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Report #EWW 10-07

REPORT TO CORE AREA LIQUID WASTE MANAGEMENT COMMITTEE
MEETING OF WEDNESDAY 24 FEBRUARY 2010

SUBJECT **ENVIRONMENTAL IMPACT STUDY FOR SAANICH EAST WASTEWATER TREATMENT FACILITY – CORE AREA WASTEWATER TREATMENT PROGRAM**

PURPOSE

To present to the Core Area Liquid Waste Management Committee (CALWMC) the *Environmental Impact Study of Core Area Wastewater Treatment Facilities: Terrestrial Environment. Part 1: Saanich East Facilities* (Appendix A) for approval and to request direction to implement recommended mitigation measures.

BACKGROUND

At its meeting of October 7, 2009, the CALWMC authorized Capital Regional District (CRD) staff to prepare an Environmental Impact Study (EIS) of a wastewater facility on the Finnerty-Arbutus site in Saanich East, as required by the Ministry of Environment. The Minister of Environment has called for the CRD to conduct environmental assessments of wastewater facilities as part of the Liquid Waste Management Plan amendment process. Assessments of the entire project were to be submitted by the end of 2009. Because sites have not been selected for all of the facilities, however, the CRD and Ministry of Environment agreed that an EIS for the Saanich East site will be completed first, followed by other sites in 2010. The draft contents of the EISs were reviewed and approved by the Ministry of Environment staff in 2009.

The attached EIS complies with the requirements of the Ministry of Environment and describes potential project effects of building and operating a treatment facility on the Finnerty-Arbutus site. Mitigation measures are outlined that would reduce the effects to less than significant levels. If the facility is relocated to the adjacent Saanich-owned property, an amended EIS will be prepared and submitted to the Ministry of Environment.

This EIS examines only terrestrial effects. A marine study will be prepared when baseline information has been collected on waters and biota in the Haro Strait study area.

The EIS contains a set of CRD commitments (Section 8) to implement recommended actions that will avoid or mitigate identified effects. Many of the recommended actions respond to information gained from the extensive public involvement program associated with the candidate sites in Saanich East-North Oak Bay, and the Environmental and Social Review (ESR) of the candidate sites.

Key findings of the EIS are:

1. The application of standard design, construction, and operational practices will reduce effects on traffic, air quality, and human health at the Saanich East facility to less than significant levels.
2. Construction of the Saanich East facility will result in significant effects on vegetation, wildlife, community use, and visual aesthetics. Mitigation will reduce all of these impacts to less than significant levels during facility operation, though the loss of mature forest on the facility footprint will be permanent.

3. The Saanich East treatment facility operation has the potential to occasionally release odours under the existing project design. Augmenting the levels of odour treatment and ensuring backup systems are installed will reduce adverse odour effects to less than significant levels at all times.
4. Visual aesthetic effects of the facility can be reduced to less than significant levels by improving design quality of the treatment facility, and reducing visibility of the facility from surrounding properties. Existing vegetation will be maintained where feasible. Once newly-planted landscape vegetation matures, visual impacts will be reduced.
5. An archaeological impact assessment will be conducted on the site when the facility footprint is refined. Under British Columbia legislation, a proponent is required to mitigate a project's impacts on identified archaeological features. Complying with this requirement will reduce adverse effects to less than significant levels.

In March, a process will commence to seek public input on the opportunity to shift the site from the Finnerty-Arbutus site to the Saanich-owned metre station site as recommended by the public, the ESR, the EIS and the CALWMC. Should the process ultimately lead to a shift in location, the EIS would be amended to reflect the change.

ALTERNATIVES

1. That the CALWMC approve the EIS (Appendix A).

2. That the CALWMC direct staff to revise the EIS and re-submit it to the Ministry of Environment.

FINANCIAL IMPLICATIONS

Complying with the recommended mitigation measures will incur labour and other costs, which are included in the project budget. These actions are not expected to materially affect the overall cost of planning, building, and operating the Saanich East facility.

SUMMARY

Construction and operation of treatment and ancillary facilities will result in environmental and social impacts, nearly all of which can be effectively mitigated. The nature of the impacts and recommended mitigation measures are described in the EIS. The effects of building and operating wastewater treatment facilities need to be considered in the context of the substantial improvements in the quality of effluent released into the marine environment resulting from the CRD's Core Area Wastewater Treatment Program.

Submission of the EIS satisfies the requirements of the Ministry of Environment. The commitments to action contained in the EIS will resolve many identified technical issues and will respond to public concerns. The actions will help to minimize adverse effects of building and operating the wastewater facility.

RECOMMENDATION

That the Core Area Liquid Waste Management Committee approve Appendix A, *Environmental Impact Study of Core Area Wastewater Treatment Facilities: Terrestrial Environment. Part 1: Saanich East Facilities.*

Dwayne Kalynchuk, PEng
Project Director, Core Area Wastewater Treatment

DK:jta
Attachment: 1

ENVIRONMENTAL IMPACT STUDY OF CORE AREA WASTEWATER TREATMENT FACILITIES:
TERRESTRIAL ENVIRONMENT

Part 1: Saanich East Facilities

CRD
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December 2009

WESTLAND RESOURCE GROUP

Summary

A wastewater treatment facility will be required in the Saanich East-North Oak Bay area of the Capital Regional District (CRD). The facility is needed to reduce wastewater flows in downstream portions of the core area wastewater treatment system, and to create opportunities to provide reclaimed water and energy for use in the surrounding community. The facility in Saanich East-North Oak Bay will provide "liquids only" treatment, conveying solids for further treatment downstream.

The CRD's Core Area Liquid Waste Management Committee (CALWMC) authorized preparation of an Environmental and Social Review (ESR) of potential sites for a treatment facility in 2009. In the Saanich East-North Oak Bay area, candidate sites were identified through a Geographic Information System (GIS) analysis using criteria that consider public concerns and priorities, technical aspects of building and operating wastewater treatment facilities, and input from the CALWMC. Three land parcels were identified that have the fewest constraints to siting a treatment facility.

In the fall of 2009, the CALWMC selected the Finnerty-Arbutus site as the preferred location for a wastewater treatment facility in the Saanich East-North Oak Bay area. The Finnerty-Arbutus site and the required ancillary infrastructure are shown in Figure S-1.

Once a site was selected, an Environmental Impact Study (EIS) of the selected site and the ancillary facility routes was required. The results of the EIS are presented in this report. The environmental effects of the construction and operation of the facility on the following topics were assessed:

- Geotechnical hazards,
- Fresh water,
- Vegetation,
- Wildlife,
- Fish,
- Air quality,
- Archaeology and heritage,
- Land use,
- Traffic,
- Noise, vibration, and lighting,
- Human health,
- Visual aesthetics, and
- Reclaimed water use.

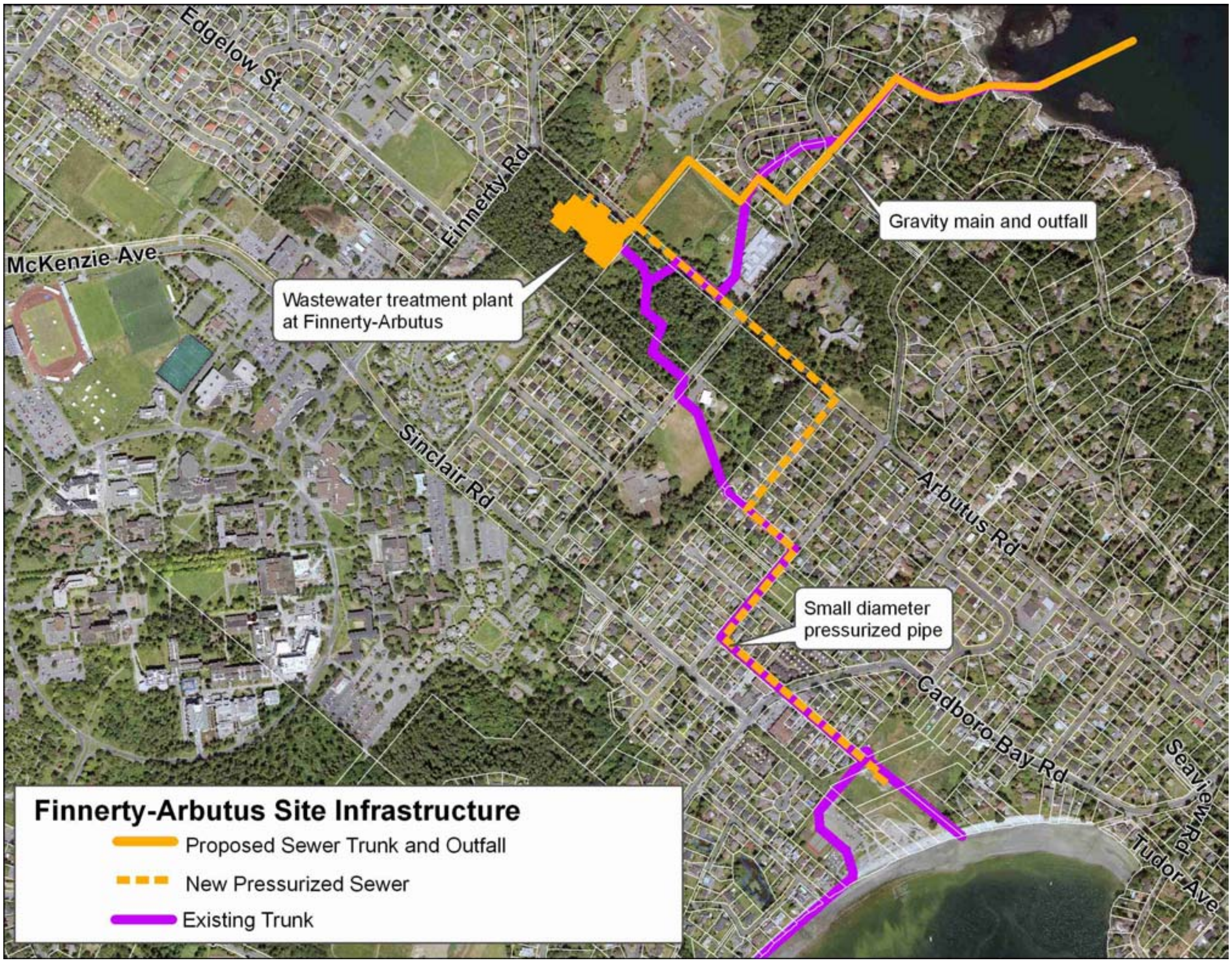

Figure S-1. Location of proposed Saanich East wastewater treatment facility and infrastructure

Potential impacts were identified for both the treatment facility and ancillary facilities required for the operation of the facility, including gravity mains, forcemains, and a small diameter pressurized pipe.

An EIS of the marine outfall and effluent discharge will be prepared and submitted under separate cover.

The methods applied in conducting the study are described in detail in Section 4. In general terms, the EIS is based on:

- a review of available literature on wastewater facility construction and operation,
- field inspections of the candidate site, ancillary facility routes, and surrounding areas,
- comments received from the public through surveys and discussions at open houses and dialogue sessions,

- analysis of plans and reports prepared by municipalities and major institutions covering land use, environmental, and other topics,
- discussions with CRD staff, staff of local governments and major land-owning institutions, and direction provided by the CALWMC.

The Saanich East facility will have the following treatment activities:

- influent pumping,
- screening and grit removal,
- primary treatment,
- secondary and tertiary treatment (membrane bioreactors or MBR), and
- disinfection (ultra violet and hypochlorite for the reuse component).

The Saanich East facility will produce reclaimed water of sufficiently high quality to be used for non-potable purposes. The facility also will allow heat energy to be recovered from effluent, for use in suitable structures nearby. The distribution and use of reclaimed water and recovered energy are discussed further in the *Core Area Wastewater Treatment Program Effluent Reuse and Heat Recovery for the University of Victoria and Surrounding Area* (Stantec November 2009).

Construction impacts are examined separately from impacts of facility operation. Construction includes site clearing, grubbing, grading, excavation, foundation work, building construction, equipment installation and testing, commissioning of the facility, and landscaping or site restoration. Clearing and grubbing will be required for the Finnerty-Arbutus site. Operations include day-to-day functioning of the treatment facility and ancillary facilities, including routine maintenance.

Project-related impacts identified in the EIS are described according to their:

- spatial extent (area affected),
- temporal extent (duration),
- reversibility,
- magnitude, and
- significance.

Table S-2 summarizes the impact significance ratings for the various topics assessed.

