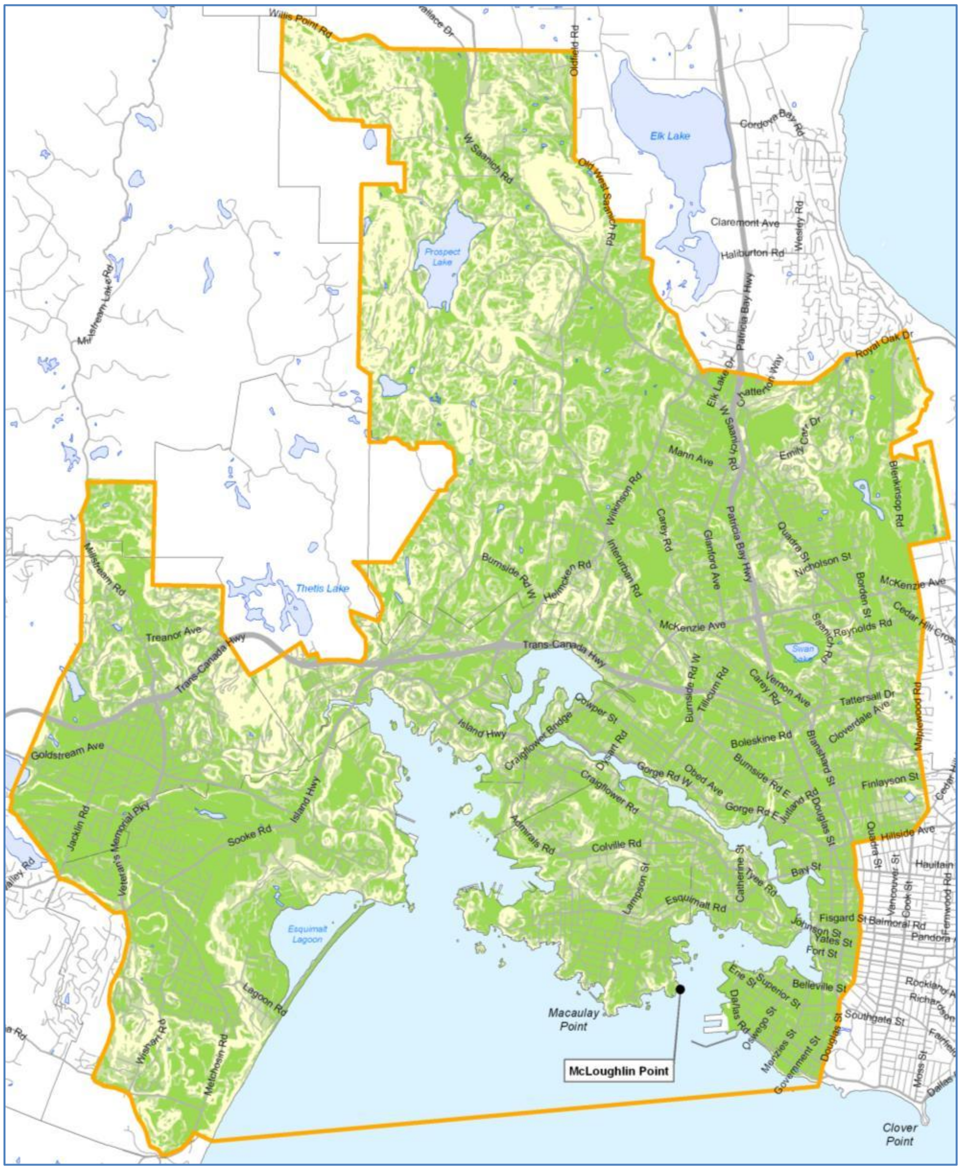
Land suitability for a biosolids facility in the Core Area of the Capital Regional District



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September 2010

WESTLAND RESOURCE GROUP

SUMMARY

The purpose of this report is to identify suitable areas for a biosolids facility in the core area of the Capital Regional District (CRD) as part of the Core Area Wastewater Treatment Program. A biosolids facility will be needed to process sludge produced at the McLoughlin Point wastewater treatment facility. The biosolids facility will use thermophilic anaerobic digesters to produce pathogen-free biosolids.

The sludge from the McLoughlin Point will be conveyed via a pipeline to the biosolids facility. Gas recovered during the anaerobic digestion of the sludge will be injected into the region's natural gas distribution system. The biosolids will be dried and shipped by barge or truck for use as fuel elsewhere.

The biosolids facility will require at least 2 ha of land. The facility will consist of several buildings and four large tanks, mainly above ground. The anaerobic digester tanks will be entirely enclosed.

The following steps were taken in identifying areas suitable for a biosolids facility in the core area.

- A set of site selection criteria was developed, based on factors considered important in siting a biosolids facility.
- Plans, reports, past CRD studies, and spatial data were collected and reviewed by CRD consultants and staff.
- Land suitability was rated for each siting criterion and maps prepared, showing the results.
- The siting criteria maps were overlaid using a Geographical Information System (GIS) spatial analysis to produce a single map that identifies areas having suitable characteristics for a biosolids facility.

Section 2 of this report presents the methods and suitability maps for each siting criterion. Section 3 presents the results of the combined suitability analysis.

The information contained in this report is intended to aid in selecting candidate sites for further study. This analysis provides a reconnaissance level investigation and should not be construed as identifying specific sites for facilities. These results need to be considered in combination with other important siting factors, such as the ability to acquire the land (described in Section 3) and compatibility with adjacent land uses. Section 4 recommends further steps to identify and acquire a suitable site.

Table of contents

Tables

Figures

1.0 INTRODUCTION

In 2007, the Capital Regional District (CRD) began technical siting investigations for wastewater treatment facilities as part of the Core Area Wastewater Treatment Program. A biosolids facility is needed to treat the sludge produced at the proposed McLoughlin Point Wastewater Treatment Facility, located in the Township of Esquimalt. In January 2010, the northern portion of the CRD-owned Hartland Landfill property in the District of Saanich was identified as a location for a biosolids facility. The estimated cost of the pipeline and pump stations to convey the sludge to the 18 km from McLoughlin Point to the Hartland site is $40 million. In an effort to reduce the cost of the conveyance system between the facilities, the CRD is seeking suitable sites that are closer to McLoughlin Point than the Hartland Landfill site.

This report outlines land investigations conducted to find suitable areas for locating a biosolids facility, including siting requirements, study methods, and results of the analysis. Following this Section 1 Introduction, Section 2 includes a series of suitability maps for the study area based on specified siting criteria. Section 3 presents an overlay analysis map that identifies areas that may warrant further consideration. The combined overlay analysis map in Section 3 identifies areas that may warrant further consideration. The report provides coarse, high level results and should not be construed as identifying specific sites for biosolids facilities.

1.1 Project description

The biosolids facility will use thermophilic anaerobic digesters to produce pathogen-free Class A[1] biosolids. The biosolids produced by the digester process will be dewatered to achieve 25% to 30% solids concentration before being dried to 95% solids content. The dried biosolids will be shipped in trucks (or possibly barged) for beneficial re-use.

A parcel 2 ha or larger is needed to accommodate the biosolids facility. The biosolids facility will consist of a series of buildings less than 8 m high (except for the digester tanks, which may be as high as 14 m above grade). The structures to be built on the site include:

- biosolids screening,
- a thermophilic anaerobic digestion complex,
- an energy and heat extraction building for biosolids management,
- a sludge dewatering building,
- thermal drying,

[1] Class A biosolids contain no detectible levels of pathogens and low levels of metals contents (SYLVIS 2008).

- an unenclosed receiving station for fats, oils, and grease (FOGs) and organic waste,
- an operations building,
- gas flaring units,
- phosphorus recovery facilities,
- odour control facilities, and
- a biogas treatment and scrubbing facility (not an enclosed building).

Processing the sludge generated by wastewater treatment will provide opportunities for beneficial use by:

- co-digesting sewage sludge combined with fats, oils, and grease (FOGs, from restaurants) using thermophilic anaerobic digestion to stabilize and reduce solids, kill pathogens, and generate methane gas (biogas) for use onsite or offsite in the natural gas distribution system,
- drying the digested sludge and selling the resulting biosolids as a fuel for cement kilns, paper mills, or other energy facilities, and
- extracting struvite (phosphate) from the digested sludge and using it as a fertilizer (Stantec 2009a).

Figure 1 shows preliminary facility footprint for the biosolids facility at the CRD-owned Hartland North site included in *Liquid Waste Management Plan (LWMP) Amendment #8*. The facility layout may change if a different site is selected. Detailed facility design will begin following site selection and continue through the spring of 2012. Facility construction is expected to begin in September 2012 and will be completed by September 2015.

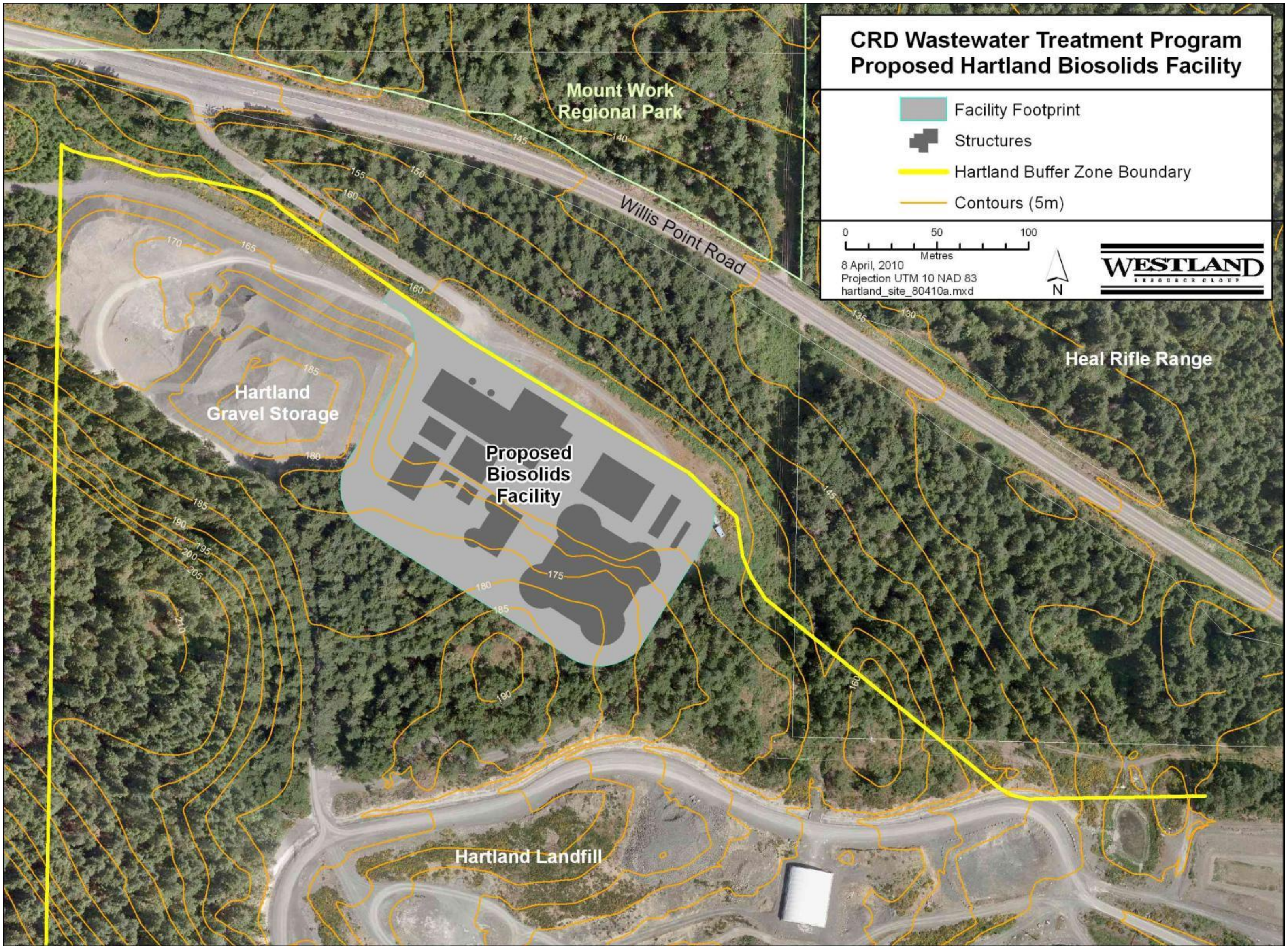


Figure 1. Conceptual layout of biosolids facility

1.2 Selecting the study area

The area included in the siting study is shown in Figure 2. The main purpose of the study is to identify suitable areas for the anaerobic digester facility that are closer to the McLoughlin Point liquids treatment facility than the Hartland North site. Initially, any area south of the Hartland North site in the Capital Region was to be sought. The radius line in Figure 2 shows all areas less than 14 km from McLoughlin Point. Upon further consideration, however, portions of the core area municipalities where a facility would not be located were excluded from the study area. Such areas include:

- large natural parks and protected areas,
- densely urbanized portions of the core area where previous studies indicated that it is unlikely that a suitable two-hectare site could be located, and
- very high elevation and distant areas that would require considerable pumping and pipes, thereby increasing project costs and potential disruption of neighbourhoods during construction.

Excluding the foregoing areas from further examination resulted in the study area boundary shown in Figure 3. The southern portion of the study area has benefited from data collection and analysis conducted during previous phases of the CRD wastewater project (Westland July 2009 and September 2009). The area roughly north of McKenzie Avenue required collection of new information to support this siting study.

