the analyses in the TIA report represent a more conservative scenario than with the current concept plan for the site.

## 4.0 RECOMMENDED ROAD NETWORK IMPROVEMENTS

As the projected external site traffic with the current development plan is similar or less than that used in the TIA report, the recommendations in the TIA report are still considered valid. The recommended road network improvements are illustrated graphically in Exhibit 2.

Yours truly,

**WARD CONSULTING GROUP**
A Division of EBA Engineering Consultants Ltd.

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# APPENDIX A



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ward consulting group
A DIVISION OF EBA ENGINEERING CONSULTANTS LTD.

**OCEANVIEW GOLF RESORT & SPA, NANAIMO**

**Proposed Site Concept Plan**

**ISSUED FOR USE**

PROJECT NO. V31201024

DATE May 2009

**Exhibit 1**


ward consulting group
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# OCEANVIEW GOLF RESORT & SPA, NANAIMO

## Recommended Road Network Improvements

ISSUED FOR USE

| PROJECT NO. | DATE | |
|---|---|---|
| V31201024 | May 2009 | Exhibit 2 |

October 29, 2009 EBA File: V31201024.002

Cable Bay Oceanside Spa and Resort
400 – 7015 McLeod Trail S.
Calgary, AB T2H 2K6

Attention: Glenn Brower

**Subject: Circulation Comments on Oceanview Master Plan Submission**

Dear Glenn,

We have now reviewed the circulation comments provided by the City of Nanaimo on the latest version of the Master Plan submission for the Oceanside Spa and Resort. Following is our response to various transportation and traffic related issues raised on pages 3, through 6 of the City's letter dated September 24, 2009.

(a) Internal Road Layout: The focus of the traffic impact assessment was on the impact of development traffic on the broader road network, as opposed to a detailed review of the internal roads. As the internal road network is evolving as the overall Master Plan develops, in part in response to comments from various agencies, it would be somewhat counterproductive to undertake a thorough review of the internal roadways. We would anticipate undertaking a more detailed review of the internal roadway layout, including intersection requirements for key roads once an overall plan has been approved. However, given the steep grades across much of the site, this may require localized relaxations from the City's typical road standards that would typically be applied to a more typical urban development.

(b) Duke Point Ferry Traffic: The focus of the traffic impact study was on typical peak hour conditions during the weekday morning and afternoon peak hours. While we acknowledge that there are short surges in traffic when a ferry unloads, this is a relatively infrequent occurrence and may not necessarily occur during the peak times for site traffic.

In establishing the Terms of Reference for the study, no specific request was made to account for the cycles of traffic to and from the ferry. Furthermore our analysis focussed on intersections and road networks away from the Duke Point Highway, where the impact of surges in ferry traffic would be less pronounced. It should also be noted that ferry unloading typically lasts for a short period of 10 to 15 minutes and only occurs once every two hours when a ferry is unloading.



Ward Consulting Group – A Division of EBA Engineering Consultants Ltd.
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1066 West Hastings Street • Vancouver, British Columbia V6E 3X2 • CANADA

While we acknowledge that during that time immediately after a ferry arrives, there may be higher than average traffic volumes, this would be compensated for the periods in between the ferry arrivals where volumes on the highway will be much lower.

(c) Existing Transit Services: The original traffic study for this site was conducted several years ago. It is understood that there have been changes to the transit services since that time. . Currently the Cedar area is served by *Route 7: The Cinnabar/Cedar Loop* route, which operates from the South Parkway Plaza to Cedar at Clifford. This service operates with two buses in the morning peak period and three buses in the afternoon peak period. There is limited evening and weekend service on this route. As noted in our traffic study, we do not believe that the level of existing transit service is sufficient to warrant a reduction in the traffic generation estimates for the Oceanside project.

Further discussion of future transit services to the Oceanside Spa and Resort are covered in Item 5 below.

(d) Internal Road Network/Pedestrian Connectivity: The layout of the internal road network in this site is a challenge due to the steep grades across much of the site. Provision of dedicated pedestrian/bicycle links and trails will help provide more direct connections for non-auto modes, particularly to and from the Village core. The alignment for these pedestrian links is in part governed by the design of the golf course, and, as with the internal roadways, will evolve as the overall concept plan for the site is developed in more detail.