Table S-1. Finnerty-Arbutus site – Significance of Impacts

Impact on:	Impact significance[1]							
	Treatment facility				Ancillary facilities			
	Construction		Operation		Construction		Operation	
	Unmitigated[2]	Mitigated[3]	Unmitigated[2]	Mitigated[3]	Unmitigated[2]	Mitigated[3]	Unmitigated[2]	Mitigated[3]
Geotechnical hazards	L	L	L	L	L	L	L	L
Hydrology and water quality	L	L	L	L	L	L	L	L
Vegetation	S	S	L	L	L	L	L	L
Wildlife	S	S	L	L	L	L	L	L
Fish	L	L	L	L	L	L	L	L
Air quality	L	L	S	L	L	L	L	L
Archaeology and heritage	TBD	TBD	L	L	TBD	TBD	L	L
Land use	S	S	L	L	L	L	L	L
Noise, vibration, and lighting	L	L	L	L	L	L	L	L
Traffic	L	L	L	L	L	L	L	L
Human health	L	L	L	L	L	L	L	L
Visual aesthetics	S	S	S	L	L	L	L	L

S =	Significant	The identified effect would have characteristics that render it unacceptable to the public, regulators, other interests, or that exceeds standards or contravenes legal requirements.
L =	Less than significant	Effects that are not considered significant.
N/A =	Not applicable	
TBD =	To be determined.	Before construction begins, an Archaeological Impact Assessment will be completed on the site and ancillary facility sites to evaluate significance.

1. The text of the EIS explains the basis for the ratings assigned, and describes the mitigation measures needed to reduce impacts to less than significant levels. Definitions of the terms used in significance ratings can be found in Table 4-1.
2. For the unmitigated impacts, no additional mitigation measures are implemented beyond following standard operating procedures and the actions outlined in the project description.
3. The mitigated impacts include additional mitigation measures, outlined in the EIS, which will further reduce or avoid adverse effects.

Key findings of the EIS are:

- The application of standard design, construction, and operational practices will reduce impacts on traffic, air quality, and human health at the Saanich East facility to less than significant levels.
- Construction of the Saanich East facility will result in significant impacts to vegetation, wildlife, community use, and visual aesthetics. Mitigation will reduce all of these impacts to less than significant levels during facility operation.
- The Saanich East treatment facility operation has the potential to occasionally release odours under the existing project design. Augmenting the levels of treatment and ensuring backup systems are installed will reduce odour impacts to less than significant levels at all times.
- Visual aesthetic impacts of the facility can be reduced to less than significant levels by improving design quality of the treatment facility, and reducing visibility of the facility from surrounding properties. Once screening vegetation matures, the significance of visual impacts is reduced.
- Archaeology impacts cannot be determined until an Archaeological Impact Assessment (AIA) is conducted on the site. Under British Columbia legislation, a proponent is required to mitigate a project's impacts on identified archaeological features. Complying with this requirement reduces impacts to less than significant levels.

Construction and operation of treatment and ancillary facilities will result in environmental and social impacts, nearly all of which can be effectively mitigated. The nature of the impacts and recommended mitigation measures are described in the EIS. The less than significant impacts of building and operating wastewater treatment facilities need to be considered in the context of the significant improvements in the quality of effluent released into the marine environment resulting from the CRD's Core Area Wastewater Treatment Program.

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1.0 INTRODUCTION

The Capital Regional District (CRD) has provided wastewater treatment services for communities in the region for decades. Operating under permit from the British Columbia Ministry of Environment (MOE), the CRD currently discharges screened wastewater from core area municipalities into the deep marine waters of the Strait of Juan de Fuca.

In 2006, the British Columbia Minister of Environment directed the CRD to begin planning to provide a higher level of wastewater treatment for the core area municipalities. Subsequently, the province requested the CRD to consider resource recovery as part of its wastewater treatment program planning.

The Core Area Liquid Waste Management Committee (CALWMC) has authorized staff and consultants to undertake a variety of planning studies associated with wastewater treatment technology, resource recovery and reuse, and facility siting. This work was initiated in 2006.

An Environmental Impact Study (EIS) is required by the MOE as part of the Liquid Waste Management Plan amendment process. An EIS is required for the entire Core Area Wastewater Treatment Program, and is to examine both the marine and terrestrial environments. This report presents the EIS for the terrestrial environment. The terrestrial EIS covers facilities in the Saanich East area; other facilities will be subject to assessment as their sites and technologies are chosen. An EIS for the marine environment will be presented under separate cover.

The Ministry of Environment identified the following six objectives for wastewater treatment in a letter to the CRD dated December, 2007.

- *Objective 1: Meet regulatory standards*
- *Objective 2: Minimize total project cost to taxpayers*
- *Objective 3: Optimize the distribution of infrastructure*
- *Objective 4: Reduce greenhouse gas emissions*
- *Objective 5: Optimize smart growth strategies*
- *Objective 6: Examine opportunities for public-private partnerships.*

On June 12, 2008, the CRD provided a plan to the Ministry of Environment on how these objectives will be met entitled *Core Area Wastewater Management Program – Program Development Phase – Report to the Minister of Environment* (Associated Engineering *et al.* June 2008). In this plan, the CRD adopted a series of goals and accompanying strategies for wastewater management. The three goals are:

- *protect public health and the environment,*
- *manage wastewater in a sustainable manner, and*

- *provide cost effective wastewater management* (*Ibid*).

The core area includes seven municipalities: Colwood, Esquimalt, Langford, Oak Bay, Saanich, Victoria, and View Royal (Figure 1-1). The CRD wastewater treatment program aims to find optimum locations and construct the following facilities:

- a Saanich East secondary treatment facility that will perform liquids treatment, provide an opportunity to recover energy from wastewater, and produce reclaimed water suitable for irrigation, toilet flushing and other uses,
- a pump station at Clover Point that will pump three times the average dry weather flow (ADWF) at this location to McLoughlin Point for secondary treatment,
- a wet weather primary treatment facility at Clover Point for flows up to four-times ADWF,
- a treatment plant at McLoughlin Point that will provide primary treatment for flows up to four-times ADWF and secondary treatment for flows up to two-times ADWF, and membrane bioreactor and UV treatment for the effluent to be reclaimed for irrigation and toilet flushing,
- a biosolids processing and resource recovery facility at an upper harbour industrial site or at Hartland Landfill for sludge transported from the McLoughlin Point facility, and
- a West Shore secondary treatment facility, which is currently being planned in collaboration with Colwood and Langford and will be the subject of further study in 2010.

The purposes of the EIS are to:

- describe the location and type of wastewater treatment facilities in the Saanich East area,
- assess the potential environmental effects of facility construction and operation, and
- recommend mitigation measures to avoid or reduce project effects.

Section 2 of this report describes the proposed project, including the existing infrastructure, proposed development, project schedule, and regulatory requirements. Section 3 describes the process used to select facility sites, short-lists of candidate sites, and public involvement. Section 4 presents the project description for the Saanich East facility. Section 5 describes the study methods used to assess project effects. Section 6 describes the site conditions, potential project effects, and proposes mitigation measures to reduce or avoid adverse effects. Section 7 presents the cumulative effects assessment. Section 8 recommends mitigation measures, an Environmental Protection Plan, and confirms the CRD's commitment. Section 9 describes the expertise of the preparers of the report. Section 10 presents a list of references used in the study.

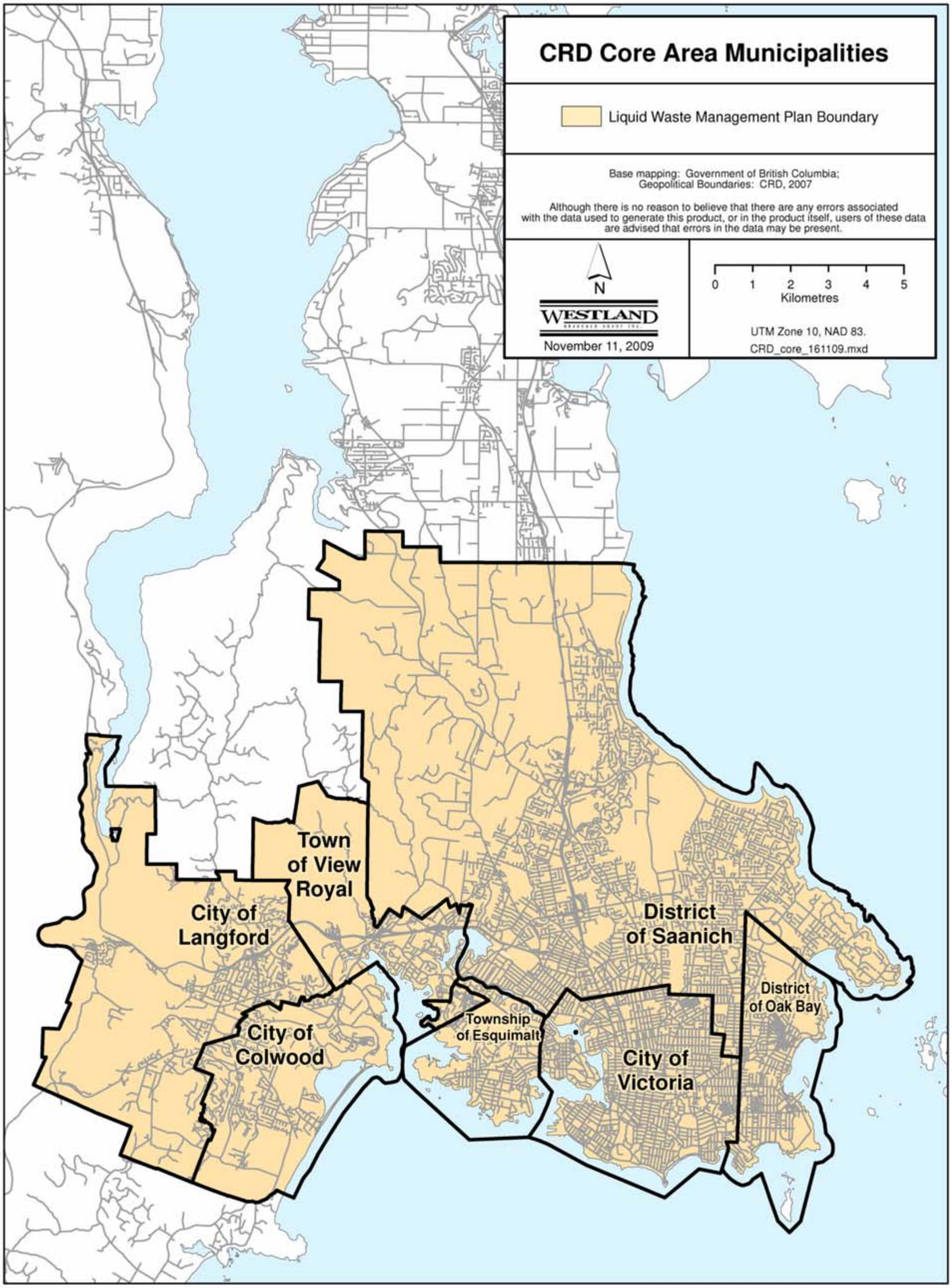


Figure 1-1. Core area municipalities

2.0 WASTEWATER TREATMENT IN THE CORE AREA

This section describes the existing municipal and regional sewer infrastructure in the core area, sources of wastewater, design considerations such as population growth, the Saanich East facility project schedule, and relevant local, provincial, and federal regulatory requirements.

2.1 Existing infrastructure

The Capital Regional District (CRD) operates two major trunk sewerage systems in the core area. These trunks terminate at the major pump stations and outfalls at Clover Point and Macaulay Point. The trunk systems include several pump stations, minor lift stations, and wastewater bypass locations, shown on Figure 2-1.

The collection and conveyance of sewage to a CRD trunk line is a municipal responsibility. The authority of the CRD to operate the trunk sewers and sewage disposal facilities, including the responsibility to acquire, design, construct, operate, maintain, renew, and administer trunk sewers and sewage disposal facilities, was a function under the 1975 Supplementary Letters Patent and was converted to a service operated under a bylaw through the adoption of Bylaw No. 2312 on 14 August 2002. The service operated under Bylaw No. 2312 would encompass energy and resource recovery options arising from sewage treatment and disposal, together with all sewage treatment and biosolids management processes. Through Supplementary Letters Patent issued to the CRD on 1 June 1978, the CRD was granted the function of septage disposal.

Municipal systems

The age, condition, and extent of sewage collection systems varies among municipalities. Many sewers in portions of Victoria, Esquimalt, and Oak Bay date back to the early 1900s. Sewers in Saanich are generally much newer, having mainly been installed since the 1960s. The Town of View Royal's sewer system was constructed in the late 1970s. Few areas in these core municipalities remain unsewered, with the exception of areas of View Royal and Saanich. The general layout of the existing infrastructure is shown in Figure 2.1.

Beginning in the late 1990s, developments in Colwood and Langford were able to connect to a new regional sewer system. The sewer mains convey wastewater via the north west trunk to Macaulay Point pump station and outfall. Many homes in Colwood and Langford remain served by onsite septic systems. In future years, the municipalities plan to connect all developments to the community sewer system.