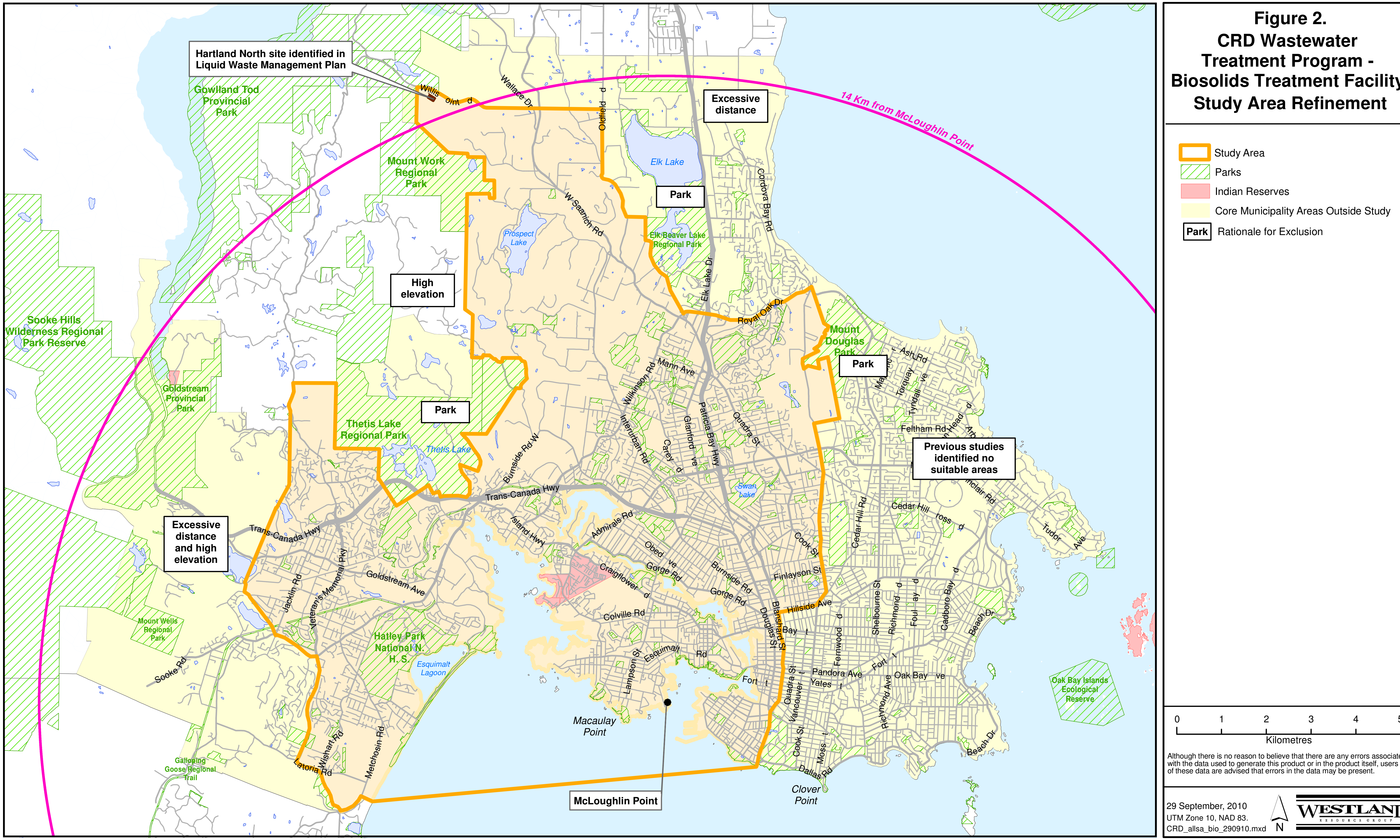
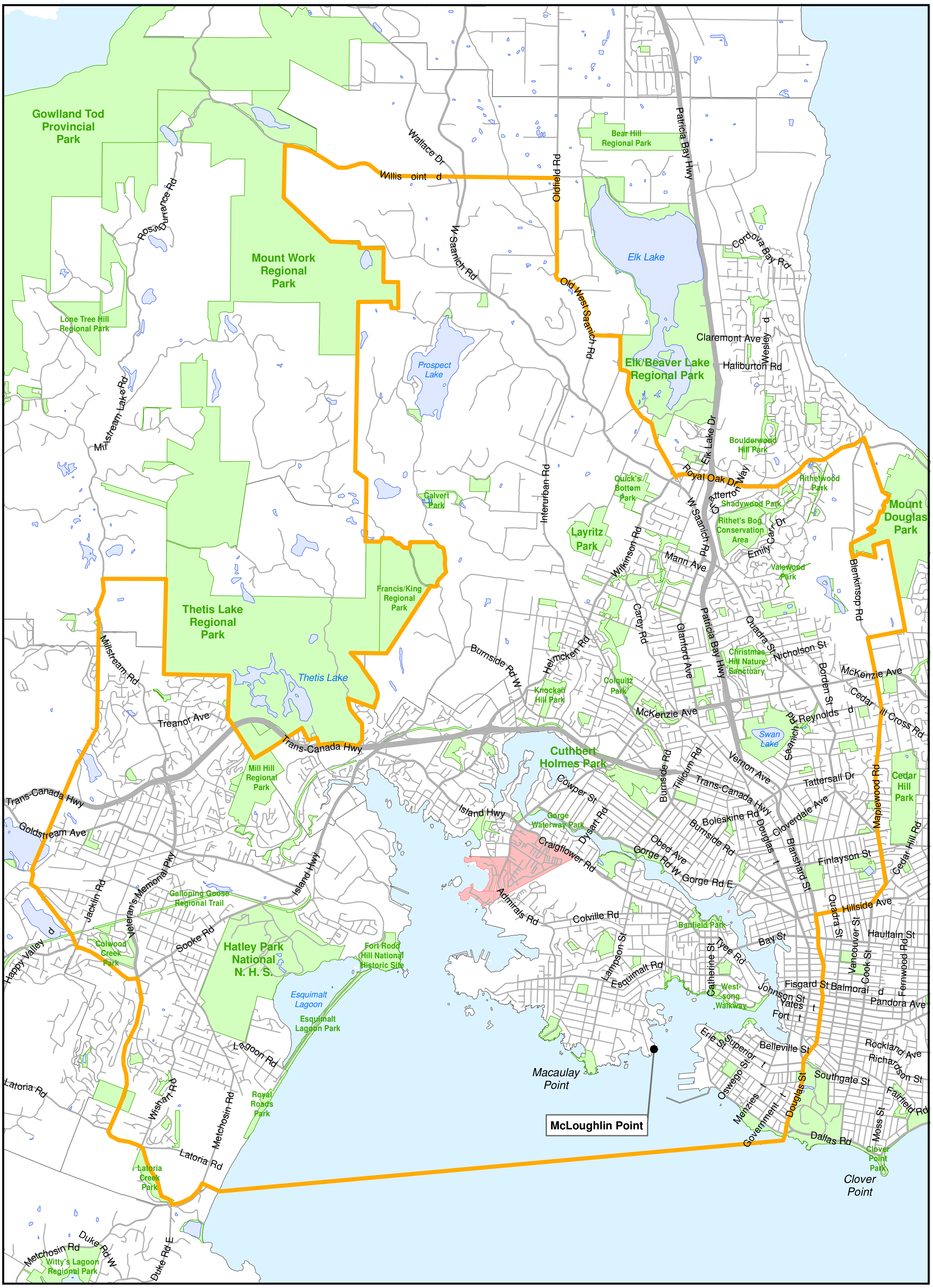


Figure 2. Study area boundary refinement



CRD Wastewater Treatment Program - Biosolids Treatment Facility	Study Area	
	Parks	0 1 2 3 4 Kilometres
	Indian Reserves	Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.
	Study Area	21 September, 2010 UTM Zone 10, NAD 83. CRD_sa_bio_210910.mxd
	= 2 hectare parcel	WESTLAND RESOURCE GROUP INC.

Figure 3. Study area

2.0 CRITERIA-BASED ANALYSIS

This section of the report presents the methods and results of the land investigations for a biosolids facility in the core area.

As discussed in the foregoing section, a study area was defined to include lands closer to McLoughlin Point than the current proposed Hartland North location and excluded large natural parks and protected areas and densely urbanized areas examined during previous investigations.

Next, a set of siting criteria was developed to identify areas for a biosolids facility that are technically, socially, and environmentally suitable. CRD staff worked with the consulting team to develop the criteria. Table 1 presents the site selection criteria for the biosolids facility.

Table 1. Site selection criteria for the biosolids facility

Topic	Criteria	Rationale
Conveyance	Elevation	Lower elevation areas, requiring less pumping, conserving energy, and reducing capital and operating costs
Land use	Land use compatibility	Areas where existing and planned land uses are compatible with facility operations and are not sensitive to nuisance effects
Biology	Ecological Integrity	Areas where facilities would avoid adverse effects on sensitive or important habitat
Geotechnical	Construction conditions	Suitability of the surficial soils, site drainage, and levels of seismic and liquefaction risk that could affect facility construction and operation
	Slope stability	The stability of slopes for facility construction and operation
	Slope steepness	Suitability of slopes for facility construction
Access	Suitability for barge landing	Physical suitability of shorelines and compatibility of backshore land use for barging facilities
	Proximity to truck routes	Linear distance to the nearest municipally-designated truck route
Archaeology and heritage	Archaeology and heritage features	Likelihood of encountering archaeological or heritage features

The siting criteria reflect technical, economic, social, and environmental factors that are important in selecting sites. The criteria are based on technical expertise, public engagement information, experience gained in previous siting studies, and political direction.

- The elevation criterion identifies lower elevation areas where the amount of pumping between the McLoughlin Point and biosolids facilities.
- The land use compatibility criterion identifies areas where the operation of a biosolids facility would be compatible with existing and planned land uses.
- The ecological integrity criterion identifies sensitive or important ecosystems.
- The geotechnical criteria identify areas where soils or slopes could affect the construction and operation of a biosolids facility.
- The suitability for barge landing criterion identifies shoreline areas that may be suitable to construct a barge landing to transport dried biosolids by barge instead of by truck.
- The proximity to truck routes criterion identifies areas near designated truck routes that would limit the distance trucks travel on local roads.
- The archaeology and heritage criterion identifies areas that have or may have archaeological or heritage features.

Maps were prepared showing the suitability of land according to each siting criterion. Areas that were highly suitable for a biosolids facility received a high rating and areas that were less suitable received a lower rating. The siting criteria maps were then electronically overlaid to create an overall rating for lands in the study area. This final step in the analysis is presented in Section 3.

The study area only includes areas that are closer to the proposed McLoughlin Point wastewater facility than the Hartland North site, the site presently identified in the CRD's *Liquid Waste Management Plan* for the biosolids facility. Proximity to McLoughlin Point cannot be used at this stage of the selection process, because specific areas first need to be identified. After candidate sites are specified during future stages of the siting study, the length of pipes needed to reach those locations can be calculated.

The following sections describe the methods and the results of the analysis of lands in the study area.

2.1 Elevation

Methods

Lower elevation areas require less pumping, thereby conserving energy and reducing capital and operating costs. A CRD Digital Elevation Model dataset (2007) was used to calculate the elevation of areas in the study area. This dataset has a 1 m resolution.

Table 2 provides definitions for the rating categories used in the analysis. Areas with an elevation below 20 m above sea level (ASL) were rated “3” (high suitability for a biosolids facility). Areas between 20 m and 40 m ASL were rated “2” (moderate suitability). Areas that were higher than 40 m ASL were rated “1” (low suitability).

Table 2. Definitions related to elevation

Elevation	Site suitability rating	Definition
Below 20 m	High score: 3	The area has an elevation less than 20 m.
20 m to 40 m	Moderate score: 2	The area has an elevation between 20 m and 40 m.
Above 40 m	Low score: 1	The area has an elevation above 40 m.

Results

Figure 4 shows areas that have a suitable elevation to reduce pumping requirements. The following areas were identified as at suitable elevations:

- coastlines (Esquimalt Harbour, Esquimalt Lagoon, Victoria Harbour, Gorge Waterway, Portage Inlet),
- View Royal along Trans-Canada Highway and Portage Inlet,
- Interurban Road and northern portion of Carey Road,
- Esquimalt,
- Burnside-Gorge area,
- James Bay,
- Downtown Victoria,
- Swan Lake, and
- Vic West.