It is noted that in our Traffic Impact Study it as assumed that a high percentage of the traffic generated by the uses on this site would be internal to the site. In order to minimize the impact of this traffic, and promote non-auto use for these trips, it will be important to ensure an attractive pedestrian and trail network is available within the site.

In terms of the trail naming convention, we will defer to others on the team to ensure that the naming conventions in the Master Plan are consistent.

At this stage it is considered premature to determine the specific surface treatments that should be used for the pedestrian links.

(e) Future Transit Services: We have made initial contact with BC Transit to obtain feedback on the likely services that may be provided in the future when the site is developed, and on the need for a formal transit exchange within the Village core. BC Transit has indicated that they do not anticipate a significant level of transit service to be provided to the development, and do not anticipate the need to provide a dedicated transit interchange/transfer station within the site.

To accommodate future transit services, provision should be made within the plan to allow for up to two bus layover points within the village core area. Each of these should have the ability to a standard 40 foot bus. The provision of an off-road exchange to accommodate interchange between buses is not considered appropriate given the expected level of transit ridership at the site.

The timing for introduction of transit service to the area will in part depend on the rate of development. BC Transit staff indicated that transit service to the Village core may be considered when the commercial uses in Village are developed. Transit service would likely be more oriented to employees at the various commercial establishments.

Given the steep grades and the layout of the internal road network, it is unlikely that formal transit service would be provided to the residential areas outside the Village core; however, the operator of the golf course may wish to consider providing a local shuttle bus throughout the development to allow residents to access the golf course without having to drive.

(f) Intersection Performance Criteria: The choice of a threshold point at which intersection performance is considered to be "unacceptable" varies between jurisdictions. In general Level of Service D for any individual movement is considered to be acceptable. It should be noted, that the level of service estimates provided in Table 4.1 represent the level of service for the worst movement at the intersection which is typically the movement from a minor road. Not all vehicles would experience this level of service.

As noted in Table 4,1, several intersections will operate at Level of Service C under the 2031 combined traffic conditions. However, it should be noted that several of these would also operate at LoS C under the background traffic conditions, which includes considerable growth in traffic other than that from the subject development.

With respect to performance of the intersection at Holden Corso Road/McMillan Road, the analysis assumed no change to the existing laning at this intersection, i.e., a single approach lane on all three legs with turning traffic sharing a single lane. The Level of Service C assigned to this intersection is due to traffic making a right turn from Holden Corso Road onto McMillan Road.

Based on the volumes, providing a separate westbound right turn lane would reduce delays at this intersection. While the westbound leg may still operate at Level of Service C, the average delay for westbound vehicles would be improved. It is therefore recommended that in order to improve the performance at this intersection in the long term, consideration could be given to widening the westbound approach to provide two separate lanes, one for left and one for right turning traffic. Based on the volumes, a right turn lane of approximately 30 metres (four vehicles capacity) is considered sufficient to allow right turn traffic to access McMillan Road without being queued behind left turning traffic.

As this intersection will operate at Level of Service C under the background traffic conditions, the Oceanside Spa and Resort could accelerate the time at which this improvement is required.

(g) Roundabout Design: We acknowledge that it is possible to design a roundabout to accommodate large vehicles; however, this would have implications on the overall land

required to construct the roundabout, and would make the overall footprint of the intersection considerably larger than with other traffic controls.

The extent to which drivers adapt to a roundabout will depend in part on whether users regular travelers or visitors to the area. In this particular case, it is likely that the majority of the travelers using this roundabout would be regular commuters. As such they are likely to be more familiar with correct roundabout etiquette.

Acknowledging that a roundabout could be designed to accommodate large trucks, and that over time driver familiarity with roundabout operations may not be an issue, provision of a roundabout to control traffic flow at Maughan Road/Lindsey Road would be limited by cost and right-of-way requirements, as noted by the City.

(h) Design Standards For Local Roads: Our report identifies what we consider to be the minimum width for various roads in the area. We acknowledge that providing wider shoulders to support pedestrians and cyclists would be desirable. We also concur that all other design criteria should conform with the *Geometric Design Guide for Canadian Roads*.

(i) Extension of Lindsey Road: In all of the traffic work conducted for this development we have consistently recommended the need to ensure a second access route is available for the site. From strictly a traffic volume and intersection capacity perspective, we have indicated a second access route should be in place after the development reaches 300 units.

We understand that a second access route would provide opportunities to support other site servicing requirements. It is therefore likely that the Lindsey Road extension would be in place in advance of any development on the site.