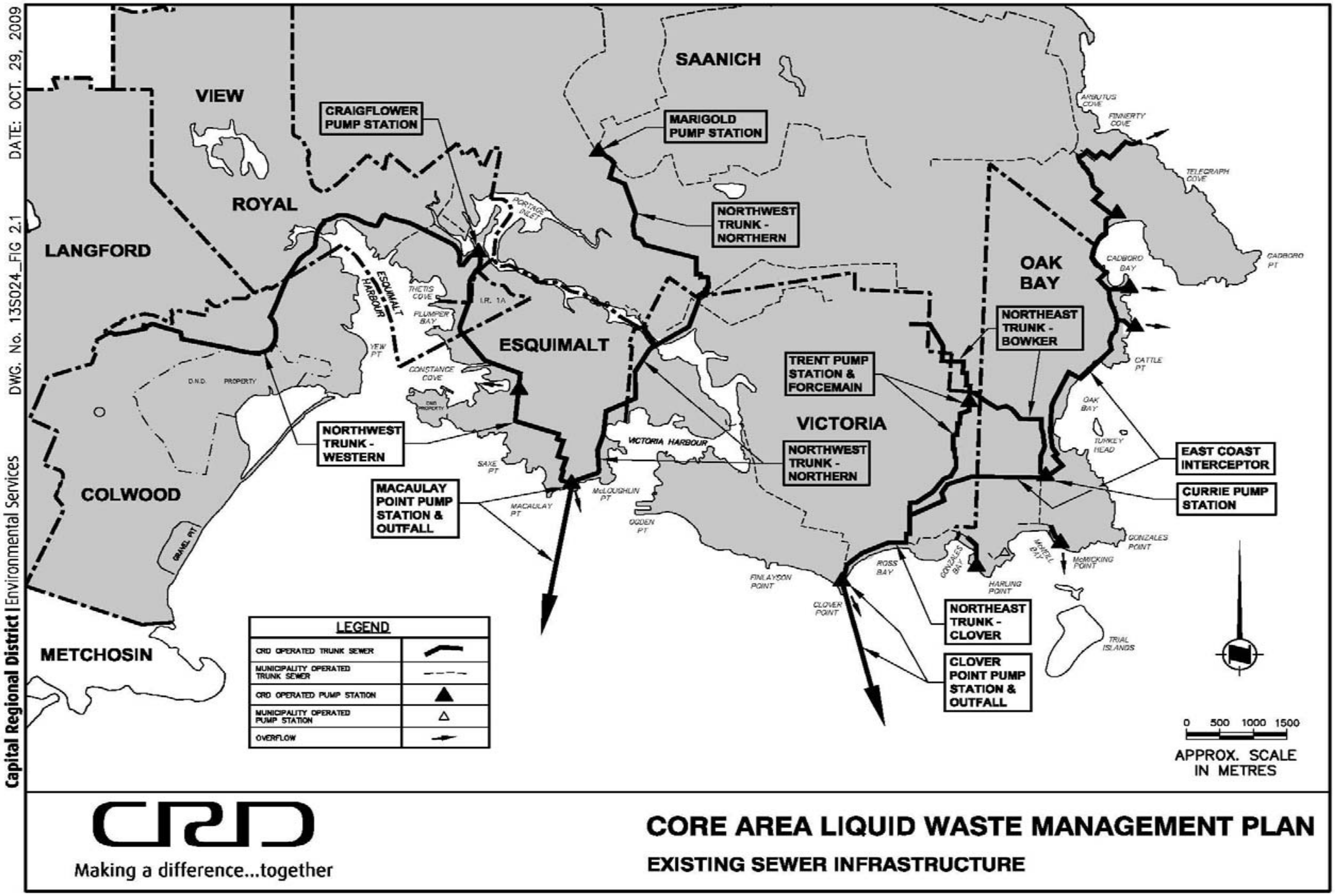


Figure 2-1. Existing sewer infrastructure in the core area

Regional systems

Northwest trunk sewer - Macaulay Point outfall

The northwest trunk sewer serves the Colwood, Esquimalt, Langford, and View Royal municipalities, the Vic West area of Victoria, and most sewered areas of the District of Saanich. The first section of the northwest trunk sewer was completed by the City of Victoria in 1917. This section extended from the Gorge waterway to Macaulay Point. The original trunk sewer was rebuilt and extended north of the Gorge waterway into Saanich in the early 1970s. A separate branch of the sewer line was constructed west to serve Esquimalt and View Royal and extended in 1997 to serve Colwood and Langford.

The Macaulay Point pump station and outfall were completed in 1971. The 900 mm diameter Macaulay Point outfall, the terminus of the northwest trunk sewer, extends off Macaulay Point a distance of 1.7 km off-shore, discharging an average annual flow of 44,000 m^3 of screened sewage per day (2008 average) at a depth of 60 m below sea level. Wastewater is discharged uniformly through 28 ports located along a 150 m long diffuser at the end of the outfall. A 336 m long emergency bypass outfall is used when the pump station's capacity is exceeded.

The Macaulay Point pump station, located at the head of the outfall, provides the pressure necessary for the outfall operation. In 1989, fine screens were installed in the station to remove sewage solids, plastic, and floatable materials larger than 6 mm. The screenings are transported to Hartland landfill twice weekly for disposal. The Marigold peak flow storage tank, completed in 2003, was added to the regional system to address capacity deficiencies in the northwest trunk and to attenuate wet weather overflows from that system.

East coast trunk sewers - general

In the past, the conveyance and disposal of wastewater on the south and east coast of the region was done on a local basis by the municipalities of Oak Bay, Saanich, and Victoria. Prior to 1992, sewage was discharged through a short outfall at Clover Point. The northeast trunk sewer, originally discharging at McMicking Point in Oak Bay, is another old system dating back to early 1900s. This trunk sewer was jointly built by the City of Victoria and District of Oak Bay. Some Saanich sewers, constructed to meet housing demand in the Shelbourne and Gordon Head areas in the 1960s and 1970s, were connected to an outfall at Finnerty Cove, and others were diverted to the northeast trunk. In Oak Bay, local sewer systems discharged to short outfalls at Humber Road and Rutland Avenue in the Uplands area and to small outfalls in the Harling Point area.

The CRD, with the cooperation of the municipalities, worked to reduce the number of small outfalls along the east coast of the core area. The east coast interceptor trunk sewer, completed in 1992, eliminated the discharge of sewage at all of the locations mentioned, except during periods of heavy rainfall. Flow from the east coast interceptor is pumped to Clover Point where it combines with additional flow from Victoria. In 1980, the CRD constructed the Clover Point pump station and deep water marine outfall to serve the eastern portions of the core area.

East coast interceptor sewer system

The east coast interceptor sewer system was fully operational in January 1992. The 10 km sewerage conveyance system intercepts flow from the Finnerty Cove outfall in the District of Saanich, from the Penrhyn lift station serving Cadboro Bay in Saanich, from Humber and Rutland outfalls in Oak Bay, and flow from Victoria, Oak Bay, and Saanich that was previously discharged at McMicking Point. The Currie Road pump station in Oak Bay redirects the wastewater from the east coast to the Clover Point pump station.

The Trent peak flow pump station and forcemain were added to the system in 2007 and 2008 to divert peak flows away from the old, overloaded northeast trunk. The northeast trunk had frequently overflowed unscreened sewage into Bowker Creek and into Oak Bay at the Broom Road overflow.

Clover Point pump station and outfall

At Clover Point, as at Macaulay Point, the sewage is screened to eliminated objects larger than 6 mm prior to discharge to the outfall. The 1100 mm diameter outfall extends 1.1 km offshore from Clover Point, terminating in a diffuser 196 m in length at a depth of 67 m. The average daily sewage flow discharged at the outfall was 50,000 m^3 per day in 2008. The pump station has installed standby power to maintain station functions during power failures. A 330 m emergency bypass outfall is used when station capacity is exceeded.

Septage disposal

Septage, the waste material removed periodically from residential and commercial septic tanks or sewage holding tanks, is discharged to a privately owned and operated septage receiving facility in Langford. The septage is treated at the facility to comply with CRD source control requirements prior to discharge to a municipal sewer, which is connected through the northwest trunk sewer system to the Macaulay Point outfall.

Federal systems

The Department of National Defence (DND) operates wastewater collection systems at CFB Esquimalt properties (Naval dockyard, Naden area, Work Point barracks) that connect directly to municipal or regional sewerage systems. DND also operates sewage collection systems that serve the Belmont Park subdivision and DND operations in the Esquimalt Lagoon area. These systems, which previously incorporated septic tank treatment and effluent discharge to a marine outfall at Coburg Peninsula, are now diverted to the North West trunk and the Macaulay Point outfall.

In Esquimalt, wastewater collection systems in Songhees Indian Reserve and Esquimalt Indian Reserve discharge to municipal or regional sewerage systems.

Private systems

In addition to the CRD marine discharges at Macaulay Point and Clover Point, the Ministry of Environment has issued several permits for sewage discharge in the core area. These permits are primarily for ground discharge of effluent in quantities exceeding 22,730 litres per day following treatment in septic tanks or secondary treatment plants, and serve subdivisions, schools, golf course clubhouses, and hospitals. Since the extension of the trunk sewer system into Colwood and Langford, many of these facilities are now connected to sewers.

The Dockside Green development in the City of Victoria has its own sewage collection system, on-site sewage treatment plant, and point of discharge to the harbour. The development uses a membrane filtration plant with nitrogen and phosphorus reduction to produce high quality reclaimed water. This non-potable water is used for toilet flushing, irrigation, and a landscape feature on the property. The reclaimed water and stormwater runoff from the development discharges to Victoria Harbour near the Point Ellice Bridge.

2.2 Design considerations

The proposed CRD core area wastewater system will be designed to convey and treat wastewater from:

- residential populations,
- industrial, commercial and institutional (ICI) sources, and
- infiltration and inflow (I&I).

Information regarding each of these contributors is provided in the following sections, along with discussion of how appropriate I&I reduction and water conservation programs can reduce these flows.

The design flows listed in this section will serve existing populations, businesses, and institutions, with a modest allowance for growth, and will reflect commitments to effective water conservation and I&I reduction programs.

Residential populations

Information to estimate existing and future populations was obtained from municipal Official Community Plans and CRD regional planning population projections Table 2-1.

Table 2-1. Estimated CRD total population (sewered and unsewered)

	2006 Population	Avg. Annual Growth Rate (2006-2015)	2015 Population	Avg. Annual Growth Rate (2015-2045)	2045 Population	Avg. Annual Growth Rate (2045-2065)	2065 Population
Oak Bay	18,059	0.1%	18,222	0.1%	18,777	0.1%	19,175
Victoria	78,659	1.0%	86,028	0.5%	99,913	0.1%	102,032
Esquimalt	17,407	0.5%	18,206	0.5%	21,145	0.1%	21,593
Saanich	110,737	0.5%	115,821	0.5%	134,515	0.1%	137,368
View Royal	8,375	2.0%	10,009	1.5%	15,645	1.0%	19,280
Colwood	15,470	2.0%	18,488	1.5%	28,698	1.5%	39,506
Langford	22,229	5.1%	32,462	2.9%	60,851	1.5%	81,958
Total	**270,936**		**299,236**		**379,544**		**420,912**

Source: CRD, December 2009

Table 2-1 presents total estimated populations, both sewered and unsewered. In Oak Bay, Victoria, and Esquimalt, the total and sewered populations are essentially the same. Colwood, Langford, View Royal, and Saanich have substantial unsewered populations, but with the exception of Saanich, the unsewered populations are expected to be serviced by 2030.

Industrial, commercial, and institutional wastewater

Discussion paper 033-DP-1 (Kerr Wood Leidal January 2009) provides estimates of wastewater generation based on population equivalents of industrial, commercial, and institutional development in the core area.

Infiltration and inflow

The third contributor to wastewater quantities, in addition to flows from residential populations and industrial, commercial, and institutional sources, is infiltration and inflow (I&I) of stormwater into sanitary sewer systems. I&I becomes significant during wet weather cross-linkages and tends to increase as residential storm sewers and wastewater systems age. Climate change may result in increased winter rainfall, with a related potential increase in I&I rates.

The municipalities and the CRD will need to invest sufficiently in aging wastewater systems to fully compensate for the effects of infrastructure decay. It is estimated that about 1% of the replacement cost of existing systems will need to be invested annually to respond adequately to the need to reduce I&I..

Water conservation

Since water conservation programs were introduced by the CRD in the mid 1990s, the total annual water consumption per capita has decreased by approximately 8% (CRD 2009). CRD water conservation programs target residential, industrial, commercial, and institutional users, and include rebates, school programs, education, bylaws, publications, and audits.

Design wastewater flows

Design wastewater flows are derived from flows from residential populations, industrial, commercial, and institutional sources, and flows resulting from infiltration and inflow of surface water and ground water into the sanitary sewer systems. Schedule 3 of the *Municipal Sewage Regulation* (MSR) requires that, for discharges to open marine waters, secondary treatment be provided for daily flows up to two times the average dry weather flow (ADWF) and primary treatment for flows greater than this. ADWF is defined in the MSR as “the daily municipal sewage flow to a sewage facility that occurs after an extended period of dry weather such that the inflow and infiltration has been minimized to the greatest extent practicable.”

Based on the foregoing parameters, Table 2-2 presents the proposed levels of treatment for dry weather and wet weather flows at the Saanich East wastewater treatment facility (see the *Core Area Liquid Waste Management Plan Amendment No. 7* for the design flows for the other wastewater treatment facilities).