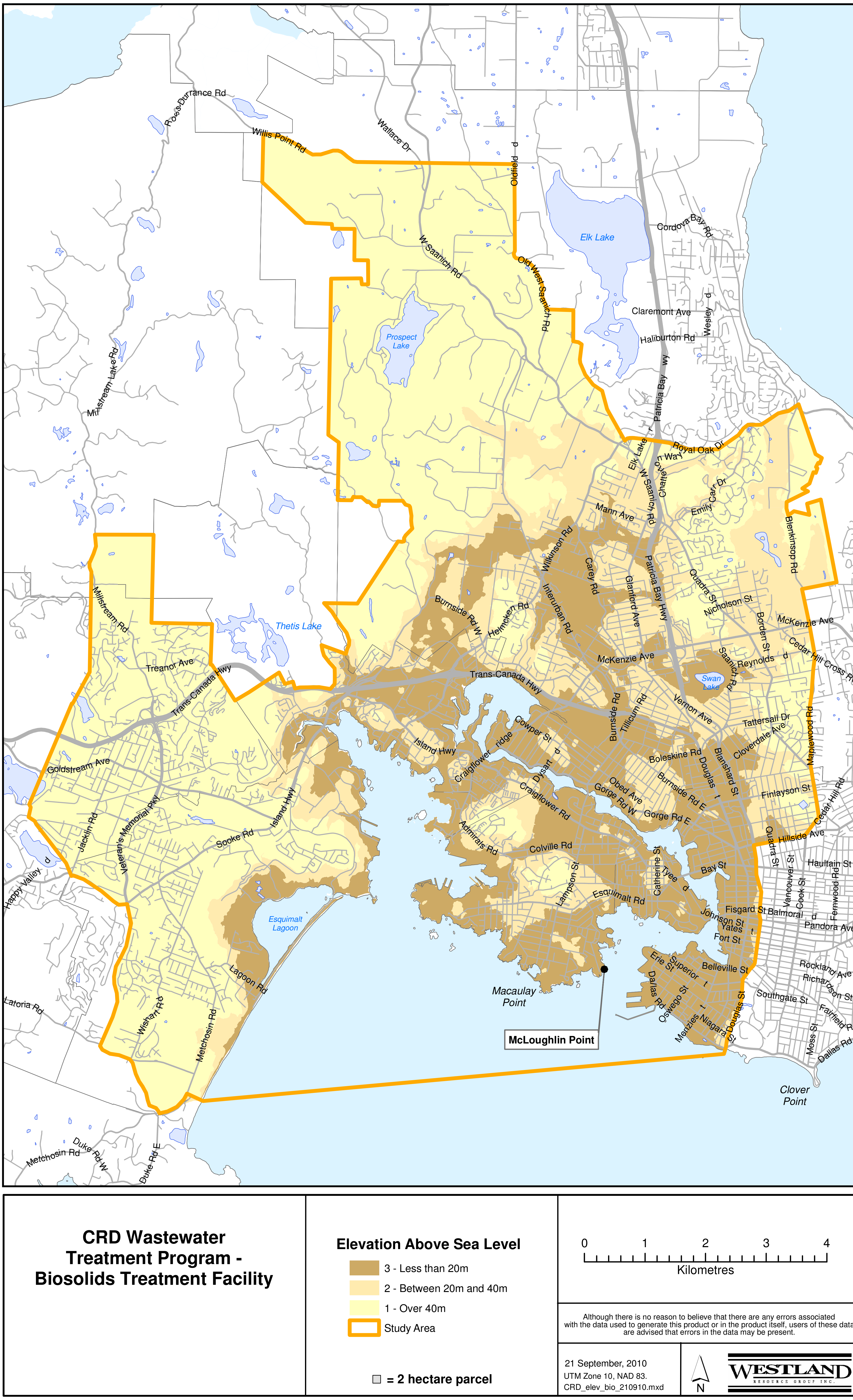


Figure 4. Elevation

2.2 Land use compatibility

Methods

The land use compatibility assessment involves a series of tasks to identify the planned land uses in the study area so that the compatibility of the land uses with the operation of the biosolids facility can be determined. The land use information in this study builds on a previous CRD study, *Projecting Energy Demand for the Core Municipalities 2020 and 2065* (Westland 2008). The land use information is based on municipal Official Community Plans (OCPs), which identify future land use. Key steps conducted for this biosolids facility study include:

1. **Review *Projecting Energy Demand for the Core Municipalities 2020 and 2065* dataset.** The dataset developed for the 2008 energy demand study involved a series of steps to understand projected growth patterns and land use change for the seven Core municipalities (City of Colwood, City of Langford, City of Victoria, District of Saanich, District of Oak Bay, Township of Esquimalt, and Town of View Royal). These steps included:

    a. Gather and review Official Community Plans for the seven core municipalities. The plans used for the study included:

        - City of Colwood Draft OCP, April 17, 2008
        - City of Langford Final Draft OCP, April 17, 2008
        - City of Victoria, 1995, OCP map last updated September 26, 2005
        - District of Saanich OCP, July 2008
        - District of Oak Bay OCP, Consolidated to June 11, 2007
        - Township of Esquimalt OCP, March 19, 2007
        - Town of View Royal OCP, Consolidated to November, 2007

    b. Develop uniform land use classifications for the study area, reclassifying 71 distinct land use classes from the seven OCPs into 27 land use categories relevant to the CRD study.

    c. Review ortho photos to remove inconsistencies and inaccuracies from the reclassified land use categories.

    d. Prepare maps of reclassified Core Area land uses.

2. **Identify significant revisions in Core Area OCPs since 2008.** The study team reviewed the OCPs posted on each of the Core municipalities' websites to determine if the documents have changed since 2008 (when the land use database was developed). The City of Victoria and Town of View Royal are currently undertaking OCP reviews, but revised OCP information is not yet available. In 2008, draft versions of Colwood's

and Langford's OCP data were used. The database was updated in 2010 to reflect changes between the 2008 draft OCPs and the final versions released in 2009.

3. **Revise future land use areas.** Relatively large parcels of vacant land were identified in some municipalities. OCPs provide general statements about the future of these areas, but in most cases future land uses are subject to change. These vacant parcels are identified as Future Development Areas (FDAs) for this siting assessment.

4. **Develop and assign compatibility ratings.** Each land use category was assigned a rating that reflects the compatibility of the land use with operation of a biosolids facility. The rationale for the ratings is presented in Table 3.

In assessing the land use compatibility of various sites, the following assumptions were made:

- Most of the facility will be located above ground.
- Surrounding land use was not examined in identifying land use compatibility at this stage of the assessment, aside from residential land uses.
- This study focussed on the effects of operation of a biosolids facility, rather than construction. The activities associated with building the biosolids facility would have an adverse effect on most land uses, but those impacts would be namely short-term. Operations impacts are longer term and, therefore, formed the primary considerations in facility siting.
- The land use compatibility assessment is based on generalized land uses drawn from OCPs. Further assessment is needed to determine the compatibility of specific land parcels.

Table 3 presents the land use compatibility ratings and a rationale for the land use compatibility ratings applied for this siting assessment.

Table 3. Land use compatibility ratings

Land Use Category	Land Use Compatibility Rating	Rationale
Business or light industry centre	2	This land use category includes a mix of light manufacturing and service commercial activities and a variety of architectural forms. A biosolids facility may be compatible with the function of the area.
Future development area	3	Future land uses in these areas are not specifically defined. Most of these sites are vacant, and could support the operation of a biosolids facility.
Industry-utility	3	A biosolids facility is considered compatible with industrial and utility land uses.
Institutional	1	A biosolids facility would be aesthetically and functionally incompatible with institutional uses such as schools, universities, and churches.
Military	2	Military lands contain a mix of land uses, including fuel tanks, material storage, and open space. A biosolids facility could be compatible with some uses of military lands.
Mixed Use Centre	2	These areas are identified as supporting employment opportunities. A mix of land use exists, some of which may be compatible with a biosolids facility.
Parks	1	The presence of a built structure such as a biosolids facility is not compatible with the intended use of a dedicated natural park or recreation area.
Neighbourhood Centre	1	Neighbourhood centres are intended to be the focal point of the local community. The location of a biosolids facility in these areas would not be consistent with the intended land use form and function.
Residential	1	Operation of a biosolids facility would not be functionally compatible with a residential neighbourhood.
Retail Commercial	2	Operation of a biosolids facility would not be compatible with pedestrian-oriented retail areas, but a facility could be compatible with automobile–oriented malls and "big box" style development.
Rural	2	Rural lands support agricultural operations, hobby farms, and large land holdings. A biosolids facility could be compatible with existing land uses.
Urban Centre	1	Urban centres are intended to be the business, residential, cultural, and retail hub of the community. A biosolids facility would not be compatible with the intended land use form and function of urban centres.

Results

The results of the mapping exercise identified the following categories of land use that are considered to have moderate to high compatibility with a biosolids facility (Figure 5).

Military land: The Department of National Defense (DND) land holdings in the study area may offer opportunities to site a biosolids facility, though securing rights to federal land poses a challenge.

Industrial areas: Industrial areas in Langford, Esquimalt, Victoria, and Saanich provide opportunities for siting a biosolids facility based on the form and type of development that exists or is planned.

Mixed use centre: The diverse land uses in mixed use centres may allow for a biosolids facility, depending on the location and design of the facility.

Future Development Areas: These undeveloped or underdeveloped areas offer opportunities for a biosolids facility to be integrated with future land uses.

Rural lands: The range of land uses in rural areas may offer opportunities for siting a biosolids facility in select locations. Large lots and existing screening could be used to ensure the facility is compatible with the landscape. Associated infrastructure such as greenhouses could be built nearby to use the gas from the biosolids facility.

Business or light industry centre: Light industrial areas support a variety of business types from light manufacturing to services. A carefully designed and operated biosolids facility could be compatible with these uses.

Retail commercial: Operation of a biosolids facility would not be compatible with pedestrian-oriented retail areas, but a facility could be compatible with automobile-oriented malls and "big box" style development.

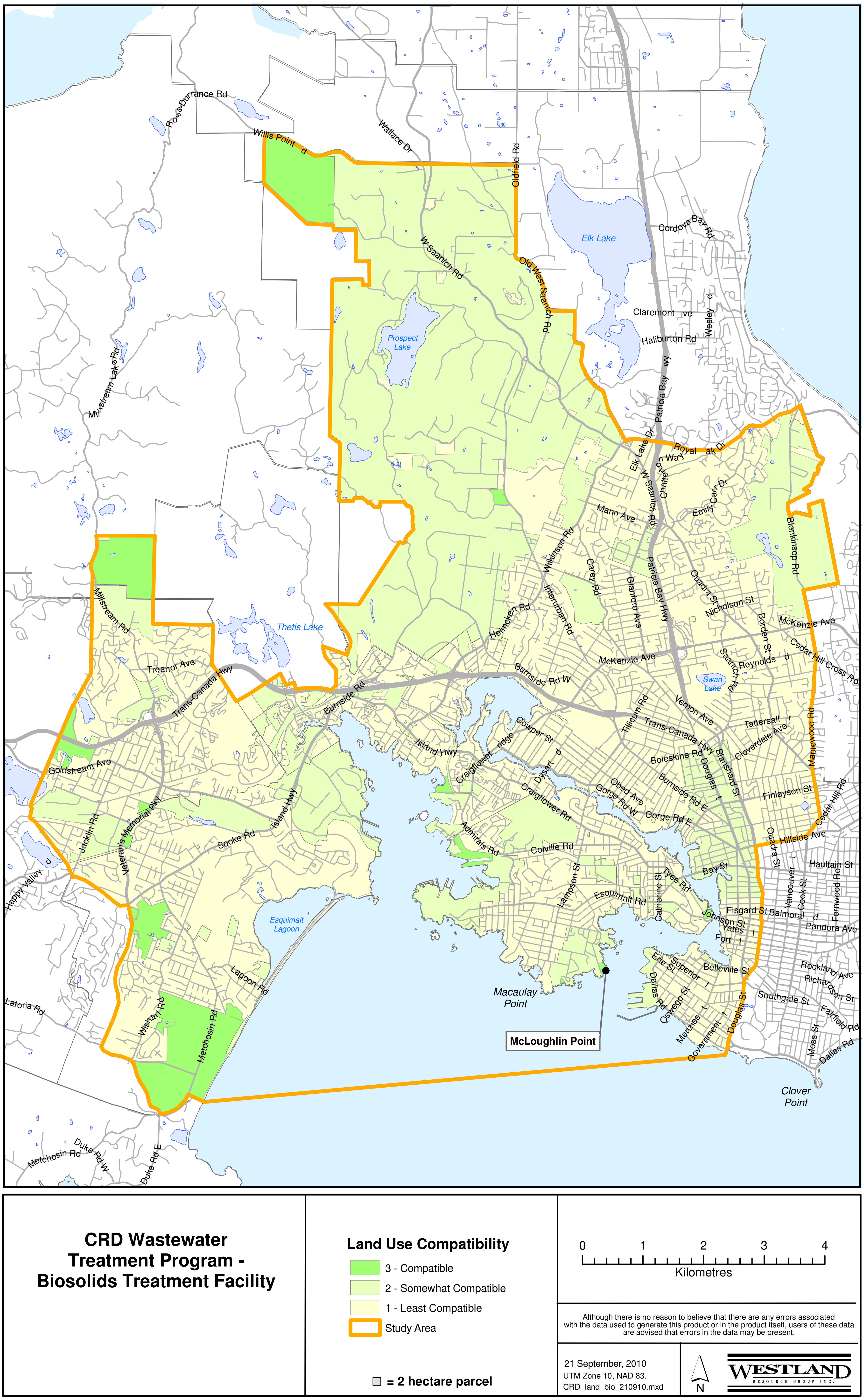


Figure 5. Land use compatibility

2.3 Suitability for barge landing

Barges may be used for transporting dried biosolids from the digester facility to Greater Vancouver. The cement kilns in Greater Vancouver can burn the biosolids as a coal substitute, improving the wastewater management project's carbon footprint.

This section of the study examines the potential suitability of coastal areas for landing barges and loading the dried biosolids.

Methods

This study represents a reconnaissance-level assessment of coastal conditions that would allow barges to safely land, load, and depart. The study also considers accessibility of backshore areas for delivery of biosolids by truck. Data used to conduct the study include:

- The Capital Regional District Harbours Atlas and Natural Areas Atlas,
- review of orthophotos of relevant coastal and harbour areas, and
- consultant familiarity with conditions prevailing in the coastal zone.

Field inspection of specific barge landing areas was not conducted. Such detailed field assessment of potential areas is considered necessary during future steps in the site selection process.

The following factors were considered in determining the suitability of coastal areas for barging:

1. **Foreshore and backshore types**. The CRD Harbours Atlas identifies the substrates and physical characteristics of foreshore and backshore units. For example, mobile beach sediments (such as at Coburg Peninsula at Esquimalt Lagoon) or estuarine areas (such as at the head of Esquimalt Harbour) are considered poorly suited to barge landing. Consolidated soils and stable rock materials are considered more suitable.