I trust that this provides adequate response to the items raised by the City. We look forward to continuing to work with the Project Team to develop a satisfactory internal road network and access plan for the site that will enable the project to move forward.

Yours truly,

**WARD CONSULTING GROUP**
A Division of EBA Engineering Consultants Ltd.

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Sr. Traffic/Transportation Engineer
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# APPENDIX D - RECOMMENDED TREE SPECIES

## CABLE BAY RESORT - RECOMMENDED TREE SPECIES April 27, 2009

The following is the recommended typical tree species palette for use throughout the areas of Oceanview Resort (medium – large varieties of genus).

**Deciduous Material:**

| | |
|---|---|
| Maple varieties | (Acer sp.) |
| Horse Chestnut | (Aesculus sp.) |
| Red Alder | (Alnus Rubra sp.) |
| Pacific Madrone | (Arbutus Menziesii sp.) |
| Hornbeam varieties | (Carpinusu sp.) |
| Hawthorn varieties | (Crataegu sp.) |
| Beech varieties | (Fagus sp.) |
| Ash varieties | (Fraxinus sp.) |
| Honey Locust | (Gleditsia sp.) |
| Sweet Gum | (Styraciflua.sp) |
| Tulip Tree | (Liriodendron sp.) |
| London Plane | (Platanus sp.) |
| Poplar/Aspen | (Populus sp.) |
| Flowering Cherry varieties | (Prunus sp.) |
| Garry Oak | (Quercus Garviana sp.) |
| Oak varieties | (Quercus sp.) |
| Linden species | (Tillan sp.) |

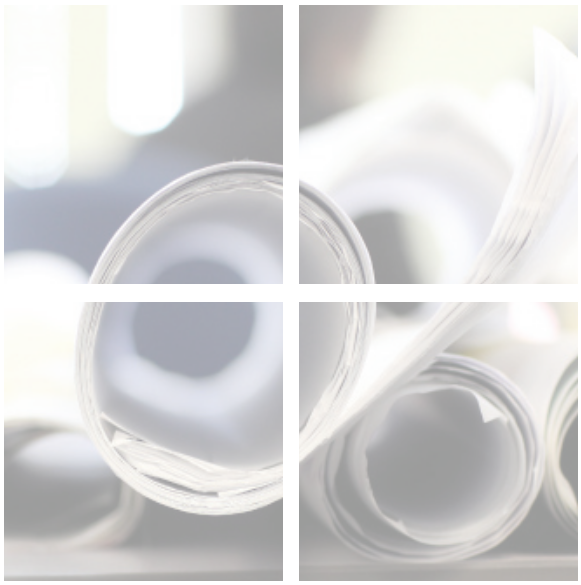
**Coniferous Material:**

| | |
|---|---|
| Spruce varieties | (Abies sp.) |
| Cedar varieties | (Cedrus sp.) |
| Pine varieties | (Pinus sp.) |
| Douglas Fir | (Pseudotsuga Menziesii sp.) |
| Western Red Cedar | (Thuja Plicata sp.) |
| Western Hemlock | (Tsuga Heterophylla sp.) |

Recommended tree species for golf course natural open space and reclamation areas

Recommend tree species for areas of significant urban development and individual residential lot landscaping

**Note:** Avoid use of thorny plants with large seed pods or fruit bearing trees in proximity to pathways.



# APPENDIX E - ENGINEERING DRAWINGS


## GRADE LEGEND

- ROAD GRADE AT 0–3%
- ROAD GRADE AT 3–6%
- ROAD GRADE AT 6–9%
- ROAD GRADE AT 9–12%
- ROAD GRADE AT 12–14%

| Rev. No. | DATE | BY | REVISION DESCRIPTION | ENGR |
|---|---|---|---|---|
| 01 | 07/15/09 | dp | UPDATED DEVELOPMENT LAYOUT | MIW |
| 02 | 08/05/09 | dp | UPDATED DEVELOPMENT LAYOUT | MIW |
| 03 | 09/30/09 | dp | REVISED ROAD PROFILE GRADES | MIW |
| 04 | 10/15/09 | dp | UPDATED DEVELOPMENT LAYOUT | MIW |
| 05 | 10/29/09 | dp | UPDATED DEVELOPMENT LAYOUT | MIW |