Table 2-2. Saanich East design hydraulic flows

Item	2030		2065	
	Flow (ML/d)	Treatment	Flow (ML/d)	Treatment
ADWF	16.6		17.2	
1.75 x ADWF	29.0[1]	Secondary	30.1	Secondary (MBR)
1.75 to 4 x ADWF	37.4	Primary	43.0	Primary
Filtration for Reuse	29.0	≈12 MLd guaranteed[2]	30.1	≈12 ML/d guaranteed
Biosolids		Discharge to downstream treatment		Discharge to downstream treatment

Source: CRD, December 2009

[1] By combining the 1.75 x ADWF of high quality MBR effluent with 0.25 x ADWF of primary effluent, the secondary treatment requirement for 2 x ADWF can be met.

[2] The amount of highly treated reuse water that can be always available is something less than the ADWF.

2.3 Project schedule

Table 2-3 presents a project schedule for the Saanich East wastewater treatment program. The design phase of the Saanich East treatment facility is expected to begin in 2010. By the end 2010, treatment facility construction will begin. The facility will be fully operational before the end of 2013.

Table 2-3. Project schedule

Task	**2010**				**2011**				**2012**				**2013**	
	Q1	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**
Federal permits (outfall only)														
Treatment facility design														
Outfall design														
Treatment facility construction														
Pump station and ancillary facility construction														
Outfall upgrade														
Overall system commissioning														
Facilities operational														

2.4 Regulatory requirements

The CRD is required to complete an Environmental Impact Study (EIS) as part of the Liquid Waste Management Plan Amendment, as stated in the Minister of Environment's letter dated 14 December 2007. An EIS assesses the extent to which the proposed treatment facility or use of reclaimed water will affect human health and the environment.

The Saanich East facility is subject to local bylaws, zoning, permits, and building codes in the District of Saanich. The Finnerty-Arbutus site is currently zoned for residential use, so rezoning and an Official Community Plan (OCP) amendment will be required before a wastewater treatment facility can be constructed on the site. A building permit also will be required. The CRD will work with the District of Saanich to ensure that the facility complies with local regulations.

The Saanich East facility may be subject to the *Canadian Environmental Assessment Act (CEAA)*. The CRD communicates regularly with the Canadian Environmental Assessment Agency to ensure that the facility complies with federal environmental laws. A *CEAA* study may be required. No federal permits are likely to be required for construction of the terrestrial portion of the facility.

3.0 SITE SELECTION

In 2007, the CRD began the process of selecting sites for wastewater treatment facilities in the core area. The CRD sought sites for wastewater treatment facilities that minimize adverse environmental and community effects. The entire core area was investigated to develop a database for evaluating treatment facility feasibility and siting. This work involved collecting and analyzing geotechnical, ecological, archaeology, heritage, and land use information. These topics were studied as they relate to the technical aspects of facility operation, cost, energy consumption, resource recovery, effluent discharge, and effect on adjacent neighbourhoods.

The following criteria were applied in the search for suitable sites:

- archaeological and heritage features are avoided
- existing and planned land uses are compatible
- surficial material, seismic and liquefaction risk, and site drainage and stability are suitable for facility construction and operation
- gravity rather than pumps can be used to transport effluent, thereby conserving energy
- adverse effects on sensitive or important habitat are avoided
- reclaimed water and recovered energy can be used nearby
- parcel size is adequate for a facility to serve treatment needs to 2065
- housing, institutional structures, and school playgrounds are avoided.

The Technical and Community Advisory Committee (TCAC), the Core Area Liquid Waste Management Committee (CALWMC), First Nations, and the general public were involved in developing the foregoing criteria. The public was engaged through telephone surveys, the CRD website, and newspaper advertisements.

Databases of land use, environment, and community characteristics in Saanich East-North Oak Bay were developed specifically for the wastewater treatment program. Field work was conducted on the ecology, archaeology, geology, and land use in the study area. Based on these studies, a short list of candidate sites was developed for Saanich East-North Oak Bay. The findings were discussed with property owners of suitable sites, and with First Nations.

Following meetings with the property owners of high-potential lands, three candidate sites were identified for further study, presented to the CALWMC in April 2008, and approved for further investigation:

- Finnerty-Arbutus,
- UVic Fields, and

- Cedar Hill Corner (Figure 3-1).

The candidate sites in Saanich East-North Oak Bay were presented to the public through a series of open houses, information brochures, and workshops.

The CRD developed an Environmental and Social Review (ESR) process to identify project construction and operation impacts of the Saanich East-North Oak Bay facility and to develop mitigation measures. The ESR evaluated potential social and environmental effects of constructing and operating a treatment facility on each of the sites. The significance of the impacts was determined, and mitigation measures were recommended to avoid or reduce potential adverse effects. Results of the ESR were shared with First Nations and the public. Comments received at open houses, meetings, community workshops, and through the CRD website were incorporated in revisions to the ESR report.

After the ESR was completed for the Saanich East-North Oak Bay candidate sites, a Triple Bottom Line (TBL) analysis was performed to weigh social, environmental, and economic considerations. The TBL results were also subject to public and First Nations review, and were discussed with the Core Area Liquid Waste Management Committee and the Technical Community Advisory Committee. Revisions to the TBL report reflected comments received on the draft. The results of the TBL and ESR reports, combined with other information, were used to assist the CALWMC in choosing a location for a facility in Saanich East-North Oak Bay.

After review by the public and consideration by the CALWMC, the Finnerty-Arbutus property was determined to have the best balance of environmental, social, and economic performance. Hence, for the purposes of this EIS, the Finnerty-Arbutus property is considered to be the site for the Saanich East wastewater treatment facility.

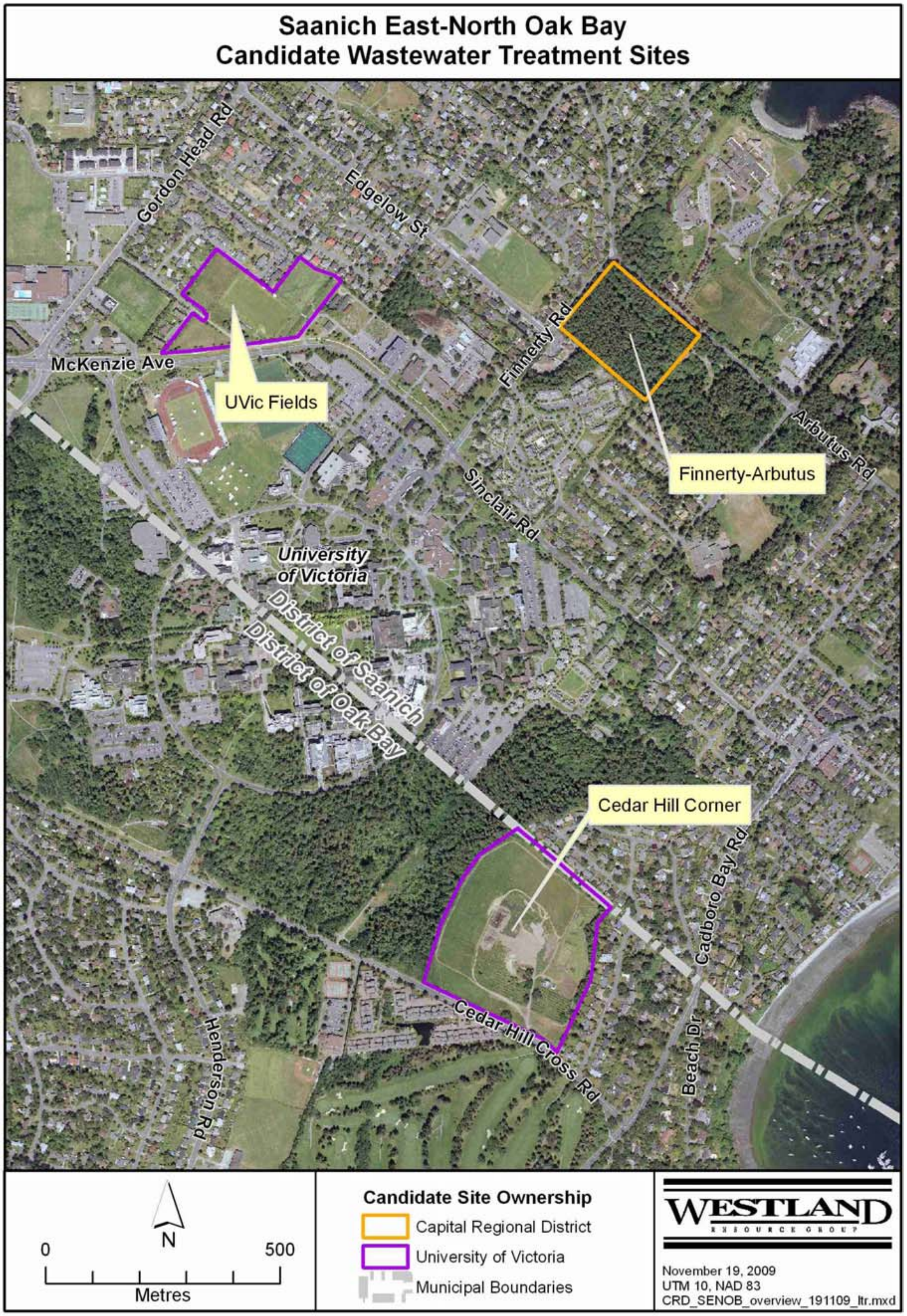


Figure 3-1. Candidate wastewater treatment sites in Saanich East-North Oak Bay

Conveyance connections and outfall

The conveyance pipe routes associated with the Saanich East facility (Figure 4-3) were selected to minimize the length of pipes and, where feasible, use existing roads and rights-of-way.

A gravity main to connect the treatment facility to the outfall will be constructed in existing and new rights-of-way. The main will be located underground across a field on the Queen Alexandra Foundation property and in an existing right-of-way on a residential property. It will then be installed beneath the roadway of Alpine Crescent, Haro Road, and Monarch Place. The gravity main will be installed in an existing right-of-way across four residential properties before reaching the existing outfall location in Finnerty Cove.

A small diameter (204 mm) pressurized pipe will be constructed to connect the Penrhyn pump station in Cadboro Bay to the Finnerty-Arbutus site. The new pipe will carry sewage from Ten Mile Point and Cadboro Bay areas of Saanich. The pipe will be located entirely under existing roads, including Penrhyn Street, Hobbs Street, Maynard Street, Rowley Street, and Arbutus Road.

The existing outfall in Finnerty Cove will be extended south east into Haro Strait at least 1500 m from mean low water and to a depth of at least 30 m below mean low water approximately located as shown in the *Core Area Liquid Waste Management Plan Amendment 7* (CRD December 2009).

Public involvement

Public meetings gave the CRD an opportunity to share important information on the site selection and impact assessment processes with the public, and to describe technical details about wastewater treatment. Public involvement programs also allowed and encouraged the public to express their specific concerns and ideas. The content and analyses in this EIS have been influenced by the concerns and priorities expressed by the public.

Since 2004, the CRD has conducted a variety of public involvement activities on the wastewater program. In the fall of 2007, the CRD sought public comment on the site selection criteria for wastewater treatment facilities through advertisements, web input, and a random telephone survey of core area residents. In 2008, site selection analysis, engineering studies, and reports to the Ministry of Environment were prepared, refining the elements of the wastewater program.

In 2009, the CRD hosted open houses and workshops to provide opportunities for the public to obtain information and to comment on the wastewater treatment program and the site selection process (Table 3-1).

Table 3-1. Neighbourhood open houses and workshops, Saanich East-North Oak Bay

Date	Time	Location
Open House: Tuesday, June 16, 2009	3:00-8:00 pm	*Gordon Head Neighbourhood* Gordon Head United Church 4201 Tyndall Avenue
Open House: Wednesday, June 17, 2009	3:00-8:00 pm	*Cadboro Bay Neighbourhood* Cadboro Bay United Church 2625 Arbutus Road
Open House: Friday, June 19, 2009	3:00-8:00 pm	*Oak Bay Neighbourhood* Emmanuel Baptist Church 2121 Cedar Hill Cross Road
Meeting-Workshop: June 22, 2009	6:30-9:00 pm	Queenswood Centre at 2494 Arbutus Road
Meeting-Workshop: July 7, 2009	6:30-9:00 pm	Emmanuel Baptist Church 2121 Cedar Hill Cross Road
Meeting-Workshop: July 9, 2009	6:30-9:00 pm	Queenswood Centre at 2494 Arbutus Road

Attendees at the open houses discussed the project with CRD staff and consultants, and had opportunities to complete comment forms that contained six open-ended questions on facility siting. The questions could also be answered online at the CRD's website, http://www.wastewatermadeclear.ca. Overall, 1000 people participated in regional processes, including 600 people in Saanich East-North Oak Bay.