2. **Adjacent land uses**. Land uses adjacent to coastal segments were considered in light of their suitability for accommodating truck traffic and barge loading. For instance, industrial land uses were considered highly suitable for this use, whereas residential areas were not.

3. **Access potential**. The ability of trucks to access the shoreline was considered in general terms. Steep backshore areas were considered poorly suited to barge loading, whereas areas with more moderate backshore slopes were considered highly suitable. Nearby road access also was considered an important determinant of suitability.

Only areas below (southeast of) the Selkirk trestle were considered in Victoria harbour, because barge traffic above the trestle would be constrained by trestle configuration and water depth. Otherwise, all areas of Victoria and Esquimalt harbours were considered, as were outer shore areas of the project study area. Ecological sensitivity was excluded from the barge landing rating because that variable is examined in the "ecological integrity" criterion described elsewhere in this report.

Additional variables that could affect suitability for barge landing should be considered at future stages of the project. For instance, marine conditions (such as water depth and effects of fetch) were not included. This information was not readily available at a usable scale, but should be considered before decisions are made on barge landings.

Land ownership was not directly considered as part of this review, although backshore land uses are sometimes a surrogate indicator of ownership. For example, military backshore uses are a good indicator of the presence of DND-owned land. Ownership is an important consideration in acquiring barge landing rights. Ownership is mapped in the section of this study dealing with the ability to acquire a site.

The following assumptions were made in the review of barge landing suitability:

- Elaborate docking facilities would not be needed, because barges can be loaded directly from the shore if appropriate conditions prevail. Existing docks or easily-upgraded docks could be used for biosolids loading.
- Dried biosolids would be delivered by truck. If the biosolids processing facility is located near to shore, it may be possible to transport the biosolids to the barge by conveyor, but such a circumstance was not considered in determining shore suitability for barge landing.

The following three ratings were assigned in determining suitability of the coastal zone for barge landing (Table 4).

Table 4. Definitions related to suitability for barge landing

Rating	Suitability	Rationale
1	Low	Areas considered not suitable because of poor physical conditions or backshore land uses that are not compatible with barge access and loading. Coastal morphology such as the mobile Coburg Peninsula, estuaries, and fragile headlands are considered unsuitable. Residential backshores and highly urbanized locations (such as downtown Victoria) are considered low suitability.
2	Moderate or unknown potential suitability	Some areas may have barge loading potential but additional information is required. Such areas include portions of Esquimalt harbour controlled by First Nations, or where future backshore land uses are unknown.
3	Potentially suitable	Areas with potential suitability for barge loading include: • areas where barges are presently landed, • docks and marine service foreshore areas (excluding marinas for pleasure crafts), and • locations with vacant backshores that could accommodate barge landings. A variety of areas have good potential, including portions of Victoria's outer harbour, near Rock Bay and Point Hope Shipyard, the City of Victoria works yard, DND Esquimalt (on east and west sides of Esquimalt Harbour), near the graving dock, vacant land on the View Royal-Esquimalt boundary, and near the Leheigh gravel pit in Colwood.

Further field investigations and contacts with property owners are required before confirming the suitability and availability of areas for barge landing.

Results

Figure 6 shows areas that may be suitable for a barge landing facility. Based on the reconnaissance level review of shoreline suitability, the areas with the highest potential suitability for barge landing are either:

- Locations where barges presently land or where they are known to have landed in the recent past,
- Areas of the shoreline developed for wharves or similar boat landing facilities, or
- Locations where the shoreline has appropriate topography and backshore land use that would permit development of a barge landing facility without serious environmental or community consequences.

Most of the areas deemed to have high suitability for barge landing are in Esquimalt and Victoria harbours. In Esquimalt harbour, many of the coastal areas deemed to have high suitability are on

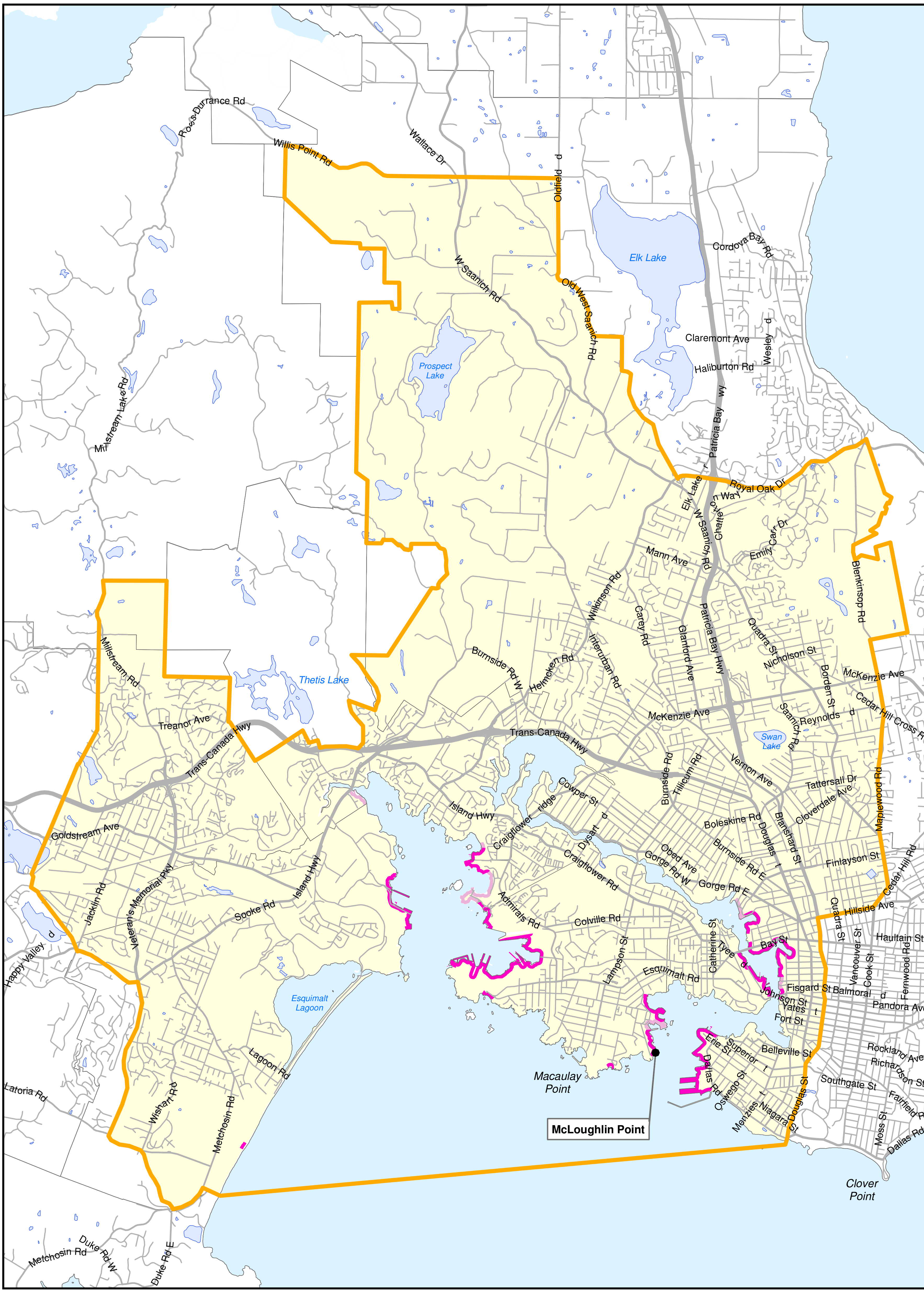
DND land, so arrangements would need to be made with the federal government for such use. In Victoria harbour, industrialized portions of the outer harbour (Ogden Point and adjacent areas to the north, McLoughlin Point and adjacent areas to the north) and industrial portions of the inner harbour near Bay Street have the highest potential for barge landing.

A single location east of Metchosin Road in Colwood also was identified as having high potential. This area, part of the Lehigh gravel operation, was used for decades for loading gravel onto barges.

Small areas of shoreline having moderate suitability for barge landing were identified in Esquimalt and Victoria harbours. These areas have physical characteristics that would (or could) be suitable for barge landing, but environmental or backshore conditions require further study. These areas include lands controlled by the Songhees and Esquimalt First Nations in Esquimalt Harbour and an area near the mouth of the Millstream Creek in View Royal. In Victoria Harbour, areas near the foot of Fisgard Street, near Jutland Road, and near the Work Point barracks marina in Esquimalt may merit further consideration.

Other parts of the shoreline are deemed to have low potential for barge landing. These areas have geomorphologic or topographic conditions or access constraints that would preclude their use for barge landing. More detailed investigations could, however, identify additional locations having moderate or high suitability.

If barge transport of biosolids is pursued, more detailed investigation of the suitability and feasibility of coastal areas should be conducted.



CRD Wastewater Treatment Program - Biosolids Treatment Facility

Suitability for Barge Landing

- 3 - High
- 2 - Moderate
- 1 - Low
- Study Area

□ = 2 hectare parcel

0 1 2 3 4
Kilometres

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

21 September, 2010
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Figure 6. Suitability for barge landing

2.4 Proximity to truck routes

Methods

This criterion is the linear distance to the nearest municipally-designated truck route calculated using ArcGIS Spatial Analyst Geographical Information Systems (GIS) package. Areas that are closer to a truck route would require less truck travel on local roads and are therefore considered more suitable for a biosolids facility. A dataset of truck routes that are designated in municipal OCPs was provided by the CRD. A buffer analysis was performed to identify and rate areas based on their proximity to the nearest designated truck route.

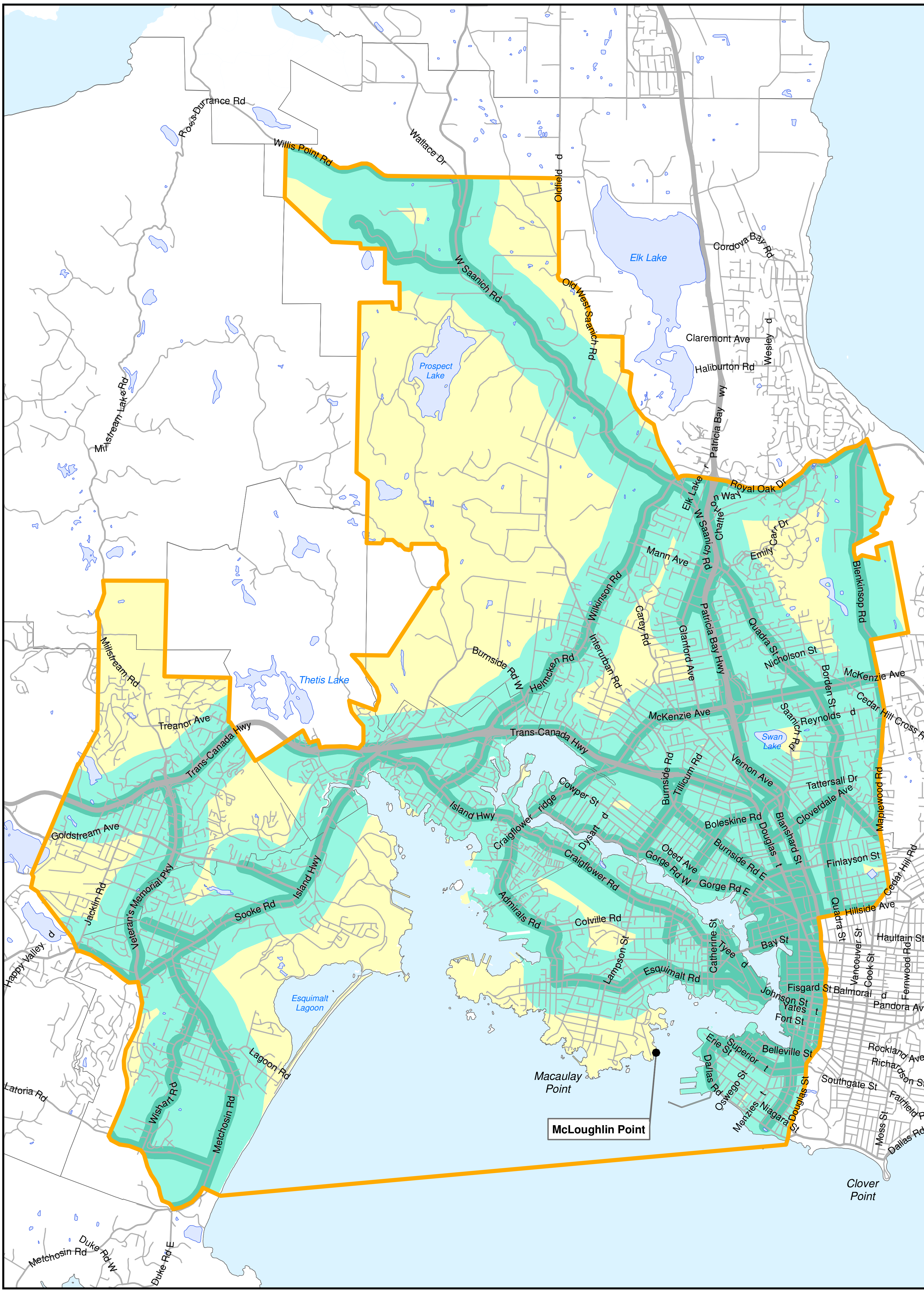
Table 5 explains the metrics used to rate the proximity to truck routes. Areas that are within 100 m of a municipally designated truck route are rated "3" (highly suitable for a biosolids facility). Areas between 100 m and 500 m from a truck route are rated "2" (moderately suitable), and areas further than 500 m from a truck route are rated "1" (low suitability).