### LEGEND

| PROP. | EXIST. | PROP. | EXIST. |
|---|---|---|---|
| WATERMAIN | | HYDRANT | |
| STORM SEWER | | ABOVE GROUND FLUSHOUT | |
| SANITARY SEWER | | BELOW GROUND FLUSHOUT | |
| GAS MAIN | | CATCHBASIN | |
| ELECTRICAL DUCT | | MANHOLE | |
| CULVERT & DITCH | | CLEANOUT | |
| DITCH INLET/OUTLET | | HYDRO POLE | |
| SWALE | | CAP | |
| EDGE OF PAVEMENT | | PLUG | |
| VALVE BOX | | STREETLIGHT | |
| LIMIT OF CONSTRUCTION | | FENCE | |

SITE LEGAL DESCRIPTION

BENCHMARK DESCRIPTION

ENGINEER'S SEAL

HORIZONTAL SCALE: 1:5000

VERTICAL SCALE:

DESIGN: MIW

DRAWN: dp

CHECKED:

PLOT DATE: 10-29-09

PRINT DATE:

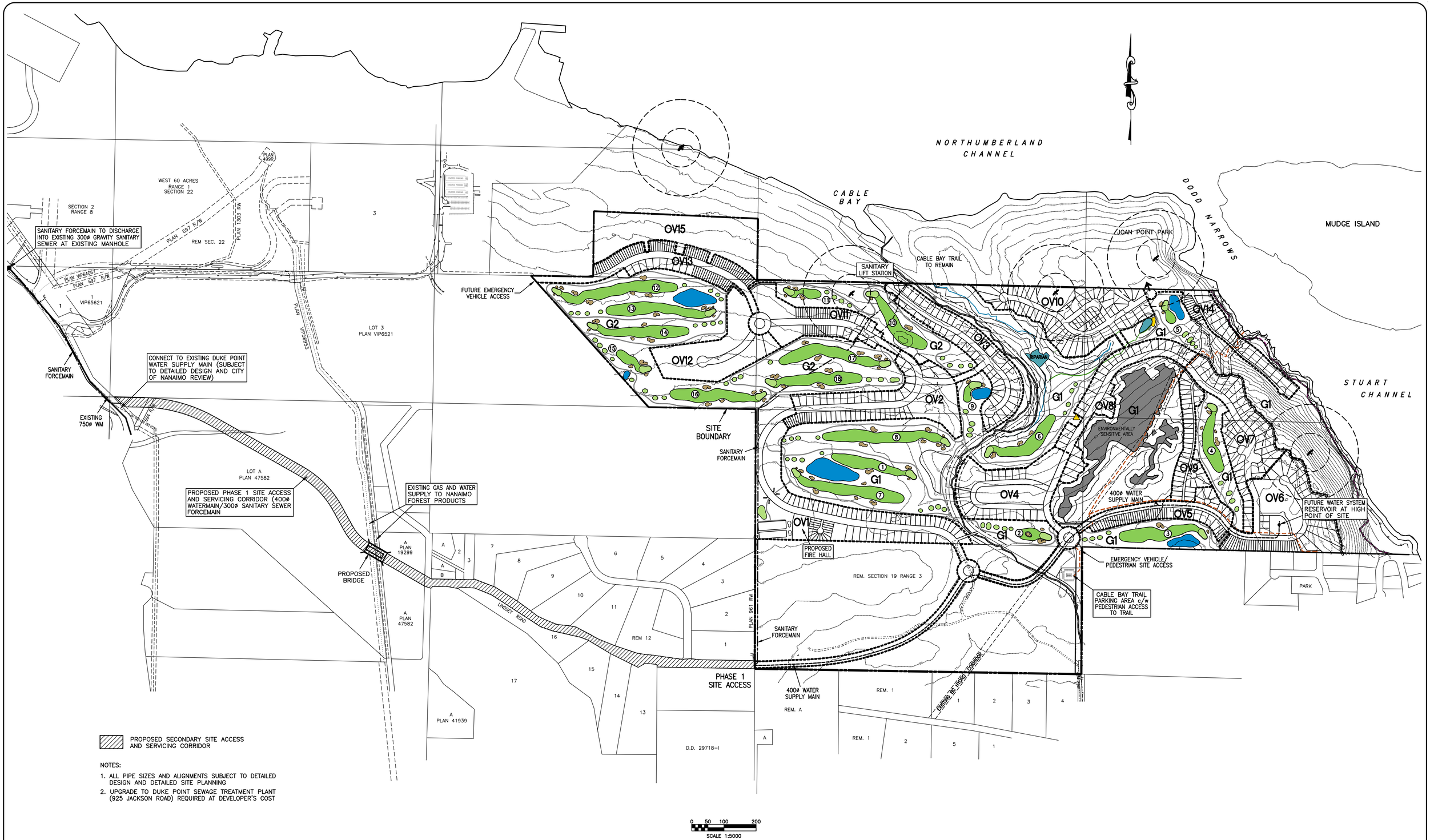
CLIENT NAME: OCEANVIEW GOLF RESORT & SPA LTD.