The Saanich East-North Oak Bay workshops provided a forum for input and feedback on the candidate sites through facilitated discussions and large group questions and answers. Key points from those discussions were recorded on flipcharts. A detailed summary of the results of the public consultation program in Saanich East-North Oak Bay is presented in *Public Consultation Summary Report Saanich East-North Oak Bay Wastewater Treatment Facility Siting Core Area Wastewater Treatment Project* (J. Loveys July 22, 2009). The main areas of public concern are:

- community and property value impacts,
- public safety,
- environmental impacts,
- transparency of decisions, and
- siting and resource recovery opportunities.

Resource recovery

A study was completed to identify the potential demand for energy recovered from wastewater in the core area. This research was based on forecasting development in the years 2030 and 2065 using municipal Official Community Plans, the CRD's Regional Growth Strategy, and additional information collected from municipal and regional planners, developers, and institutional managers. Floor area ratios of residential, commercial, institutional, and other buildings were estimated, based on community plans, zoning bylaws, municipal staff discussions, and information from the British Columbia Assessment Authority. Using energy demand forecasts provided by BC Hydro, and the locations of hot water boiler heating systems, the future demand for energy was estimated and mapped in the core area. Using the resulting future energy demand and supply maps, the study team identified 38 energy recovery opportunity areas that have the greatest potential to use energy from wastewater for a portion of their space and water heat.

Major water users in the core area – golf courses, playfields, and large institutions – were mapped to identify potential areas where treated effluent could be used to supply non-potable water needs. Information from the energy demand and water reuse potential studies assisted in identifying suitable sites for wastewater treatment facilities.

4.0 PROJECT DESCRIPTION

This section presents a description of the treatment technology, construction, and operation of the proposed Saanich east facility and its associated ancillary facilities.

4.1 Treatment facilities technology and operations

The Saanich East facility will be a "liquid stream only" wastewater treatment facility. Dilute sludge from the secondary treatment process at the Saanich East treatment facility will be discharged into the existing CRD sewer system for further treatment at downstream facilities.

The Saanich East facility will provide the following levels of wastewater treatment and meet the stated quality standards for treated effluent.

Table 4-1. Saanich East facility treatment activities and effluent quality

Flow Range	Treatment Steps	Treatment level
0 to 1.75 times Average Dry Weather Flow (ADWF)	• Influent pumping • Screening and grit removal • Primary treatment • Secondary and tertiary treatment (membrane – bioreactors - MBR) • Disinfection (ultra violet and hypochlorite for the reuse component)	• Meets standards for effluent reuse and exceeds standards for discharge to a marine environment
Greater than 1.75 to 4 times ADWF	• Influent pumping • Screening and grit removal • Chemically assisted primary settling	• Meets standards for flows that exceed >2 times ADWF for discharge to a marine environment

Treatment units will be designed to achieve, the following standards for unrestricted reclaimed water use (per Schedule 2 and Schedule 5 Table 3 BC Reg. 321/2004 and 305/2007):

- biological oxygen demand (BOD5) <10 mg/L
- naphelometric turbidity units (NTU) < 2.

Standby facilities are required to meet reliability requirements for the Saanich East facility because facility shutdowns must be avoided. The Saanich East facility will be designed to provide treatment works:

- to produce a reclaimed water, or
- allow discharge of effluent to marine waters via an outfall.

The treated effluent that will be discharged to the marine environment through the Finnerty Cove outfall is only required to meet a provincial discharge objective of 45 mg/L BOD and 45 mg/L TSS, but typically it would be of a much higher standard because MBR technology is being used. All effluent slated for water reuse will meet the quality standards outlined in the *Municipal Sewage Regulation*, including disinfection with ultraviolet and hypochlorite.

The equipment and treatment units to be installed in the Saanich East treatment facility will comply with the process reliability standards set out in the British Columbia *Municipal Sewage Regulations*.

The treatment facility is proposed to be constructed in two stages. Stage 1 will be built between 2010 and 2012, and will see 75% to 90% of the ultimate membrane capacity constructed. The remaining 25% will be constructed in about 2030 (CRD March 2007). Secondary and tertiary treatment capacity for reclamation is to be provided for up to 1.75 times the ADWF or 29 ML/d for the year 2030. Primary treatment will be provided for flows to about 66.4 ML/d. Treated effluent not required for reclamation will be discharged through the existing Finnerty Cove outfall. This outfall will be extended to move the discharge point further offshore, pending results of marine studies presently underway. The outfall extension component of the Saanich East project will be assessed in the marine portion of the EIS.

The facility design is to be low profile and architecturally designed to fit with the surrounding neighbourhood. Components of the facility will be arranged and configured to suit the site.

A schematic diagram of major steps in the wastewater treatment process at the Saanich East facility is presented in Figure 4-1.

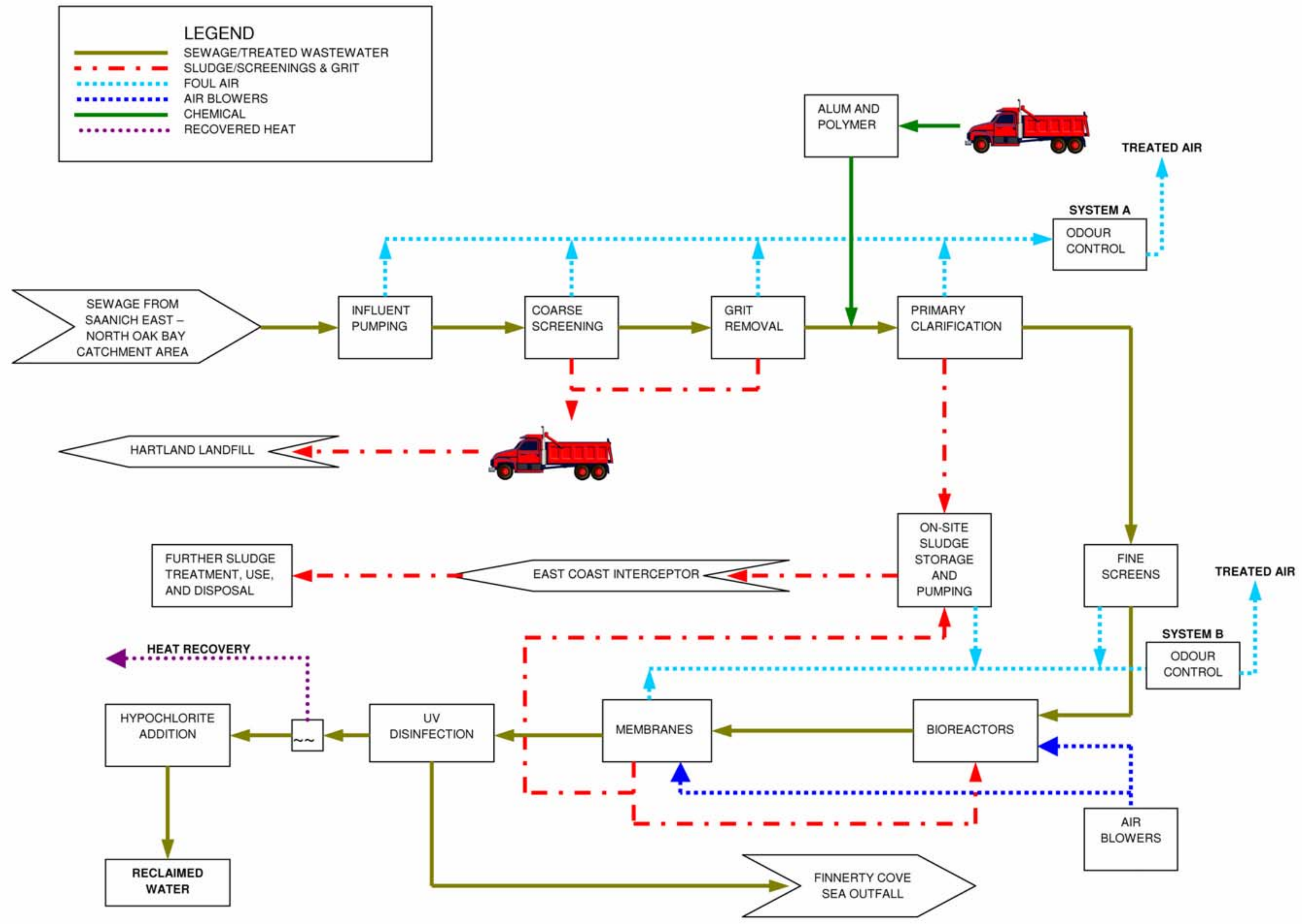


Figure 4-1. Saanich East treatment process schematic

Steps in the wastewater treatment process

Wastewater treatment at the Saanich East facility will involve:

- an influent pumping station (>69 ML/d),
- screening and grit removal of all wastewater flows (>69 ML/d),
- chemically-enhanced primary treatment for flows exceeding 1.75 times average dry weather flows (ADWF), (37.4 ML/d),
- secondary and tertiary treatment using Membrane Bioreactor (MBR) technology of wastewater volumes up to 1.75 times ADWF, or 29 ML/d,
- sludge (an average of 5.2 tonnes/day, and a range of 3.5 to 6.8 tonnes/day) discharge and conveyance in existing trunk sewers for downstream treatment, and
- unused treated effluent released to marine waters near Finnerty Cove via an upgraded and extended existing or replaced outfall.

The Saanich East wastewater treatment facility is planned to be constructed in two stages:

- Stage 1 construction (2010) to 75% to 90% of ultimate membrane capacity
- Stage 2 (2030) to 100% of ultimate capacity with the addition of membrane cassettes.

4.2 Treatment facility and ancillary facilities footprints

The Saanich East facility site on the corner of Finnerty Road and Arbutus Road is shown on Figure 4-2. The wastewater will be diverted into the treatment facility from the existing collection trunk sewer through a 20 m-long pipe, depending on the final location of the inlet structure of the treatment facility (Figure 4-3). The treated (unused) effluent will be discharged to the marine environment near Finnerty Cove through a 1,200 m-long gravity main and outfall. The screenings and grit will be transferred by enclosed truck for disposal to the Hartland Landfill site, which is approximately 18 km northwest of the Finnerty-Arbutus site. The sludge will be pumped or discharged by gravity to the East Coast Interceptor. Wastewater from the Penrhyn pump station (the Ten Mile Point and Cadboro Bay catchments) will be pumped to the Finnerty-Arbutus facility intake by a small diameter, 1,500 m long, forcemain.