Table 5. Definitions related to proximity to truck routes

Proximity to truck route	Site suitability rating	Definition
Less than 100 m	High score: 3	The area is within 100 m of a truck route.
100 m to 500 m	Moderate score: 2	The area is between 100 m and 500 m from a truck route.
More than 500 m	Low score: 1	The area is more than 500 m from a truck route.

Results

Figure 7 shows the proximity of areas to truck routes. Much of the land in the study area is within 500 m of a municipally designated truck route, especially the developed areas in the southeast (downtown, James Bay, Vic West, Esquimalt, and Saanich). Major transportation corridors such as the Patricia Bay Highway, West Saanich Road, the Trans-Canada Highway, and the Island Highway are major truck routes. Areas near to, or on, truck routes reduce traffic impacts on residential neighbourhoods. Truck routes can, however, experience traffic congestion during peak periods and access to adjacent properties can be difficult near busy intersections.



CRD Wastewater Treatment Program - Biosolids Treatment Facility

Distance to Truck Routes

- 3 - Less than 100m
- 2 - Between 100m and 500m
- 1 - More than 500m
- Study Area

□ = 2 hectare parcel

0 1 2 3 4
Kilometres

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

21 September, 2010
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Figure 7. Proximity to truck routes

2.5 Ecological integrity

Methods

Ecological integrity was assessed on the basis of amount and extent of human-induced disturbance of terrestrial and aquatic habitats in the study area. Site disturbance may be a direct effect of human activity, such as clearing for infrastructure (*i.e.,* roads, buildings, sea walls, parking lots) or an indirect effect, including introduction of invasive plant species or ground disturbance by high levels of human use.

Environmental integrity was classified into the following three categories:

- **High** (score: 1). Level of past disturbance is relatively low, and the area contains relatively natural vegetation communities, wildlife habitat features, intact plant communities, or important riparian or marine foreshore habitats.
- **Moderate** (score: 2). Some disturbance has occurred, as a result of clearing or ground disturbance, or construction of infrastructure or buildings. Despite the disturbances, a moderate potential for wildlife habitat features, areas with native plant communities, moderately intact riparian habitat, or moderate marine foreshore habitat remains.
- **Low** (score: 3). The area has been disturbed or permanently altered. Though some limited potential remains for wildlife habitat, native vegetation, or riparian or marine foreshore habitats, these features are generally isolated and not thought to contribute to a functional, natural ecosystem.

These characteristics are summarized in Table 6.

Table 6. Definitions related to ecological integrity

Ecological integrity	Site suitability rating	Definition
Low	High score: 3	The area has been disturbed and altered. Though some limited potential for wildlife habitat features or areas with native vegetation may exist, these areas are isolated and fragmented and are not thought to contribute to a functional "native" ecosystem.
Moderate	Moderate score: 2	The land has been previously disturbed (cleared, obvious ground disturbance, infrastructure, or buildings present), but a moderate potential for wildlife habitat features or areas with native vegetation communities remain.
High	Low score: 1	The area displays a relatively low level of past disturbance. The area contains relatively natural vegetation communities or wildlife habitat features.

A GIS layer depicting the ecological integrity of the study area was generated. Several databases were used in combination with ortho-photography and professional opinion to classify landscape features of the study area and develop subjective ecological integrity ratings. Existing GIS databases used include:

- Sensitive Ecosystem Inventory data for east Vancouver Island,
- Victoria Natural History Society atlas of important wildlife habitats,
- Federally defined important bird areas or migratory bird areas (Canadian Wildlife Service),
- known occurrences of species at risk (BC Conservation Data Centre),
- fish bearing streams (FISS data), and
- Harbours Ecological Inventory and Rating (HEIR) project (Capital Regional District Harbours Atlas).

Results

The ecological integrity rating reflects the amount and extent of human induced disturbance of aquatic, marine, and terrestrial habitats in the study area. Factors such as connectivity of habitats, and likelihood for hosting species at risk are also taken into account. Figure 8 shows areas of high, moderate, and low ecological integrity. This section of the report discusses the characteristics of each category.

Areas with high ecological integrity are poor locations for siting the biosolids facility. Areas with high ecological integrity include mature or old forests and intact natural plant communities. Northern and rural areas have greater concentrations of these types of habitats than other parts of the study area. Floodplains and low-lying agricultural fields, such as those in the Blenkinsop Valley, Panama Flats, and Hastings Flats provide important overwintering and staging habitat for migratory birds, including Tundra Swans. Riparian areas and vegetated areas adjacent to fish-bearing streams are important ecologically. The Riparian Area Regulation could restrict development in these areas. Some marine shorelines in the study area also have high ecological value, especially areas of intact, rocky shoreline.

Areas with moderate ecological integrity are not ideal development sites for the project from an ecological perspective. Although some human-induced disturbances have occurred in these areas, elements of the ecosystem remain intact, or could be restored. The greatest concentrations of areas with moderate ecological integrity occur in the rural landscapes of Saanich. Some areas adjacent to streams have been modified by past disturbances, and are classified as having moderate ecological integrity. Gravel and rocky beach shorelines are considered to have a moderate ecological rating.

Areas rated as having low ecological integrity are considered the best development sites for the biosolids facility. Highly developed, urban, and industrial areas in the study area are rated as having low ecological integrity. Highly modified shoreline habitats and sandy beaches are considered to have lower marine values, and are suitable for the biosolids facility. Examples of areas with low ecological integrity include the Hartland landfill, gravel pits in Colwood, and cleared land adjacent the Interurban campus of Camosun College and the Vancouver Island technology park.

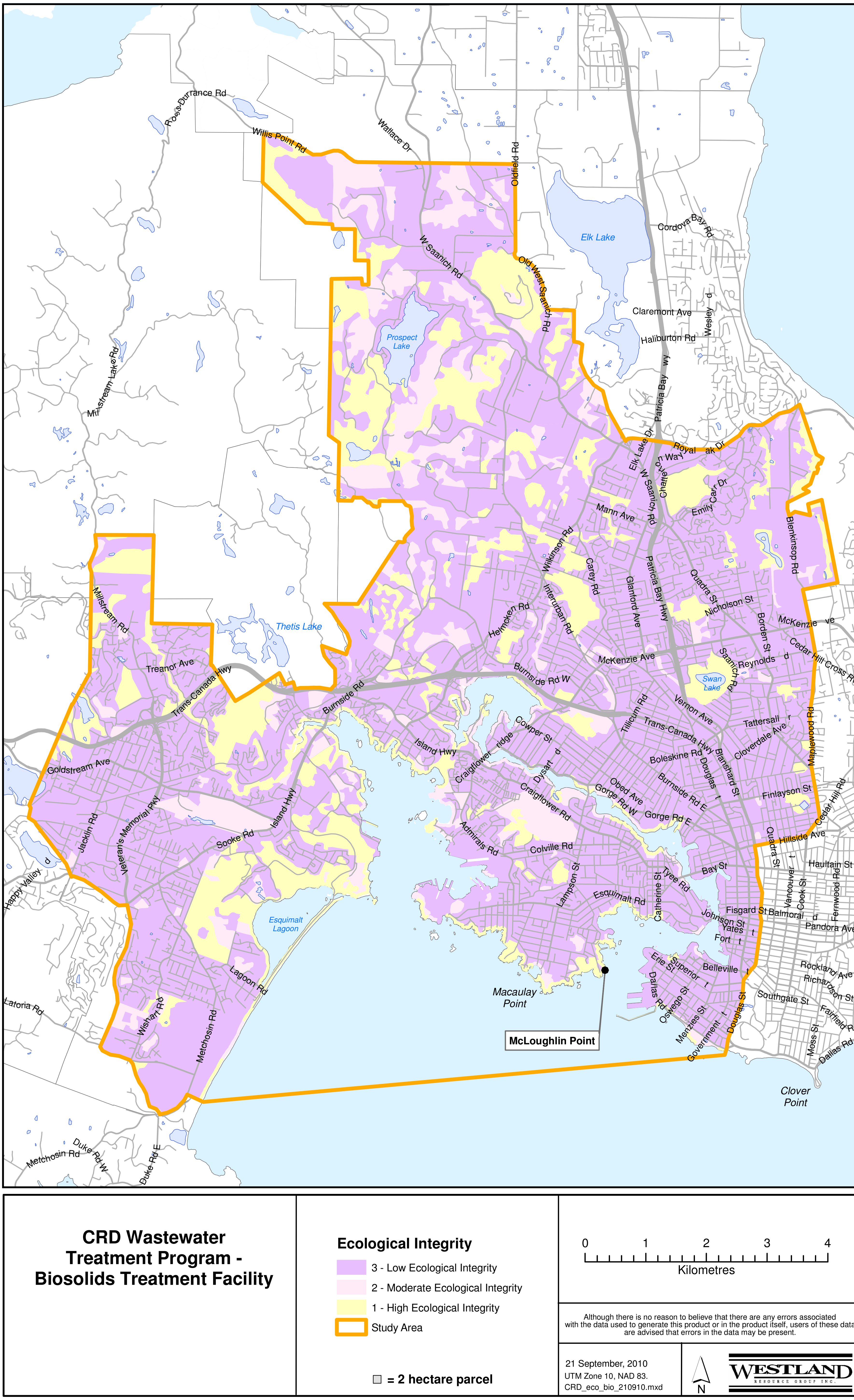


Figure 8. Ecological integrity

2.6 Geotechnical conditions

Methods

Geotechnical conditions in the study area were investigated by collecting and reviewing available information. Sources included previous reports covering the study area, regional maps detailing bedrock (Muller 1980) and Quaternary geology (Monahan & Levson 2000), and earthquake hazard maps for Greater Victoria (Monahan *et al.* 2000a, Monahan *et al.* 2000b, McQuarrie & Bean 2000). This information was supplemented with interpretation of historical air photos, and knowledge of local soil conditions and their engineering properties by C.N. Ryzuk & Associates Ltd. Other than reconnaissance visits conducted during the study of the McLoughlin Point-Hartland Wastewater facilities, no field work was conducted.

The published map data relating to geotechnical conditions has limitations. The boundaries between units are inferred between points of known conditions and the interpolation between points may not reflect actual soil conditions on the ground. Additionally, the relative accuracy of the information depends on the quantity and coverage of available information. More information is available for urbanized areas than for undeveloped or rural areas. Accordingly, the soils conditions in the northern portion of the study area, approximately north of Helmcken and Wilkinson roads, are not well known, and map interpretations are based primarily on topography and typical stratigraphy.

The results of the initial geotechnical investigations are shown on the associated maps of the study area, with the accompanying report describing the interpretation and assessment of the mapped information. It should be noted, however, that the map layers and report are not intended for facility design because the actual site conditions are unconfirmed. A site-specific geotechnical investigation of candidate sites will be required to better assess soil and groundwater conditions, and to subsequently provide design parameters for the proposed facility.

The construction constraints for the proposed facility are based on a variety of geotechnical factors, including soil conditions, groundwater conditions, and seismic considerations. Inherent in each of these factors is an increasing cost of constructing the biosolids facility associated with increasing constraint level. Explanations of the factors and ratings follow.

- Soil conditions: The primary geotechnical constraints are imposed by poor soils such as organic-rich soils (including peat), thick normally consolidated clays, and thick non-select fills. These soils typically have reduced bearing capacity and may necessitate the use of deep foundation elements. The soils also may experience consolidation settlement when subjected to increased surface loading from facility construction and placement of fill. In the case of non-select fills, the soils may be prone to long-term ongoing settlement, and may require removal or replacement.

- Groundwater conditions: A detailed investigation of groundwater conditions was not undertaken for this report, though organic-rich soils and thick soft clays are typically associated with relatively high groundwater tables. Accordingly, general groundwater conditions can be inferred from available mapping of Quaternary geology.
- Seismic Considerations: The study area is located in a region that will be affected by ground motions associated with a Cascadia subduction event, with the potential effects of such a seismic event being a major constraint to development. The effects of relative amplification of ground motions and potential for liquefaction were considered in this study. Both ground motion and liquefaction are products of, and are reflected by, soil conditions.

Table 7 summarizes the criteria used to rate the geotechnical construction conditions in the study area. The soils, groundwater, and seismic factors were considered together, and the following three classes of construction constraints were established:

- considerable constraints,
- some to minor constraints, and
- minor to no constraints.

Considerable constraints occur mainly on organic-rich soils, peat, and some fill areas, all of which have high relative seismic amplification and possible liquefaction potential. Areas with these soils can also have an elevated groundwater table, which could increase the complexity of design and construction, along with the associated cost. These soils typically have poor bearing capacity and deep foundations would likely be required. Specialized design and alternative construction methods would be required, although in some areas it may not be possible to fully mitigate the impacts.

Some to minor constraints were identified, primarily in areas with soils believed to consist of thick, soft clay deposits. These soils have moderate relative seismic amplification and low liquefaction potential. However, they are susceptible to consolidation settlement when subjected to substantial increased surface loading from new building loads or fill placement. The softer clays also have lower bearing capacity, and generally are accompanied by higher groundwater levels. Construction in these soils requires special considerations, but potential impacts are usually mitigable, although the required actions may increase the associated construction and design costs.

Minor to no construction constraints have few geotechnical concerns. Soils in this classification are either thin soils overlying bedrock or competent granular soils, or locations where bedrock is exposed at the surface. In general, no unique geotechnical issues are expected for these areas, and issues encountered could likely be easily resolved.