PROJECT NAME: OCEANVIEW GOLF RESORT & SPA

# ROAD GRADIENT ANALYSIS PLAN

NEWCASTLE ENGINEERING LTD.

| PROJECT TYPE | CLIENT No. | PROJECT No. | DRAWING No. | REVISION No. | CITY PLAN FILE No. |
|---|---|---|---|---|---|
| L | 608 | 02 | RAP | 05 | |




PROPOSED SECONDARY SITE ACCESS AND SERVICING CORRIDOR

NOTES:

1. ALL PIPE SIZES AND ALIGNMENTS SUBJECT TO DETAILED DESIGN AND DETAILED SITE PLANNING
2. UPGRADE TO DUKE POINT SEWAGE TREATMENT PLANT (925 JACKSON ROAD) REQUIRED AT DEVELOPER'S COST

0 50 100 200
SCALE 1:5000

| Rev. No. | DATE | BY | REVISION DESCRIPTION | ENGR |
|---|---|---|---|---|
| 01 | 11/07/08 | dp | CITY OF NANAIMO REVIEW COMMENTS ADDRESSED | MIW |
| 02 | 01/07/08 | dp | UPDATED PHASE 1 LOT LAYOUT | MIW |
| 03 | 08/08/08 | dp | SITE LAYOUT AMENDED | MIW |
| 04 | 12/05/08 | dp | SITE LAYOUT AMENDED | MIW |
| 05 | 02/02/09 | dp | ADDED PHEONIX WAY SITE ACCESS | MIW |
| 06 | 02/19/09 | dp | SITE LAYOUT AMENDED | MIW |
| 07 | 03/25/09 | dp | SITE LAYOUT AMENDED | MIW |
| 08 | 04/28/09 | dp | SITE LAYOUT AMENDED | MIW |
| 09 | 07/17/09 | dp | UPDATED DEVELOPMENT LAYOUT | MIW |
| 10 | 08/05/09 | dp | UPDATED DEVELOPMENT LAYOUT | MIW |
| 11 | 08/05/09 | dp | UPDATED DEVELOPMENT LAYOUT | MIW |

LEGEND

| PROP. | EXIST. | | PROP. | EXIST. |
|---|---|---|---|---|
| WATERMAIN | | | HYDRANT | |
| STORM SEWER | | | ABOVE GROUND FLUSHOUT | |
| SANITARY SEWER | | | BELOW GROUND FLUSHOUT | |
| GAS MAIN | | | CATCHBASIN | |
| ELECTRICAL DUCT | | | MANHOLE | |
| CULVERT & DITCH | | | CLEANOUT | |
| DITCH INLET/OUTLET | | | HYDRO POLE | |
| SWALE | | | CAP | |
| EDGE OF PAVEMENT | | | PLUG | |
| VALVE BOX | | | STREETLIGHT | |
| LIMIT OF CONSTRUCTION | | | FENCE | |

SITE LEGAL DESCRIPTION

BENCHMARK DESCRIPTION

ENGINEER'S SEAL

HORIZONTAL SCALE: 1:5000

VERTICAL SCALE:

DESIGN: MIW
DRAWN: dp
CHECKED:
PLOT DATE: 10-29-09
PRINT DATE:

CLIENT NAME: OCEANVIEW GOLF RESORT & SPA LTD.