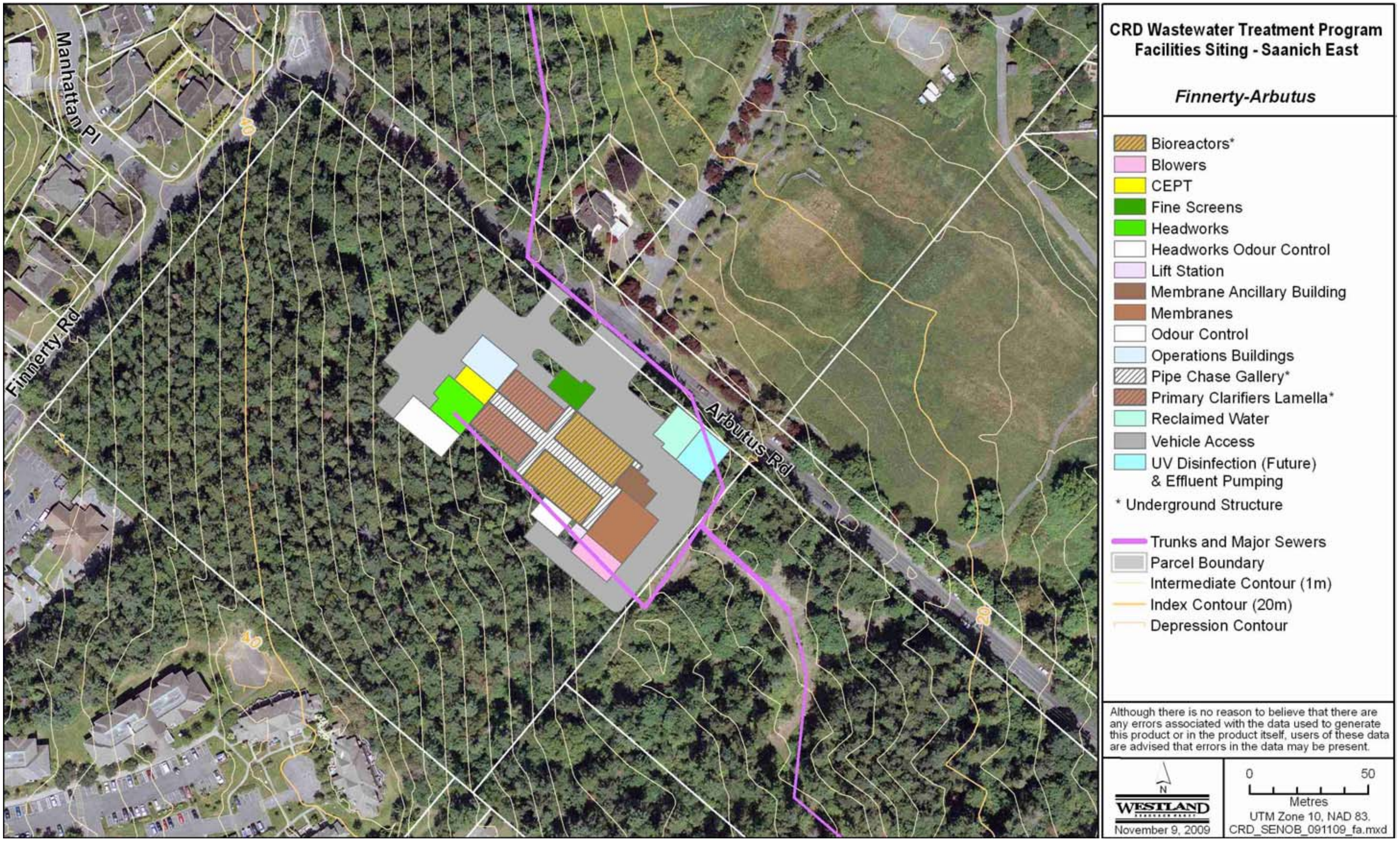


Figure 4-2. Finnerty-Arbutus facility conceptual layout

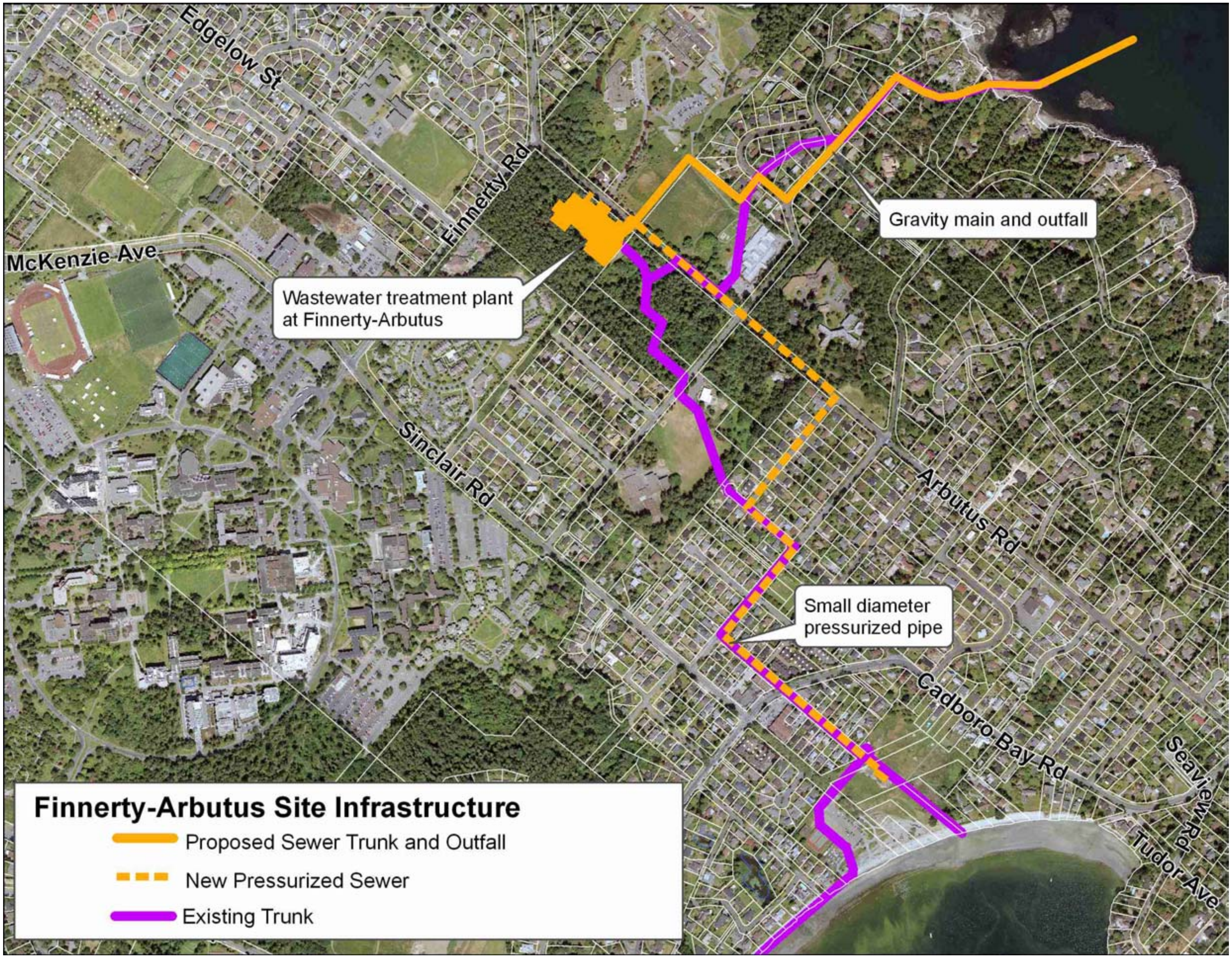


Figure 4-3. Finnerty-Arbutus facility infrastructure

4.3 Facility design description

The facility design involves the construction of several buildings and treatment tanks. The tanks will be located primarily below ground. The descriptions of the major facilities are as follows:

- **Headworks building**. This building will contain the grit removal and screening facilities. Foul air will be directed to an odour treatment system. The building height will be approximately 5 metres high.
- **Primary clarifiers**. These tanks will be mostly underground and will be covered to contain odours. Foul air will be directed to an odour treatment system.
- **Aeration tanks**. These tanks will be mostly underground and will be covered to contain odours. Foul air will be directed to an odour treatment system.
- **Membrane tanks**. These tanks will be entirely underground and will be covered.
- **Disinfection facilities**. This equipment will be contained in a building that will be approximately 4 metres high.
- **Blower building**. The blower building will be approximately 4 metres high.
- **Administration building**. This building will be the main plant structure, and will house offices, a laboratory, electrical rooms, and a small maintenance area. This building and other above ground buildings will receive a high degree of architectural treatment.
- **Standby generators**. The equipment will be housed in an outdoor kiosk. These generators will only operate during power outages or during scheduled maintenance of the facility.

4.4 Combined sewer and sanitary sewer overflows

Section 5 of *The Core Area Liquid Waste Management Plan Amendment* (CRD December 2009) outlines the CRD’s strategy for addressing inflow and infiltration (I&I) and combined sewer and sanitary sewer overflows. The goal of the CRD’s I&I program is to develop and implement a strategy aimed at reducing the amount of rainwater and groundwater entering the core area’s sanitary sewer system from both the publicly owned and privately owned parts of the system to reduce the frequency and magnitude of overflows.

The Capital Regional District and the participating municipalities commit to the following actions to reduce I&I sufficiently to reduce maximum daily wet weather flows to less than four times the average dry weather flow by 2030:

1. Continue flow monitoring in each municipality to further refine priority areas for remediation,

2. By the end of 2011, develop comprehensive inflow and infiltration management plans for the Core Area that will:

a identify and evaluate options and opportunities that promote the minimization of groundwater and rainwater inflow and infiltration into municipal sanitary sewer systems, including inflow and infiltration originating from service laterals (private and public sections of sewer connections),

b identify needed changes to legislation and legal authority to enable options and strategies,

c identify opportunities for the inspection of private sewers connected to municipal sewers:

  i. as part of the municipal process in evaluating and issuing renovation and building permits for serviced properties;

  ii. at the time of property transfer; or

  iii. other targeted inspections,

d require the repair or replacement of private sewers that have cross-connections between storm sewers and sanitary sewer or are identified as being in poor condition,

3. By the end of 2011, update and enforce sewer use bylaws to prohibit the construction of rainwater and groundwater connections to sanitary sewers, and
4. Implement the overflow reduction plans contained in the Sanitary Sewer Overflow Management Plan, which was submitted to the Ministry of Environment in June 2008.

4.5 Implementation of buffer zones

The treatment facility will be designed to be compatible with an urban residential neighbourhood. The Finnerty-Arbutus site is more than 100 m from the nearest residence. The treatment process equipment will be enclosed in buildings and the entire facility surrounded by fencing. Controls will be installed to ensure acceptable odour and noise levels at the fence line. With these measures in place, no buffer zones will be required.

4.6 Provisions for controlling adjacent development

The treatment facility will be designed to minimize effects on adjacent development. Use of adjacent properties will be controlled by District of Saanich zoning, subdivision, and building bylaws, development permits, and other controls. A rigorous technical review and public involvement process accompanies applications for rezoning or Official Community Plan amendments. Land adjacent to the Finnerty-Arbutus site is owned by the CRD, University of

Victoria, District of Saanich, and Queen Alexandra Foundation for Children. The CRD does not need to develop or implement additional provisions for controlling adjacent development.

4.7 Resource conservation and reuse opportunities

Resource conservation, such as using gravity rather than pumps to convey effluent, was one of the criteria used to select the Finnerty-Arbutus site. The elevation of the Finnerty-Arbutus site maximizes the use of gravity in conveying effluent to the facility and treated effluent to the outfall.

The CRD is involved in a joint investigation with the University of Victoria regarding the use of energy and recovered water from a treatment facility. The outcomes of the study may affect the design and operation of the treatment facility and the provision by the University of infrastructure to support resource recovery. Sludge from the Finnerty-Arbutus treatment facility will be transferred via pipeline to another treatment facility in the Core Area for further processing into biosolids.

4.8 Operations

Operations of the treatment facility include day-to-day activities at the treatment facility and pump stations, and routine maintenance of all facilities. This section provides information on transportation, traffic, noise, odour, and electricity consumption anticipated for the Finnerty-Arbutus facilities.

Screenings and grit removal

Transporting screenings and grit to Hartland landfill will require one truck every seven to eight days until 2030, and one every five to six days thereafter. This estimate is based on the following assumptions:

- 2 mm screen,
- 10.5 m^3 screenings per 100 ML treated, or 2 m^3 of screenings per day,
- 1.5 m^3 of grit removed per 100 ML of wastewater treated, or 0.3 m^3 of grit per day,
- Trucks have a capacity of 13 m^3.

Grit trucks will be enclosed to prevent spillage or odour.

Chemicals

Chemicals used in the treatment process will be largely inorganic materials such as acids, caustics, oxidizing chemical agents (alum, polymer), or compounds (mild acids) for cleaning the membranes. These chemicals will be delivered on weekly or less frequent basis in small to medium sized shipments (10-20 m^3) and stored at the treatment facility in secured, covered structures with containment features.

An estimated 200 to 400 mg/L of aluminum sulfate will be needed for chemically assisted primary treatment, requiring 5 to 11 trucks per year (4,500 L per truck).

Operational traffic

Table 4-2 summarizes the number of trucks required for screenings and chemicals for year 2020 and 2065 designs.

Table 4-2. Operational traffic for year 2020 and 2065 design

Material	Direction	2010-2030 operation	2030-2065 operation
Screenings and grits transferred to the Hartland Landfill site	Out	1.5+0.2 m^3/day (1 truck per 7 to 8 days)	2+0.3 m^3/day (1 truck per 5 to 6 days)
Chemicals--Alum	In	37.1 m^3/year (8.3 trucks per year for alum)	49.5 m^3/year (11 trucks per year for alum)

Note: A 13 m^3 closed box truck is assumed for screening and grit transporting. A 4,500 L container is assumed for Alum.

Servicing for the Penrhyn Pump Station will include scheduled site visits on a weekly basis and annual cleaning, except for unscheduled emergency attention. Sewers commonly require flushing on a rotational basis, which may be once every 5 years or more.

Sewer and outfall connections energy use

The energy requirements for the wastewater treatment facility are estimated to be 4 x 10^6 kWh/yr for an Average Dry Weather Flow (ADWF) of 17 ML/d. The energy use at the facility is high because of aeration needs and membrane operation.

Inflow connection to sites

Wastewater from Penrhyn pump station will be pumped to the Saanich East facility intake through a 1,500 m forcemain. With a 60 m elevation difference and associated hydraulic loss, the power requirement is about 50 kW.

A lift pump is required to divert wastewater from the East Coast Interceptor to the Saanich East facility. The wastewater will be diverted by pumping into the treatment facility at the site from the existing trunk sewer. Assuming a 4 m lift, the average power requirement is about 15 kW. Maximum power requirement for Peak Wet Weather Flow (PWWF) is about 60 kW. The additional energy requirements are about 150,000 kWh/yr.

Effluent discharge

The treated unused effluent will be discharged by gravity to the outfall through a 1,200 m forcemain and outfall. The outfall design will be confirmed through diffuser modeling studies in conjunction with the marine Stage 2 Environmental Impact Study (EIS) that is currently underway.

The elevation of the Finnerty-Arbutus site is 25 m above sea level. This elevation is anticipated provide sufficient head for gravity flow to the outfall and no pumping will be required.