Table 7. Definitions related to construction conditions

Geotechnical construction conditions	Site suitability rating	Definition
Minor to no constraints	High score: 3	In general, no unique geotechnical issues are expected for these areas, and issues encountered could likely be easily resolved.
Minor to some constraints	Moderate score: 2	Construction in these soils requires some special considerations, but potential impacts are usually mitigable, although the required actions may increase the associated construction and design costs.
Considerable constraints	Low score: 1	Specialized design and alternative construction methods would be required, although in some areas it may not be possible to fully mitigate the impacts.

Slope stability was considered specifically in terms of the potential for seismically induced slope failure. Potential instability is affected by the overall slope height and steepness, the characteristics of the soil and rock comprising the slope, and the presence of groundwater seepage. Higher slopes, steeper gradients, weaker soils, highly fractured rock, and groundwater are destabilizing conditions. Slopes may experience instability through a variety of mechanisms, including under static conditions, but ground accelerations due to seismic events create excess stresses and strains within the slope materials that can cause larger failures. Additional considerations for rockslopes include the potential for rockfall, the presence of adverse fractures or joints in the bedrock, and the time frame – short-term (during construction) and long-term.

Table 8 explains the criteria used to rate the slope stability of the study area. Slopes were classified by their probability of seismically induced failure. The categories are:

- of no to limited concern,
- of limited to minor concern, and
- of concern.

Slopes categorized as no to limited concern have a very low or low probability of failure. Slopes of limited to minor concern have a moderate probability of failure, and slopes of concern have a high to very high probability of failure in a design seismic event.

The depth to bedrock was not taken into consideration during preparation of the map overlays. Bedrock is capable of providing excellent bearing capacity and is not susceptible to ground amplification, although rock is more difficult and costly to excavate than soil. In the Core Area municipalities, the bedrock profile is notoriously erratic over even small distances. In general, topographic highs correspond to thinner soils, shallower bedrock, and exposed bedrock knolls, whereas basins and lower elevations have thicker soils and greater depth to bedrock.

Table 8. Definitions related to slope stability

Slope stability	Site suitability rating	Definition
Of no concern to limited concern	High score: 3	Slopes categorized as no to limited concern have a very low or low probability of failure.
Of limited to moderate concern	Moderate score: 2	Slopes of limited to minor concern have a moderate probability of failure.
Of concern	Low score: 1	Slopes of concern have a high to very high probability of failure in a design seismic event.

The slope steepness analysis was performed using the CRD Digital Elevation Model dataset (2007). This dataset has a 1 m resolution. For the siting analysis, the dataset was smoothed to create a 20 m elevation surface across the study area and the slope between each 20 m area calculated using ArcGIS Spatial Analyst Geographical Information Systems (GIS) package. This process produced a surface showing generally sloping terrain without over-representing minor surface elevation changes.

Table 9 explains the criteria used to rate the suitability of slope steepness of the study area. The areas rated as "1" (low suitability for a biosolids facility) contain slopes greater than 10%. Areas rated as "2" (moderate suitability) have slopes between 5% and 10%. Areas rated as "3" (high suitability) have slopes less than 5%.

Table 9. Definitions related to slope steepness

Slope steepness	Site suitability rating	Definition
Less than 5%	High score: 3	Areas with less than 5% slope would have no constraint to facility design and operation.
5% to 10%	Moderate score: 2	Areas with slopes between 5% and 10% impose some constraints to site design and operation.
More than 10%	Low score: 1	Areas with slopes greater than 10% impose considerable constraints on facility design and operation.

Results

The results of geotechnical categorization are shown graphically in Figures 9, 10, and 11: Geotechnical Construction Constraints, Slope Stability, and Slope Steepness.

Areas with minor to no constraints generally display exposed bedrock, thin soils overlying bedrock, and thick, dense, granular soils. These areas are anticipated to have few geotechnical issues, all of which can be easily resolved. Conventional designs and construction methods are anticipated. No unusual geotechnical conditions are expected, such as poor soils or excessive groundwater. No unusual seismic concerns are likely, although areas with sloping bedrock outcrops have the potential for localized rockslope instability that may require remediation.

Areas with some to minor constraints generally consist of thick soft clay soils with the potential for elevated groundwater conditions. The primary concerns with these soils relate to consolidation settlement in response to increased loading from new structures and fill placement, and the potential to dewater adjacent properties over the long term if due care if not exercised. To limit the potential for settlement, new construction should be fully weight compensated (whereby a weight of soil equivalent to the new load is removed by excavation prior to construction), the site pre-loaded to induce consolidation settlement prior to construction, or deep foundation elements utilized. Digester tanks could be partially located below grade, though facilities located below the groundwater table would require special design considerations to ensure waterproofness and protect against buoyancy forces. Typically, anchors are installed to provide uplift resistance. Construction can occur in areas of some to minor constraints, as these conditions are common throughout Greater Victoria, including the downtown area.

Areas with considerable constraints have poor soil conditions, such as organic-rich soils, peat and fill materials, and elevated groundwater tables. These conditions correspond to poor seismic performance in terms of ground motion amplification and potential liquefaction. Organic soils must be removed. Softer clay soils have lower bearing capacities, so deep foundations may be required. Higher groundwater tables may cause difficulties during construction relating to maintaining a dry excavation (requiring excavation dewatering) and instability of open cutslopes due to seepage. Prolonged pumping of groundwater during construction could cause dewatering of soils beneath adjacent properties, possibly leading to settlement of structures. Conditions in these areas are geotechnically challenging and require specialized design and construction methods. The time required for construction, and the associated costs, also tend to increase in these conditions.

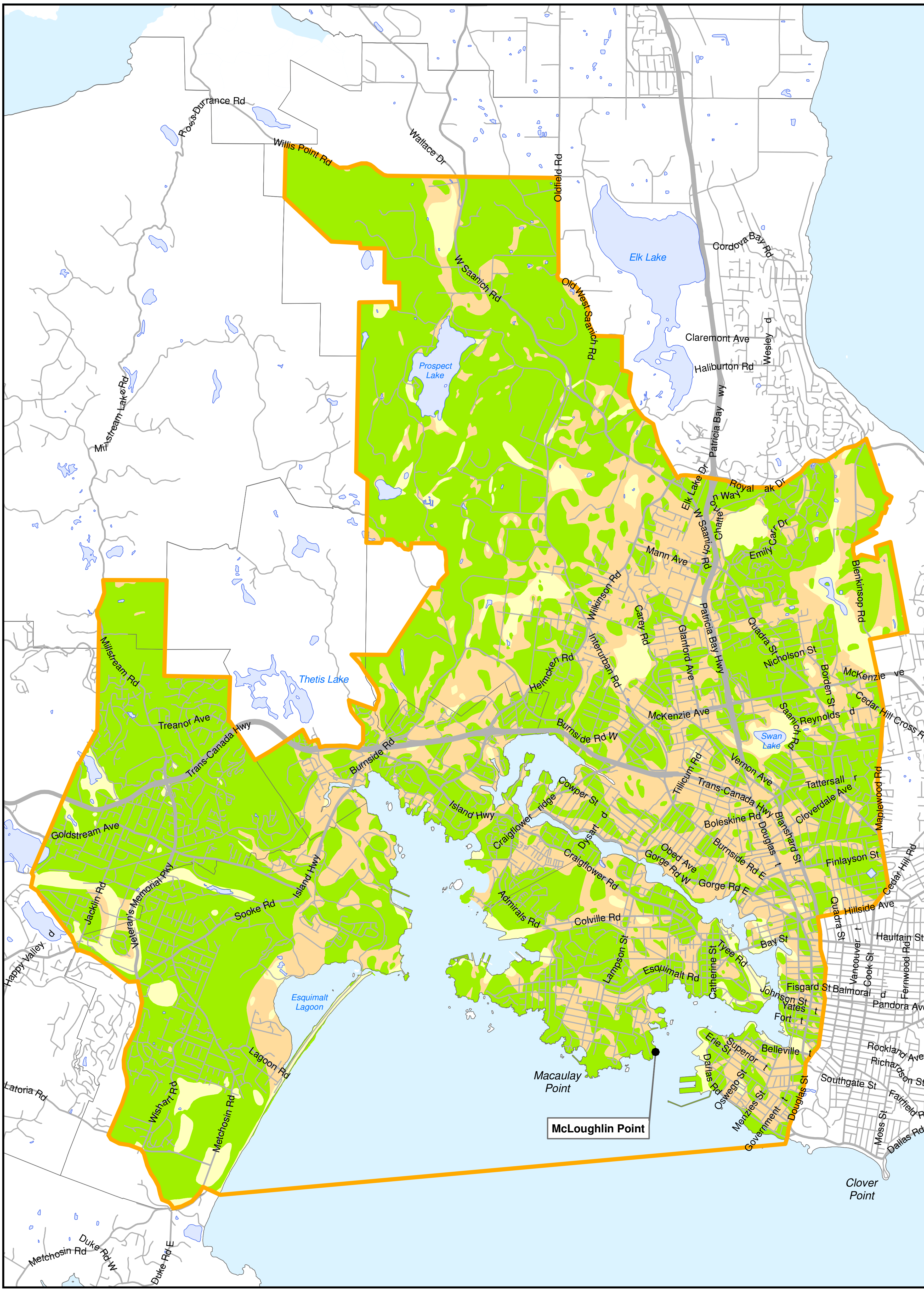
Although some map areas are designated as having minor or considerable construction constraints, it should not be inferred that these sites are necessarily unbuildable. Rather, as more constraints are imposed to a site or a project, the complexity of design and construction also increases, which results in increased time and cost.

Construction in areas categorized as having slopes of concern should be avoided. Such sites are expected to have slope instability risks that are not easily overcome. In areas with slopes of minor concern, construction is possible, provided remediation measures are implemented. Such measures include slope unloading and construction of retaining walls for soil slopes, and scaling, localized rock pinning, and installation of protective rockfall mesh for rockslopes. The cost associated with facility construction in these areas will be higher than in areas where slopes are stable.

Within the study area, there are abundant suitable sites for the proposed biosolids facility from a geotechnical perspective. Sites with more favourable geotechnical conditions are associated with minor to no construction constraints and slopes of limited to no concern. Design and construction of a facility in these areas is anticipated to have relatively few geotechnical issues of concern. Sites with less favourable conditions have been categorized as having some to considerable construction constraints and potential for slope instability.

For example, poor soil conditions are found in the area of Panama Flats and Blenkinsop Valley. The soils generally contain a substantial amount of organic material underlain by thick deposits of softer clay. The groundwater table tends to be elevated, and seismic effects are amplified. Facility design for these areas would have to account for long-term settlement and buoyancy effects for portions located below the groundwater table. Additional difficulties would arise during construction, relating to excavation stability and temporary dewatering. Some low-lying areas, such as Panama Flats, are also subject to seasonal flooding. It may be possible to construct the facility in these areas, but a variety of design and construction issues would have to be resolved.

Other areas are less favoured due to the presence of steep slopes that have the potential for landslides (soil slopes) and rockfall (rockslopes). Additional remediation measures would be required, but it may not be economically feasible to fully mitigate the hazards of some sites. Figure 11 shows the suitability of slope steepness in the study area. Most of the study area has highly suitable slopes for a biosolids facility (less than 5%). Steep slopes of concern are found to the west of Prospect Lake and along many coastal bluffs.



CRD Wastewater Treatment Program - Biosolids Treatment Facility

Geotechnical Construction Conditions

- 3 - Minor to No Constraints
- 2 - Minor to Some Constraints
- 1 - Considerable Constraints
- Study Area

☐ = 2 hectare parcel

0 1 2 3 4
Kilometres

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

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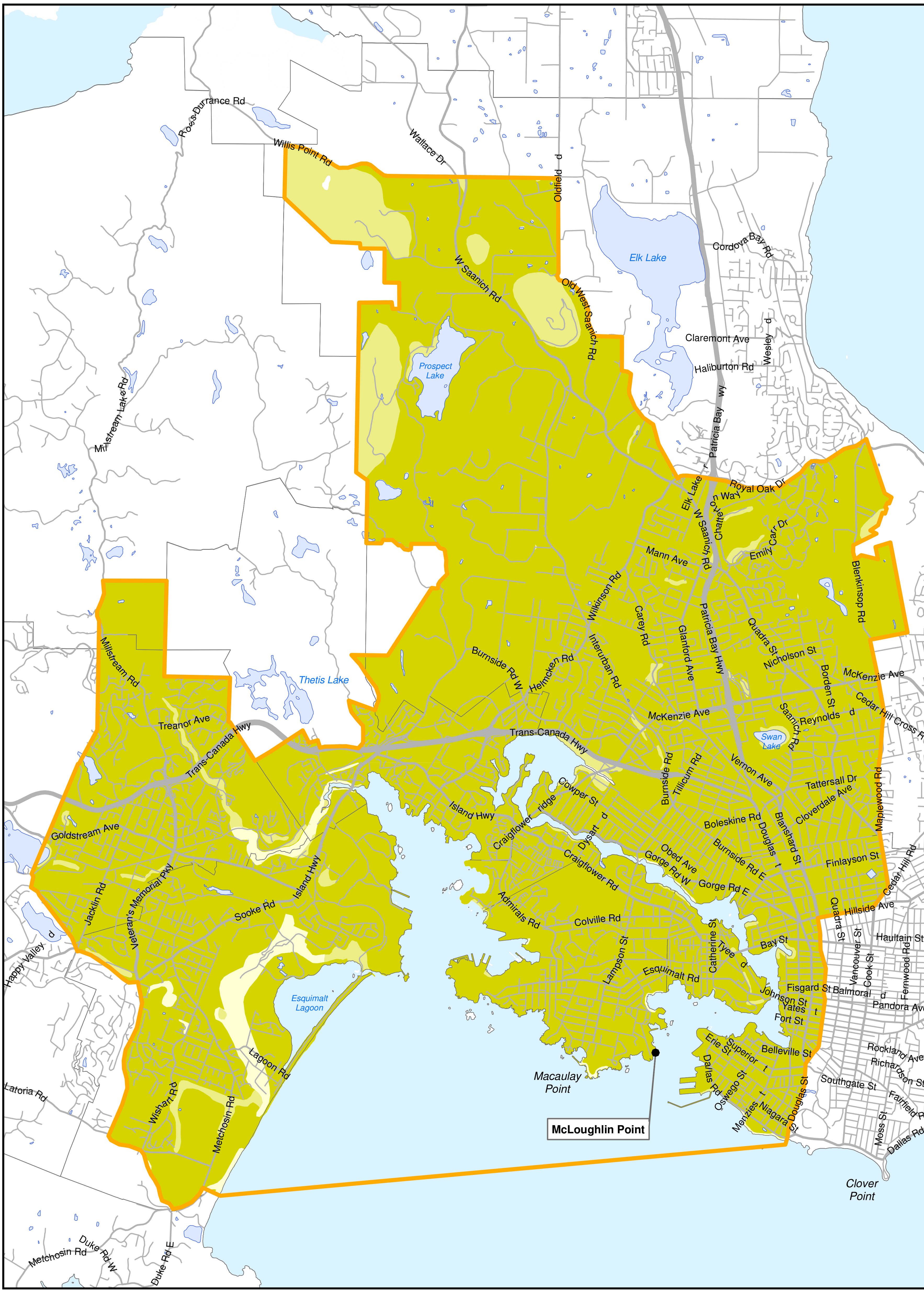
Figure 9. Geotechnical construction conditions