PROJECT NAME: OCEANVIEW GOLF RESORT & SPA

DRAWING TITLE: SCHEMATIC SITE SERVICING AND ACCESS PLAN

NEWCASTLE ENGINEERING LTD.

| PROJECT TYPE | CLIENT No. | PROJECT No. | DRAWING No. | REVISION No. | CITY PLAN FILE No. |
|---|---|---|---|---|---|
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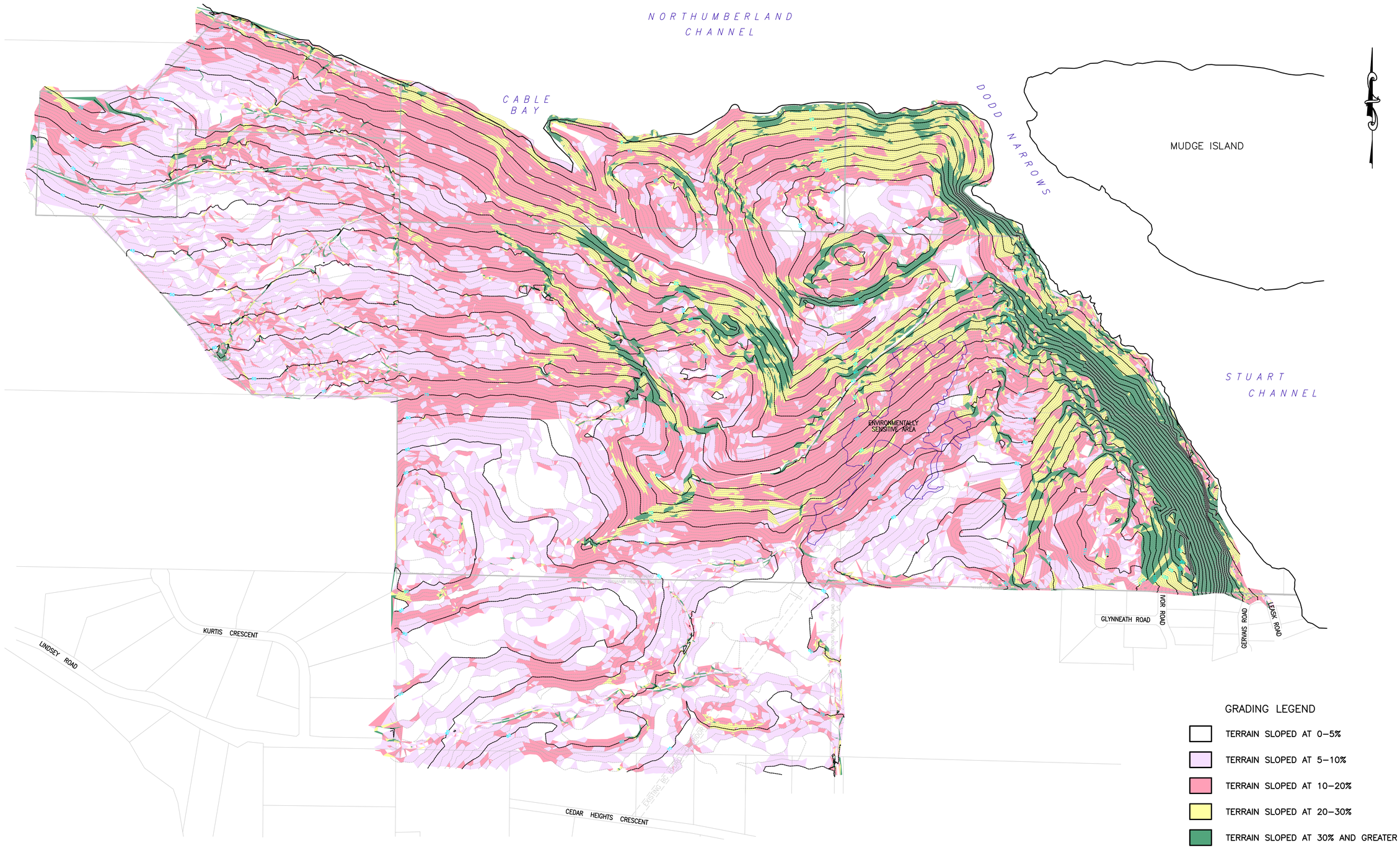