Sludge discharge

The biological sludge produced during secondary and tertiary treatment at the treatment facility will be about 0.8 to 1.0% solids concentration, and the sludge from primary clarifiers will be about 2 to 6% solids concentration. The combined sludge concentration will be about 1.5 to 2%. In this case, transferring the sludge by gravity from the on-site storage tanks in the treatment facility to the East Coast Interceptor at Haro Road could be problematic. Dilution of the combined sludge with the backwash water from the secondary and tertiary facility will be a preferred alternative for pumping the sludge to the interceptor. If needed, the effluent pumping requirements will be about one-tenth of the influent pumping power requirement.

The approximate pumping distance between the facility and the East Coast Interceptor at Haro Road is 350 m.

Electrical energy use

Table 4-3 summarizes the estimated electrical energy use at the facility.

Table 4-3. Estimated electrical energy requirements for the Finnerty-Arbutus facility

Power Requirements (kW)	
Penrhyn Pump Station to Finnerty-Arbutus facility or Finnerty-Arbutus pump station	50
Bringing gravity flow wastewater to facility	15
Power required for treatment (figures from CRD Discussion Paper 038-DP-1)	453
Sludge pumping (one-tenth of influent pumping)	1.5
Total Power required for all pumping	66.5
Total power requirement (treatment plus pumping)	519.5
Total number of kWh per year	4,550,820
Total annual energy cost (@ $0.07/kWh)	$318,557
Annual energy cost of pumping (@ $0.07/kWh)	$40,778

Noise, vibration and lighting

Noise

Operation of the wastewater treatment facility will generate noise from the following equipment on site:

- air-driven pumps,
- compressors,
- fans and blowers,
- diesel driven pumps, and
- standby diesel power generators.

Noise at the property line of the treatment facility is not to exceed 45 dB (evening) and 55 dB (daytime), and will comply with zoning regulations. Sound attenuation will be installed in the buildings housing the units and on diesel engines exhaust to ensure that decibel levels remained below 45 dB at the property line, to meet the local municipal bylaw requirement, and to meet WCB/OSHA criteria for worker safety. All noise-generating equipment will be installed in soundproof rooms to meet these requirements.

Vibration

All vibrating equipment required at the Finnerty-Arbutus facility will be contained in isolated structures that meet vibration limits acceptable to the residential community. Since the wastewater systems to be used at the treatment facilities do not include excessive vibrating equipment and are typical of current operating systems found elsewhere, vibration issues are not anticipated and if present can be fixed.

The CRD as an employer for the treatment facility will meet the requirements of the *Occupational Health and Safety Regulation of Workers Compensation Act* (BC).

Lighting

The lighting plan for the Saanich East facility is expected to include normal post top sodium vapour lighting standards similar to those on residential streets. If night work is required, higher intensity lamps may be needed. All lighting will be directed downward and will have shields installed to prevent lighting of the night sky.

In accordance with corporate activities for environmental sustainability, facility planning will incorporate energy efficiency and BC Hydro "Power Smart" initiatives and the applicable Leadership in Energy and Environmental Design (LEED™) standards for green buildings. For example, LED lighting that uses little energy and emits low UV light could be specified.

Sources of odour and odour control

Odour sources

Information on potential odour sources in the treatment facility and the two odour containment process areas are given in Table 4-4.

Table 4-4. Odour sources in the treatment facility

Source	Untreated potential odour
System A Source (the untreated wastewater recovery area)	
Headworks	Strong to Very Strong
CEPT	Light to Moderate (chemical)
Primary Clarifier*	Very Strong
Headworks Odour control	Light to Moderate (chemical)
System B Source (the treated effluent area)	
Pipe Chase Gallery	Nil to Light
Fine Screen	Very Strong
Bioreactors*	Moderate (musty)
Membranes*	Moderate (musty)
Membrane Ancillary Building	Very light
Lift Station and Sludge Pumping Station	Strong to Very Strong
Reclaimed water storage	Nil to Light
UV Disinfection (Future) and Effluent Pumping**	Nil to Very Light
Odour Control	Light to Moderate (chemical)
Blowers Building	Nil to Very Light

*Notes: * 75% of the units will be constructed for 2010-2030*
*** UV Disinfection units to be installed in future within the existing building*

Odour control in wastewater treatment facilities

The facility design will include best practice solutions for minimizing release of odour, especially from untreated wastewater and sludge. With proper attention to design details during the detailed design stage, routine release of odours from the treatment facility processes can be minimized by:

- the use of submerged inlets and weirs,
- eliminating turbulence in influent piping and channels,
- the elimination of physical conditions leading to the formation of turbulence,
- proper process loadings,
- containment of odour sources,
- off-gas treatment,
- good house keeping, and

- keeping access doors and buildings closed.

An odour control system will be designed to control facility odour at the property line. For example, a system could include a three stage wet chemical scrubber with final polish step of activated carbon and odours to scrub the treatment facility's ventilation air before this air is discharged via one or more high velocity roof fans to the atmosphere.

Odour discharges are expressed in terms of Odour Units (OU) per hour, which represents the odour concentration (OU) in the ventilation air times the ventilation airflow rate (m^3 per hour). An OU is a measure of odour concentration and is defined as the amount of dilution with clean air required to reduce the odour to a non-detectable level.

Design criteria for odour

The design of the facility will ensure that odour at the facility property line does not exceed 5 odour units (OU) per m^3, as an hourly average 98 percentile based on a 15 minute rolling average (Project Description, Mar 2009). During routine annual maintenance of odour control equipment, emissions could reach 15 odour units for a few hours. Unless such maintenance occurs during still air conditions, even odours generated during routine maintenance are unlikely to be considered objectionable by nearby residents. Table 4-5 compares various odour magnitudes.

Table 4-5. Odour intensity versus ambient odour concentration

Category Scale	Field Qualitative Odour Intensity Scale	Estimated Odour Concentration (OU) (Detection Threshold)	Typical Description of Odour
No odour (usual limit of public acceptability)	Odour activates the sense of smell but the characteristics may not be distinguishable.	≤ 5	None
Very Light	Odour activates the sense of smell but is not objectionable to most people.	> 5 – 15	Earthy, stale, musty, chemical
Light	Odour is distinctive and may be objectionable to some people.	> 15 – 50	Earthy, garbage, soil, chemical
Moderate	Odour is very distinct and clearly distinguishable and may tend to be objectionable and/or irritating.	> 50 – 150	Sewer, sour, solvent, chemical
Strong	Odour is objectionable, would cause a person to attempt to avoid it, and could produce physiological effects during prolonged exposure.	> 150 – 1,500	Offensive, sewer, garbage
Very strong	Odour is so strong it is	> 1,500	Offensive,

Category Scale	Field Qualitative Odour Intensity Scale	Estimated Odour Concentration (OU) (Detection Threshold)	Typical Description of Odour
	overpowering and intolerable for any length of time and could easily produce physiological effects.		chemical, putrid, rotten, sewer, urine, septic

Source: Adopted from Manual of Practise No. 25, Control of Odours and Emissions From Wastewater Treatment Plants, Wat. Env. Fed., 2004, and fit to real data from WWTP

For the Finnerty-Arbutus treatment facility, the ambient odour guideline is 5 OU, not to be exceeded under the worst-case meteorological conditions. The effectiveness of the treatment facility ventilation air scrubbing will be chosen so that this guideline is not exceeded during normal operation and all meteorological conditions. It is expected that there will occasionally be short periods of time when the scrubbers are being maintained and odour emissions will exceed their design values.

Security

Once the treatment facility is constructed, the operational staff will work daily at the facility. Access to the site will be controlled at all times. The building doors and main gates will be remotely alarmed by the CRD's supervisory control and data acquisition (SCADA) monitoring system. A combination of sturdy, but attractive, materials for fencing, lighting and landscaping will be incorporated into the design to discourage vandalism at the treatment facility site.

Drainage management

Current principles for low impact development and stormwater management will be employed in facility planning. Uncontaminated storm runoff from roofs of structures will be directed to infiltration facilities where site conditions allow. Parking areas and other on-grade surfaces will be constructed using permeable pavers, or the runoff from these areas will be directed to biofiltration swales or similar facilities. In general, disturbance of the natural hydrology of the site will be minimized as far as practical. Landscaping will incorporate pervious soils and vegetation to minimize increases in site runoff caused by the facilities. Native vegetation will be used in landscaping to reduce irrigation demand.

A credit for stormwater management towards LEED™ certification is available if disruption of natural water flows by minimizing stormwater runoff is limited or on-site infiltration increased and contaminants reduced.

Outfall location

The existing outfall in Finnerty Cove will be extended to Haro Strait at least 1500 m from mean low water and to a depth of at least 30 m below mean low water. A Stage 1 marine EIS has been conducted on the Finnerty Cove outfall location and a Stage 2 marine EIS is currently underway. Pre-discharge marine water quality is being established for the marine environment monitoring program.

Accidents and malfunctions

The new treatment facility will be designed with redundancy requirements to meet the *Municipal Sewage Regulations*. By providing redundancy in the design, the chance of accidents and malfunctions are greatly reduced. During the design phase a Hazard and Operability Study (HAZOP) will be completed to identify hazardous and malfunction conditions and appropriate design consideration will be given to these conditions. The risks of accidents and malfunctions at the Finnerty-Arbutus facility will be reduced by including the following features in the design:

- multiple treatment trains to enable maintenance and repairs,
- redundant equipment for critical equipment including pumps, blowers , and other identified critical process equipment,
- supervision of the treatment plant processes by an automated Supervisory Control and Data Acquisition system (SCADA). This system will include monitoring of the critical treatment process parameters, including dissolved oxygen and effluent turbidity. Alarm conditions will be indicated so that operators may take immediate corrective actions if problems arise,
- development of a regular maintenance program to minimize equipment downtime, and
- provision of standby generator to maintain the treatment process during power outages.

The CRD will develop Standard Operating Procedures for the plant. The procedures will also have emergency contingency plans for abnormal operating circumstances due to malfunctions.

The CRD will consider preparing a Conditional Management Plan (CMP) to minimize the risk of releases of effluent that could affect marine resources, particularly shellfish. A CMP would need to be approved by the CRD, Canadian Food Inspection Agency, Fisheries and Oceans Canada, Environment Canada, and the British Columbia Ministry of Environment. Details regarding offshore impacts of accidents and malfunctions will be provided in the marine EIS for the wastewater project.

4.9 Construction

Construction activities

The Saanich East wastewater treatment facility needed to serve the population from 2010 to 2030 is roughly 75% of the size of the facility needed to serve the service area in 2065. Construction work, therefore, will be undertaken in two stages. The construction period for the 2030 design year facility will begin in 2010 and will be completed in 2.5 years by the year 2013. Whether the work is delivered in a design-build or design-bid-build construction contract, the time frame for construction activity will be roughly the same. Facility capacity is anticipated to be expanded by 2030, with construction work starting in 2027 and completed in less than 2 years.

The maximum construction activity will see a peak monthly labour component of 30 to 40 workers during the concrete pouring stage. Most of the time, about 10 to 15 workers will be onsite on a daily basis. This pattern would repeat for the 2027 construction.

The construction will be done in the following stages:

1. Clearing and grubbing for the portion of the site in the facilities footprint. This work could be completed in three to four months.
2. Rough grading, road construction, site servicing, excavation and filling to prepare the site. This stage of construction will likely be undertaken in the later part of the first year and will also include installation of foundations.
3. Slabs, structures, and site facilities will then be constructed, and equipment will be installed.
4. Equipment will be delivered during the last one and half years of the construction period, and installed in accordance with the project management scheduling.

The land and marine sections of the outfall and other ancillary facilities will be constructed during the 2.5 year interval when the treatment facility is being built. The ancillary forcemains, marine outfall, and pump stations will need to be completed before the Saanich East facility begins functioning.

The CRD or Contractor will secure a staging area to provide enough space for stock piling of materials. The Contractor will manage delivery of concrete and other construction materials to be able to fit in the staging area.

Site preparation

The area requirements for individual process components are summarized in Table 4-6 for the Saanich East wastewater treatment facility. Stage I will see 75% of the ultimate capacity constructed. It is assumed that 75% of primary clarifier, bioreactors, and membranes will be constructed and the rest of the units and buildings will be constructed to accommodate installation of Stage II equipment.

Table 4-6. Area requirement for the Saanich East treatment facility components

Saanich East treatment facility units	Facility area (m^2)	
	2010–2030	2030–2065
Pipe Chase Gallery	520	520
Headworks	300	300
Fine Screen	180	180
CEPT	120	120
Primary Clarifier	450*	600
Bioreactors	630*	840
Membranes	345*	460
Membrane Ancillary Building	150	150
Lift Station + Sludge Pumping Station	80	80
Reclaimed water storage	240	240
UV Disinfection (Future) & Effluent Pumping	260	260
Operations Building	300	300
Headworks Odour Control	300	300
Odour Control	130	130
Blowers Building	200	200
Road and Parking	5,665	5,190
Total (m^2)	9,870	9,870

*Notes: * 75% of units will be constructed for 2010 – 2030.*
The 2030 area includes the 2010 facilities.

About 1 ha plus buffer and access road allowance will be prepared during Stage I to meet the total needs shown for 2065 construction.