CRD Wastewater Treatment Program - Biosolids Treatment Facility

Slope Stability

- Study Area
- 3 - Of no concern to limited concern
- 2 - Of limited to moderate concern
- 1 - Of concern

□ = **2 hectare parcel**

0 1 2 3 4
Kilometres

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

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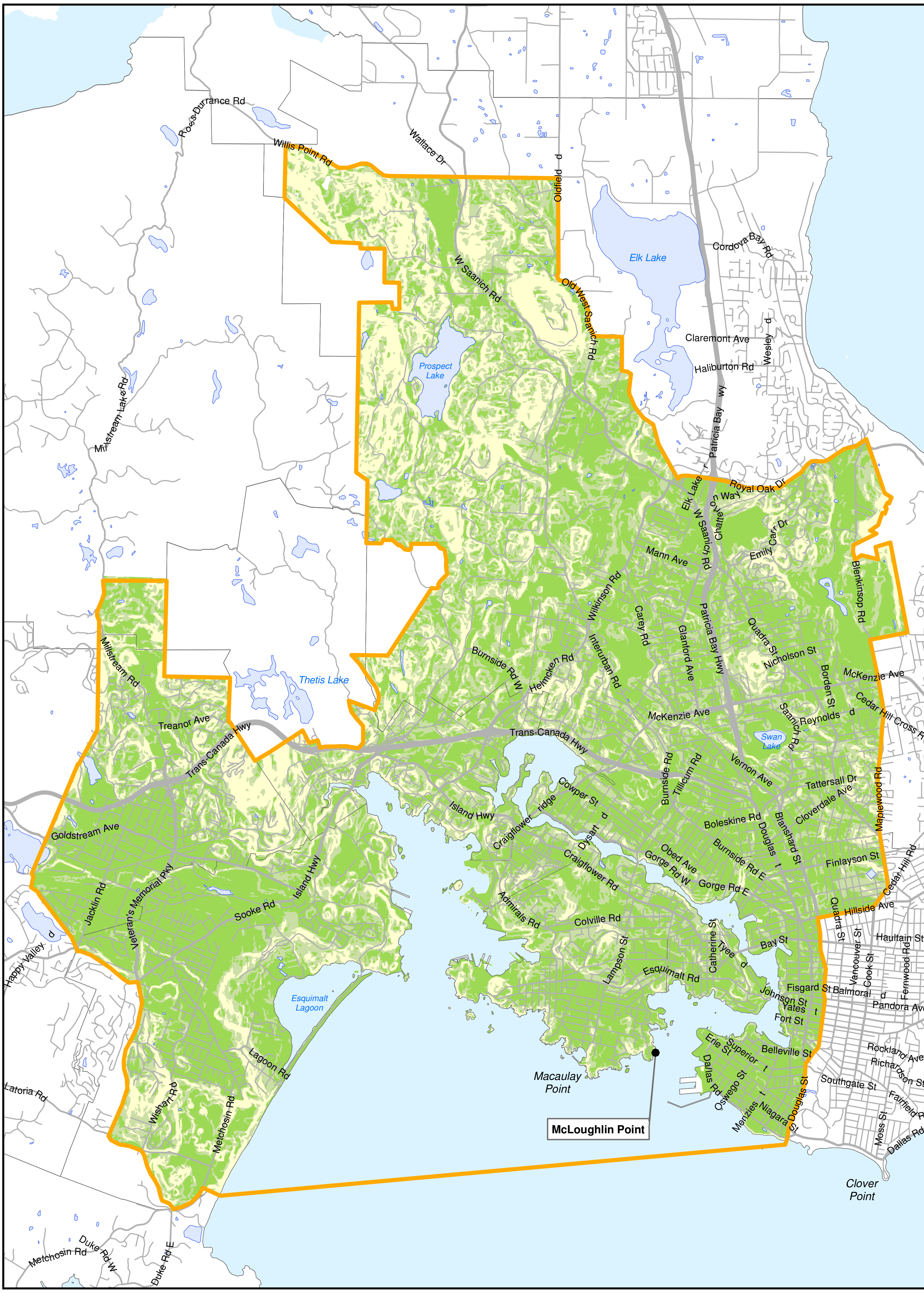
Figure 10. Slope stability



CRD Wastewater Treatment Program - Biosolids Treatment Facility

Slope Steepness

- 3 - Less than 5%
- 2 - Between 5% and 10%
- 1 - More than 10%
- Study Area

□ = 2 hectare parcel

0 1 2 3 4
Kilometres

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

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Figure 11. Slope steepness

2.7 Archaeology and heritage

Methods

The BC Archaeological Site Registry was reviewed to identify registered archaeological sites in the study area. Archaeological potential mapping conducted by Millennia Research Ltd. (2008) was reviewed to identify areas likely to contain archaeological features or resources. Two previous studies (Westland September 2009 and June 2010) conducted for the Core Area Wastewater Program were reviewed to obtain additional archaeological and heritage information for the study area.

Registered heritage sites in the study area were identified by reviewing the District of Saanich heritage database and the BC Archaeological Site Registry. The District of Saanich database contains point data that show specific locations of heritage features. These points were linked to the CRD parcel database covering the study area. Federally designated National Historic sites were identified in the study area.

Table 10 explains the criteria used to rate the archaeological potential and heritage features of the study area. The areas rated as “1” (low suitability for a biosolids facility) contain registered archaeological or heritage sites. Areas rated as “2” (moderate suitability) have recorded archaeological potential, but specific sites have not been identified. Areas rated as “3” (high suitability) have no known archaeological potential or heritage sites.

Table 10. Definitions related to archaeological and heritage

Archaeological potential and heritage	Site suitability rating	Definition
No known archaeological potential	High score: 3	Little or no archaeological potential was identified. No archaeological sites were identified. No heritage features were identified.
Archaeological potential	Moderate score: 2	The archaeological potential database identifies the area as having potential for archaeological features.
Registered archaeology or heritage sites	Low score: 1	A registered archaeological or heritage site has been identified at the site.

Results

Figure 12 presents the results of the archaeological and heritage assessment.

Dozens of registered archaeological sites were identified in the study area. Many of the known archaeological sites are near the marine shoreline and are associated with shell middens, precontact village sites, or natural resource or traditional use areas. Residential development, road and utility construction, and beach erosion have disturbed many of the sites.

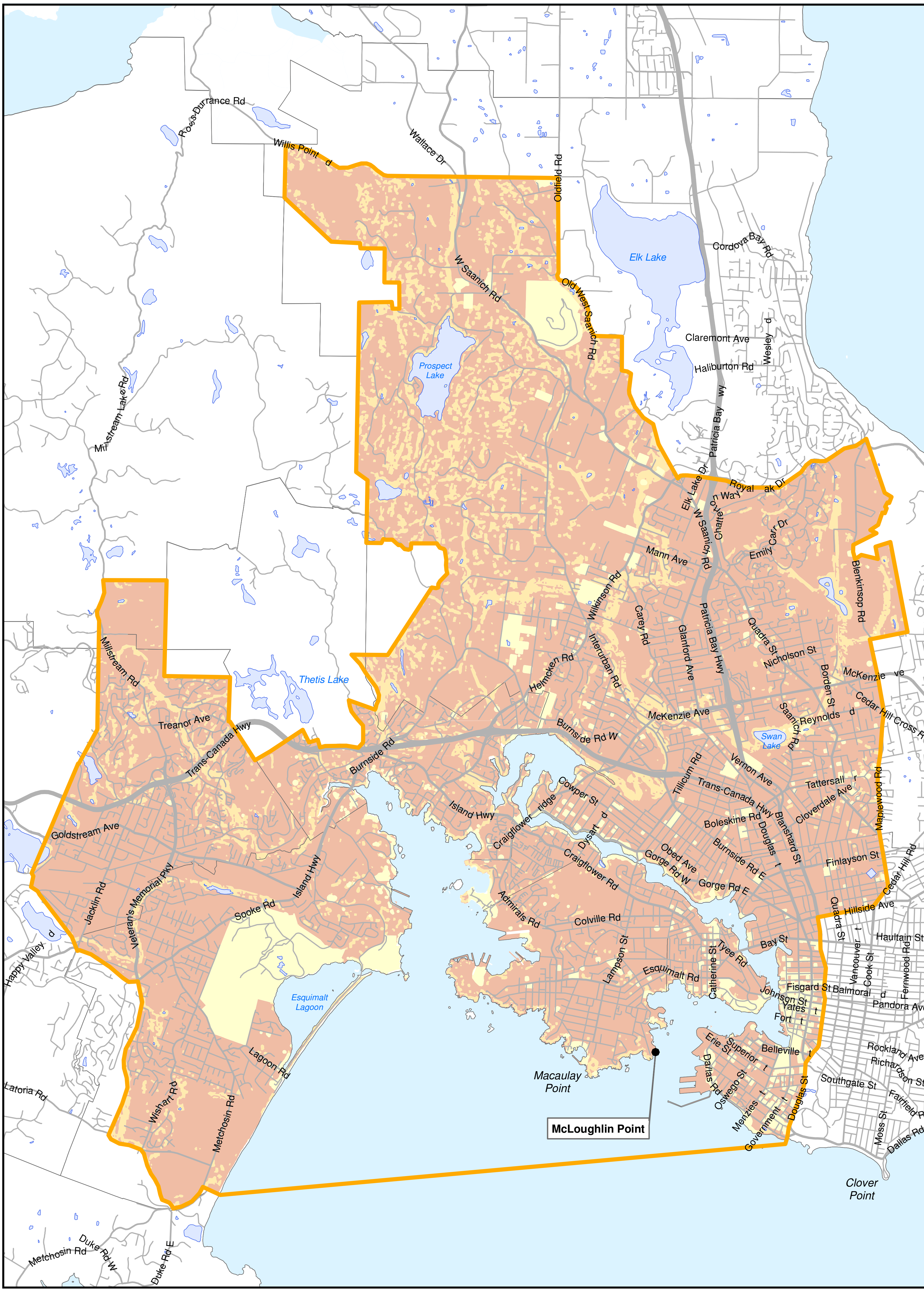
A review of archaeological potential mapping by Millennia Research Ltd. (2008) showed archaeological potential concentrated along the marine shoreline and near river and lake systems, such as:

- Esquimalt Lagoon,
- Colwood Creek,
- Latoria Creek,
- Colquitz River,
- Blenkinsop Lake,
- Millstream Creek,
- Craigflower Creek,
- Swan Creek,
- Durrel Creek,
- Prospect Lake, and
- Tod Creek.

Areas having high archaeological potential are more common in the northern portion of the study area, where there are more creeks and the land is less developed than in the south.

The Provincial Heritage Registry lists several heritage sites in the study area, structures such as churches, commercial buildings, residences, schools, and farms. Downtown Victoria and James Bay have the highest concentration of heritage structures in the study area. Saanich has several large heritage structures: the Dominion Astrophysical Observatory, Wilkinson Road Jail, High Oaks Farm, and Swan Lake Trestles.

Fort Rodd Hill and Fisgard Lighthouse National Historic Site and Hatley Park National Historic Site are located in Colwood.



CRD Wastewater Treatment Program - Biosolids Treatment Facility

Archaeology and Heritage

- 3 - No known archaeological potential
- 2 - Archaeological potential
- 1 - Registered archaeological or heritage site
- Study Area

□ = 2 hectare parcel

0 1 2 3 4
Kilometres

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Figure 12. Archaeology and heritage

3.0 COMBINED SUITABILITY ANALYSIS

Section 2 discusses the criteria developed to identify suitable areas for a biosolids facility. The combined analysis overlays the maps of each of the nine criteria described in the foregoing section. Section 3 describes the results of overlaying the maps.

The criteria described in Section 2 were assigned weights according to their perceived relative importance in determining a suitable location for a biosolids facility (Table 11). The total weights for all criteria equal 100. The criteria in Table 11 are organized into environmental, social, and economic considerations. The total weight of criteria in each of the three "triple bottom line" categories is approximately one-third of the total, balancing environmental, social, and economic criteria.

A Geographical Information System (GIS) analysis was performed that calculated the combined scores for each area on the map.