GRADING LEGEND

- TERRAIN SLOPED AT 0–5%
- TERRAIN SLOPED AT 5–10%
- TERRAIN SLOPED AT 10–20%
- TERRAIN SLOPED AT 20–30%
- TERRAIN SLOPED AT 30% AND GREATER

| Rev. No. | DATE | BY | REVISION DESCRIPTION | ENGR |
|---|---|---|---|---|
| | | | | |

LEGEND

| PROP. | EXIST. | PROP. | EXIST. |
|---|---|---|---|
| WATERMAIN | | HYDRANT | |
| STORM SEWER | | ABOVE GROUND FLUSHOUT | |
| SANITARY SEWER | | BELOW GROUND FLUSHOUT | |
| GAS MAIN | | CATCHBASIN | |
| ELECTRICAL DUCT | | MANHOLE | |
| CULVERT & DITCH | | CLEANOUT | |
| DITCH INLET/OUTLET | | HYDRO POLE | |
| SWALE | | CAP | |
| EDGE OF PAVEMENT | | PLUG | |
| VALVE BOX | | STREETLIGHT | |
| LIMIT OF CONSTRUCTION | | FENCE | |

SITE LEGAL DESCRIPTION

BENCHMARK DESCRIPTION

ENGINEER'S SEAL

HORIZONTAL SCALE: 1:5000

VERTICAL SCALE:

DESIGN

DRAWN: dp

CHECKED: dh

PLOT DATE: 04–30–09

PRINT DATE:

CLIENT NAME: OCEANVIEW GOLF RESORT & SPA LTD.

PROJECT NAME: OCEANVIEW GOLF RESORT & SPA

# TERRAIN ANALYSIS PLAN

NEWCASTLE ENGINEERING LTD.

| PROJECT TYPE | CLIENT No. | PROJECT No. | DRAWING No. | REVISION No. | CITY PLAN FILE No. |
|---|---|---|---|---|---|
| L | 608 | 02 | TAP | 00 | |

**Lewkowich Engineering Associates Ltd.**
geotechnical • health, safety & environmental • materials testing

File: G4406.05
October 7, 2009

Oceanview Golf Resort and Spa Ltd.
400 - 7015 MacLeod Trail SW
Calgary, Alberta
T2H 2K6



Attention: Mr. Glen Brower

**PROJECT: OCEANVIEW GOLF RESORT AND SPA LTD. PHOENIX WAY, NANAIMO, B.C.**

**SUBJECT: GEOTECHNICAL FEASIBILITY OF PROPOSED RESIDENTIAL LOTS ALONG ROAD "V" (NORTH-EAST CORNER OF DEVELOPMENT AREA)**

**REFERENCE: LEWKOWICH ENGINEERING ASSOCIATES LTD., PRELIMINARY GEOTECHNICAL ASSESSMENT, FILE: G4406.04, APRIL 27, 2009**

Dear Mr. Brower:

1. As you requested, Lewkowich Engineering Associates Ltd. has considered the geotechnical feasibility of development for a series of eight single family residential lots, and associated roadway, within a portion of the Oceanview Golf Resort and Spa on Phoenix Way in Nanaimo, B.C. This work is additional to the referenced report, which addressed the overall development as shown on associated referenced drawings. The lots addressed here represent the easternmost eight lots (plus *cul de sac* alignment) along Road "H" as shown on Newcastle Engineering Ltd. drawing "sk6" dated October 2, 2009.

2. These lots were not shown on the drawing that was appended to the referenced report. However, that report included a comment that referred to a slope gradient of 30 percent that was used to determine geotechnical feasibility at this site. As shown on cross sections located on Newcastle Engineering Ltd. Plan sk6, that inclination essentially represents the upper boundary of slope for the area incorporating the subject lots.

3. Factors that we have taken into account in our assessment have included rock type, strength, intensity and orientation of discontinuities (joints and bedding), and slope inclination. It should be noted that some local modification as to the extent of a potential development area can be achieved through site preparation methodology, such as retaining wall construction, rock pinning and bolting, and other measures. While some such localized preparation should be expected for these lots, we generally consider ground slopes to be adequately mild as to provide "safe" siting for both the lots and road. The scope of required retaining walls, lot grading and/or other prescriptive measures are best addressed at the time of detailed subdivision design. However, for current purposes, it is our opinion that the proposed lots are geotechnically safe and suitable for the intended purpose of supporting residential structures. This conclusion takes into account a level of risk of ten percent in fifty years for natural hazard, except for seismic hazard where we have taken into account a level of risk of two percent in fifty years.

4. Lewkowich Engineering Associates Ltd. appreciates the opportunity to be of service on this project. If you have any comments, or if we can be of further service, please contact us at your convenience.

Respectfully Submitted,
Lewkowich Engineering Associates Ltd.

G.F. Lewkowich, P.Eng.
Principal

cc: Newcastle Engineering Ltd., Attn: Mr. Mark Warbrick, P.Eng.