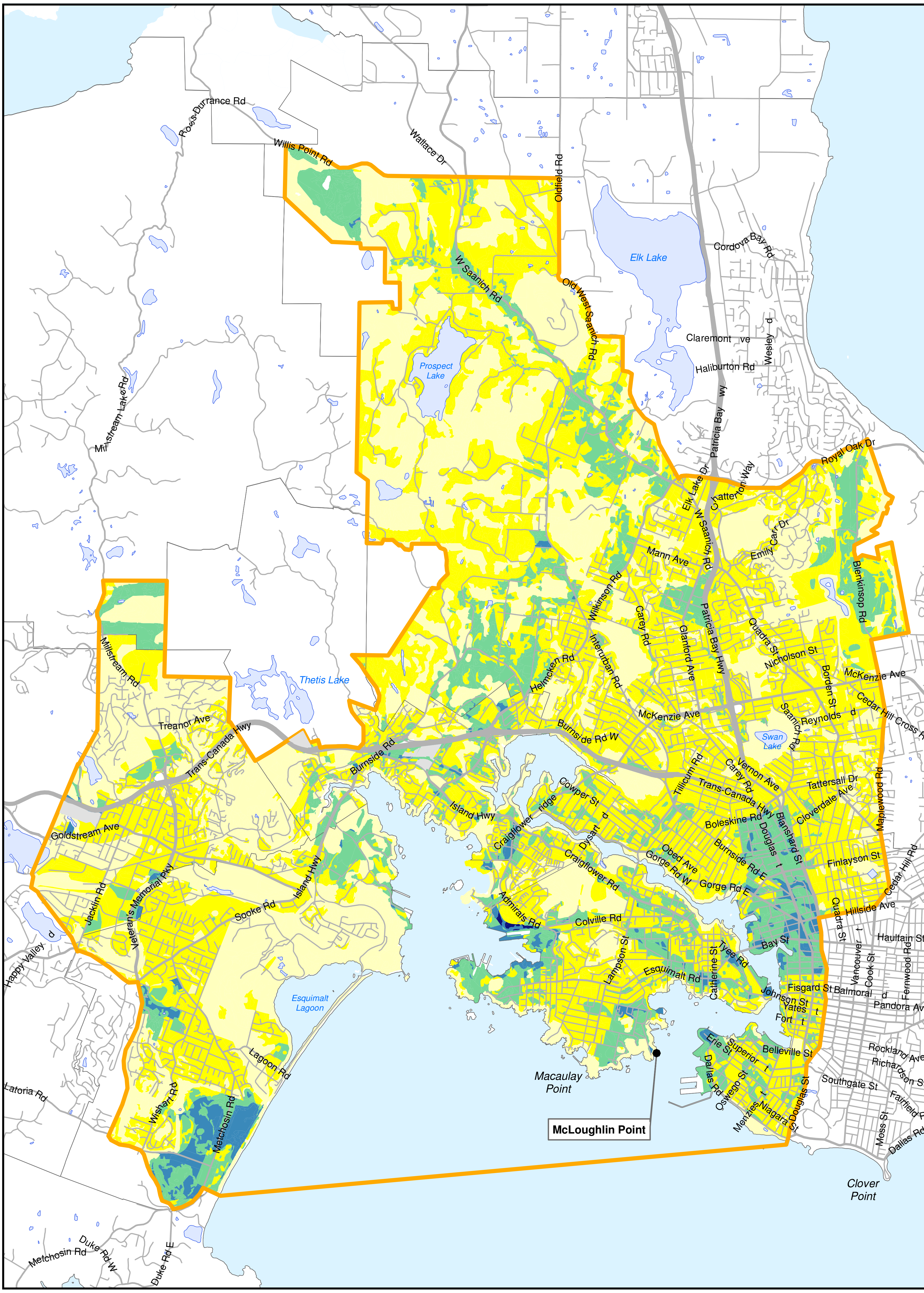
3.1 Combined analysis results

Figure 13 presents the overlay siting analysis. Dark areas are considered the most suitable for a biosolids facility and light areas are considered the least suitable. Each of the top four classes represents 10% intervals, based on total combined scores. The lowest category represents all areas having scores in the bottom 60% of all scores. This approach allows greater refinement of the best areas, which is consistent with the goal of identifying the best site for a biosolids facility. The map does not show candidate sites, though it does show areas that could be subject to further investigation to determine their suitability for a biosolids facility.

Table 11. Triple bottom line site selection criteria for a biosolids facility

TBL[2]	Topic	Criteria	Metric	Definition	Weights (%)
Environmental	Biology	Ecological Integrity	3 = low ecological integrity 2 = moderate ecological integrity 1 = high ecological integrity	Areas where facilities would avoid adverse effects on sensitive or important habitat.	35
Social	Land use	Land use compatibility	3 = compatible 2 = somewhat compatible 1 = least compatible	Areas where existing and planned land uses are compatible with facility operations, avoiding uses sensitive to nuisance effects.	20
	Access	Suitability for barge landing	3 = potentially suitable 2 = uncertain potential 1 = not considered suitable	Physical suitability of shorelines and compatibility of backshore land use for barging facilities.	5
		Proximity to truck routes	3 = < 100 m 2 = 100 m to 500 m 1 = > 500 m	Linear distance to the nearest truck route.	5
	Archaeology and heritage	Archaeology and heritage features	3 = no known archaeological potential 2 = archaeological potential 1 = registered archaeological or heritage site	Likelihood of encountering archaeological or heritage features.	5
Economic	Conveyance	Elevation	3 = < 20 m 2 = 20 m to 40 m 1 = > 40 m	Lower elevation areas require less pumping, thereby conserving energy and reducing capital and operating costs.	10
	Geotechnical	Construction conditions	3 = minor to no constraints 2 = minor to some constraints 1 = considerable constraints	Suitability of the surficial material, site drainage, and levels of seismic and liquefaction risk to allow facility construction and operation.	10
		Slope stability	3 = of no concern to limited concern 2 = of limited to moderate concern 1= of concern	The stability of slopes for facility construction and operation.	5
		Slope steepness	3 = < 5% 2 = 5% to 10% 1 = > 10%	Suitability of slopes for facility construction.	5

[2] TBL = Triple bottom line



CRD Wastewater Treatment Program - Biosolids Treatment Facility

Triple Bottom Line Suitability

Total Suitability Score (percent)

90 - 100	Best Sites
80 - 90	
70 - 80	
60 - 70	
0 - 60	Worst Sites
Study Area	

□ = 2 hectare parcel

0 1 2 3 4
Kilometres

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Figure 13. Combined suitability analysis

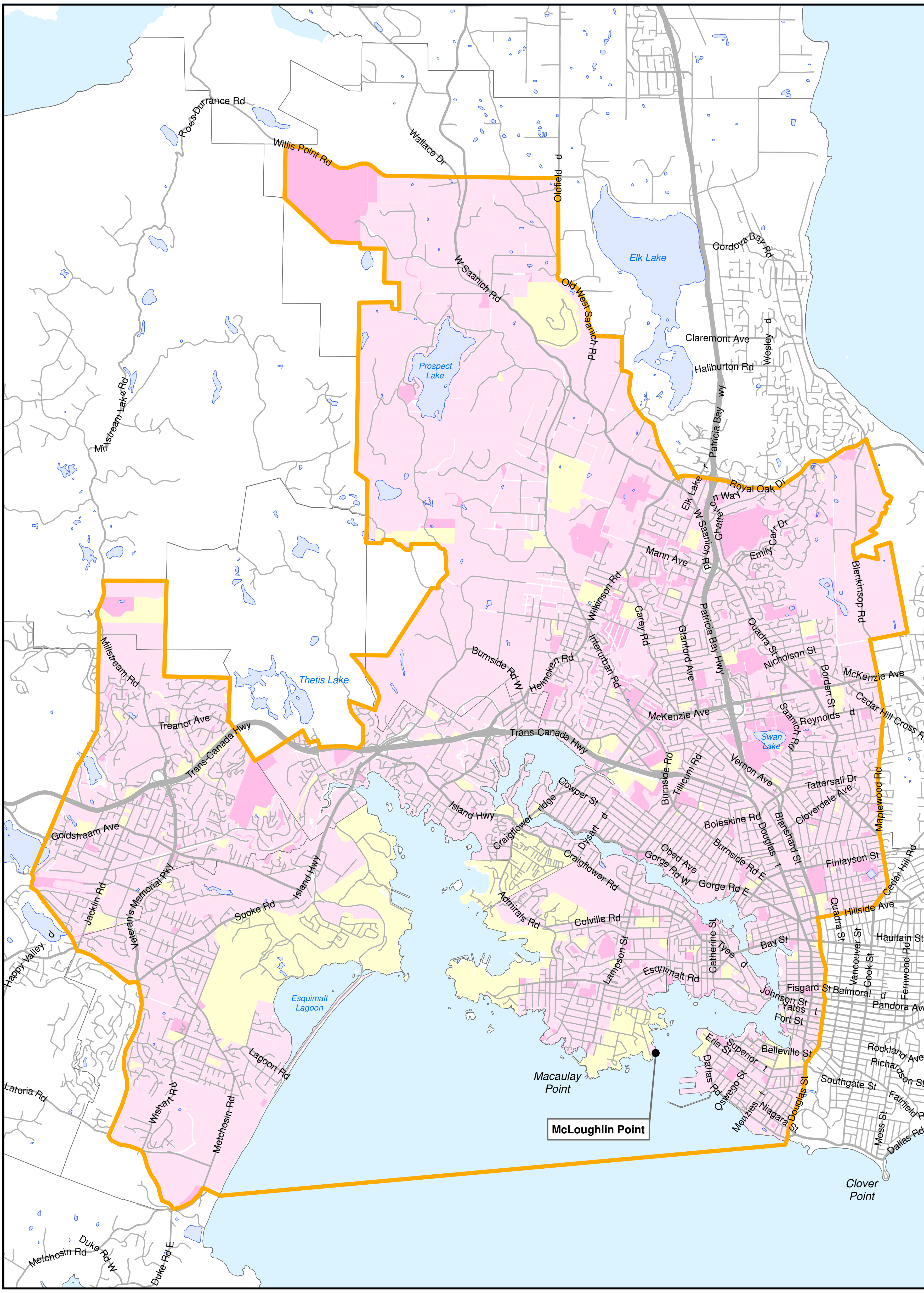
3.2 Ability to acquire land

The areas presented in Figure 13 are considered the most suitable for a biosolids facility on the basis of the technical criteria applied. However, the most suitable sites may not be available for acquisition by the CRD. One of the most important variables in determining the ability to acquire land is its ownership. Figure 14 shows areas that have been rated according to the how easily the CRD could buy or lease the property.

CRD and municipally owned lands are rated "3" (high potential). Properties owned by local governments are likely the easiest to obtain for a biosolids facility. Some local government-owned land is vacant, though most land is used for parks, utilities, and municipal facilities. The Hartland Landfill is CRD-owned.

Private and non-government property, such as residential and commercial land, is rated "2" (moderate potential) for acquisition. Private or non-government-owned property may be acquired through purchase, lease, or expropriation. Although the CRD may be able to acquire private land, the cost of doing so may be prohibitive. Most of the land in the study area is in the private or non-government category.

Land owned or leased by the federal or provincial governments is rated "1" (low potential), because this land could be the most difficult to obtain for a facility. Federal land, for example, is subject to an extensive divestiture process that takes more than five years to complete. At the end of the five year period, it is not guaranteed that the CRD would receive the land. Provincial lands are also subject to an approval process, though the time required to determine whether the land can be obtained is typically faster than the federal process. The CRD has no power to expropriate land owned by provincial or federal governments.



CRD Wastewater Treatment Program - Biosolids Treatment Facility

Ability to Acquire Land

- 3 - Property Owned by CRD or Municipality
- 2 - Property Owned by Private or Non-Government organizations
- 1 - Properties Owned or Leased by the Provincial or Federal Government
- Study Area
- **= 2 hectare parcel**

0 1 2 3 4
Kilometres

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

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Figure 14. Ability to acquire land

4.0 NEXT STEPS

The results of the land investigations in this study should be considered an aid in identifying areas that may be suitable for a biosolids facility. Additional steps need to be taken to identify specific suitable sites. The following next steps are recommended to select a site for a biosolids facility in the Core Area:

1. Discuss the findings of this study with CRD committees, staff, and consultants.
2. Specify areas that should be subject to more detailed study.
3. If a decision is made to select a site other than Hartland North, conduct a more detailed investigation to identify candidate sites.
4. Design and conduct a public engagement process to allow residents to review available information and obtain comment.
5. Contact owner(s) of identified candidate site(s).
6. Conduct a rigorous analysis of the preferred site(s) that includes an assessment of the associated costs, technical feasibility of constructing and operating a biosolids facility on the site(s), and a triple-bottom-line analysis that considers social, environmental, and economic factors.
7. Select a preferred site for the biosolids facility and prepare an amendment to the *Liquid Waste Management Plan*.
8. Prepare an Environmental Impact Study (EIS) as required by provincial regulations that assesses the potential impacts of constructing and operating a biosolids facility on the site and recommends mitigation measures to reduce or avoid these impacts. The following topics are included in an EIS:
    - geotechnical conditions,
    - hydrology and water quality,
    - vegetation,
    - wildlife and wildlife habitat,
    - fish,
    - air quality,
    - archaeology and heritage,
    - land use,
    - traffic,
    - noise, lighting, and vibration,

- human health, and
- visual aesthetics.

9. Purchase the site.

Some of the foregoing tasks may be conducted concurrently, or the sequence may be changed in response to circumstances that arise during the site selection process.

5.0 REFERENCES

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