Construction schedule

The quality of a completed treatment facility can be affected by the skill and knowledge of the contractor and its staff, their attention to the environment, and their choices of construction and inspection methods at each stage of construction. As in the development of appropriate alternatives for facility design, choices of appropriate technology and methods for construction are critical ingredients in the success of the project.

Before construction begins, the CRD may consider requesting the contractor to propose alternative building methods. These methods would be intended to improve the cost, time, and reliability performance of construction.

Treatment facility construction schedule

Expected timing for construction works could be as follows:

2010 Site clearing, excavation, construction of tanks and buildings, installation of major pipes.

2011 Complete buildings, backfill structures, install mechanical and electrical systems (pumps, piping and ducts).

2012 Complete final site grading, complete equipment installation, start up and test equipment, and complete landscaping.

Gravity sewer to outfall

The gravity main alignment from the treatment facility to the outfall will be analyzed and selected after marine studies are completed in 2010, identifying the optimum offshore location for effluent discharge. This alignment could primarily follow the existing right-of-way or could follow a new route. An alignment will be selected to minimize environmental and community impacts.

The gravity main to the outfall will be installed using a combination of open trench and trenchless methods that use boring or tunnelling techniques. For the purposes of this EIS, the analysis will be based on installing a new gravity main that follows much of the existing right-of-way using open trench construction methods, residential lots will be avoided wherever feasible.

Outfall

The marine portion of the outfall will be installed by pre-construction of pipe and sinking it in place on the water. Some prior excavation of the sea bottom may be required. This work will be done from barges except for the connection to the land portion. Dispersion modeling and the Ministry of Environment criteria will be used to determine outfall length.

Sludge line to the East Cost Interceptor at Haro Road

Waste solids from the treatment facility will be conveyed to other facilities for further treatment transferred by gravity sewer line. Approximately 350 m of new sewer line will be needed to access the East Coast Interceptor.

Sewer forcemain (small diameter)

Wastewater from the Penrhyn pump station will be pumped to the Finnerty-Arbutus intake.

Construction traffic

Construction traffic will include the delivery of equipment, supplies, and construction workers. For the 2010 to 2013 construction period, material and equipment deliveries will include 12 m^3 concrete trucks and trucks delivering reinforcing steel, major equipment, and general service materials.

The estimated truck traffic for concrete, steel, excavated material, soil and fill transport during construction for the 2030 and 2065 facilities are shown in Table 4-7. Cut and fill volumes required for site preparations were estimated from the facilities plans shown on Figure 4-2 assumptions in estimating the cut and fill volumes for each site include:

- the cut and fill work needed for the construction of the 2030 facility will be conducted in 2010, so no major site disturbing options will be needed in 2030,
- a minimum 0.5 m cut depth for clearing and grubbing was assumed over the portion required for construction of facilities for each site,
- cut materials on site will be used as fill and materials from clearing and grubbing and contaminated soils will not be reused, and
- a layer of gravel 0.3 m deep will be required to cover the cleared site.

If rock outcrops are encountered, all of the rock will be cut to level the site and crushed to be reused as fill. Peak activity is about 10 trucks per day.

Concrete volumes were estimated assuming building height for all unit processes at 4 m. A 300 mm slab was assumed for all unit processes. Peak activity is about 11 trucks per day during concrete-pouring activities.

Construction vehicles will include flatbed trucks, tandems, pickups, small to large delivery vehicles, cranes, excavators, and related equipment. The concrete is not expected to be produced in a batch facility on site, but to be delivered from elsewhere in the region.

Table 4-7. Construction truck traffic

	Concrete	Reinforcing steel	Clearing or grubbing and aggregate	Excavation
Number of truck loads Phase 1 construction (2010)	2,100 per 9 month	40 per 9 months	625 per 3 months	1,200 per 7 months
	11* per day	1 per week	10 per day	8 per day
Number of truck loads Phase 2 construction (2027)	690 per 4 months	15 per 4 months	100 per 1 month	360 per 3 months
	8-9 per day	1 per week	5 per day	6 per day

Note: A volume of 10 m^3 is assumed for cut and fill dump truck, 12 m^3 for concrete truck and 20 ton for steel trucks in the estimates. A 25% adjustment factor is used to allow for contingency.
**21 working days per month*

Labour force during construction

Construction activities will be undertaken in parallel with several crews working on different tasks. The Contractors and the CRD will minimize the effects of construction activities by informing the public on schedules and traffic routing. The labour force requirements for the construction of the facility and connecting sewers are summarized below.

Wastewater treatment facility

Construction of the wastewater treatment facility will require approximately 2,400 workers per year of site labour over 2.5 years. This estimate assumes a peak of 30 to 50 workers per day on site during the concrete work, and averages about 10 to 15 workers per day during the rest of the construction period.

Sewers

The effluent pipe installation crew could also be composed of 6 to 8 workers per day. Based on a 1,200 m length of the land section to the marine outfall (assuming 20 m/day nominal installation), the expected construction period will be 3 months.

Sewer main (for sludge transfer) construction crews could be composed of 5 to 7 workers per day. Assuming 20 m/day nominal pipe installation, the expected construction period will be 1 month, based on 350 m of pipe.

Small diameter pressure pipe for the small offsite pump station (Penrhyn) is similarly estimated as 3-4 months for 1,500 m.

Safety, security, and effects on surrounding properties

Construction is anticipated to start in late summer or fall, 2010 with the Saanich East treatment facility requiring up to 2.5 years to complete.

Peak construction activity will occur in the first nine months during excavation and pouring concrete. After this, the work will be similar to construction of utility or industrial buildings.

Safety

The noise exposure to construction workers could be a safety issue during construction and normal operating activities if proper safety procedures are not observed. Construction activities may post safety risks to the public if safety is not properly managed by the contractor and administered by the CRD.

The construction activities will comply with safety criteria established by OSHA, WCBBC, and NFPA. The safety manuals and instructions will be followed. Workers will be trained during the construction and operation period and residents will be informed about construction schedules and activities. Temporary safety fencing and warning signs will be installed around the construction site.

A traffic management plan will be prepared. This plan will address traffic disruptions, truck traffic, and access maintenance to nearby institutions, and residences during construction. Flag persons will direct vehicles and pedestrians around the construction site. Construction drivers will observe speed limits and exercise caution, particularly near the school or hospitals.

Noise

Construction activities that take place in the District of Saanich must comply with the relevant municipal noise bylaws for hours of work and noise levels. Work is allowed to occur on weekdays from 7 am to 5 pm with no work on Sundays or holidays (except in an emergency).

Construction activities such as running heavy equipment, truck deliveries, and using chainsaws, compressors, water pumps, concrete pouring pumps, rock breakers, and blasting and blasting signals could disturb nearby residents. Generally all potential noise sources that operate on a permanent or semi-permanent basis will be designed or controlled to meet the adjoining property line standard.

Vibration

Potential sources of vibration during the construction phase of the treatment facility include heavy equipment movement, blasting, compactors, and paving equipment.

Nearby residents may be affected by vibration (due to construction activity such as blasting) when vibration is only slightly in excess of perception levels. Activities causing vibration should occur only between 7 am and 5 pm Monday to Saturday. The residents will be informed and advised regarding work periods that may contain abnormal vibration conditions. The equipment in the treatment facility building is designed to ensure vibration is dampened or held within acceptable operating limits for protection of the equipment and operational staff.

The Contractor must ensure that workers are not exposed to vibration in excess of the limits specified in the *Occupational Health and Safety regulation*.

Dust and mud

Construction may result in short-term localized dust generation air quality impacts. Air pollutants generated during construction are generally fugitive dust and equipment exhaust emissions. Trucks will have box covers when hauling granular materials that could create dust nuisances.

The CRD Code of Practice for “Construction and Development Activities” will be used to mitigate dust and mud impacts. Erosion and sediment control plans will be prepared and implemented during construction. Authorities may require additional dust control plan submissions to all relevant agencies prior to construction.

During wet weather, mud from excavated areas could be spread off site through truck hauling. Tracking of mud offsite is not expected to be significant since the area is contained and trucks are unlikely to be located where tracking will be a problem.

Once the facility is operational, no dust or mud related problems are anticipated since the site will be paved and vegetated to prevent formation of either.

5.0 METHODS

This section of the EIS report outlines the data collection and assessment methods used by the study team.

5.1 Effects assessment criteria

The criteria applied in this study are based on industry standards for impact assessment, adapted for use in the Saanich East wastewater assessment. The rating of impacts under these headings focuses on mitigated impacts. The ratings assume that standard construction and operating procedures contained in the project description (Section 4) will be implemented. Significance is assessed for these mitigated project effects. If additional mitigation is recommended by the consulting team (over and above that described in the project description), those additional measures are described in the text of the EIS. These additional measures would be intended to further reduce identified project impacts.

Table 5-1 presents the assessment criteria applied in the EIS. The criteria cover such topics as the spatial context of project impacts, temporal context, reversibility, magnitude, and significance of potential effects of project construction and operation.

Table 5-1. Criteria used in assessing project effects

Assessment Criteria		Definition
SPATIAL CONTEXT location of effect		
Treatment Facility Footprint		Land area permanently occupied by the treatment facility including buildings, parking, and access.
Ancillary Facility Footprint		Land area temporarily or permanently occupied by wastewater trunks, gravity mains, forcemains, pump stations, and other associated facilities.
Workspace		Areas temporarily used during construction, including equipment and material storage or vehicle access.
Local Area		Lands within 250 m of the candidate site.
Regional Area		The Regional Study Area (RSA) is the area in the Core Area municipalities.
TEMPORAL CONTEXT of effect		
Duration (interval of the event causing the residual effect)	Short-term	Event duration is less than or equal to one year.
	Medium-term	Event duration is longer than one year but less than or equal to five years.
	Long-term	Event duration extends longer than five years.
Frequency (how often would the event that caused the residual effect is anticipated to occur)	Occasional	Event occurs intermittently.
	Periodic	Event occurs intermittently but repeatedly over the construction and operations period.
	Continuous	Event occurs continually over the assessment period.
Reversibility	Yes	The potential effect can be reversed.

Assessment Criteria		Definition
(period of time over which the residual effect extends)	No	The potential effect cannot be reversed, despite efforts to mitigate.
MAGNITUDE of the effect		
Negligible		Potential effect is barely detectable.
Low		Potential effect is well below established or derived environmental standards or thresholds.
Moderate		Potential effect is detectable but meets established or derived environmental or regulatory standards or thresholds.
High		Potential effect exceeds established or derived environmental standards or thresholds.
BENEFICIAL or ADVERSE effect		
Beneficial		The resource or topic under study would be improved as a result of project effects.
Adverse		The resource or topic under study would be worsened as a result of project effects.
SIGNIFICANCE of the effect		
Significant		The identified effect would have a combination of characteristics that render it unacceptable to the public, regulators, other interests, or that exceed standards or contravenes legal requirements.
Less than significant		All other effects that are not considered significant.

5.2 Data collection and analysis

This section describes the methods used to collect and analyze data for each EIS topic.

Geotechnical hazards

Investigation of the geotechnical conditions at the sites consisted of collection and review of available information for the study area, including most notably the BC Ministry of Energy and Mines Quaternary Geology mapping of Greater Victoria (Monahan and Levson, 2000). Published information was supplemented by interpretation of current and historical Provincial and Federal Government aerial photographs based on knowledge of local conditions, their engineering properties, and construction implications provided by C.N. Ryzuk and Associates, and an engineering site reconnaissance on April 8, 2009.

Hydrology and water quality

The assessment of hydrologic and water quality conditions in the study area was based on:

- review of topographic maps and orthophotos,
- on-site field inspections conducted in several seasons,
- examination of reports prepared by municipalities and institutions.

The University of Victoria's *Integrated Watershed Management Plan* (http://web.uvic.ca/fmgt/assets/pdfs/SWMP/SWMP.htm) provided information on water on the lands upslope from the Finnerty-Arbutus site. Storm drain information was obtained by field inspection and from maps produced by the District of Saanich and the Capital Regional District. No published information was available on water quality in potentially affected surface or ground water.

Field inspections included observation of streams and slopes on the sites. Slope angles were measured at several locations using a hand-held clinometer. Evidence of slope instability was sought. The potential relationship between drainage courses and adjacent trails was examined, as was the effect of vegetation on surface soil conditions and water quality. The locations of storm drains discharging into natural drainage courses were noted, as were the effects of these discharges on flows and erosion features.

Vegetation

A review of existing information, literature, and other data was completed before initiating field work. This office-based review included the examination of aerial photographs, existing reports about the vegetation of the study areas, and sensitive ecosystem inventory mapping of the site. The work was conducted to determine the extent of natural vegetation on the site and the variability in vegetation composition.

Information about rare and endangered plant species and plant communities was obtained from the Conservation Data Centre (CDC) online database (BC CDC, 2008). This information and an Element Occurrence Report (EOR) for each site were reviewed to determine whether rare plants or rare plant communities have been recorded on the sites or their ancillary facilities. Interviews with local naturalists were conducted and plant information provided by these individuals was used as part of the baseline data collection work completed in May 2009.

Field visits were conducted to determine vegetation composition and distribution of the existing vegetation features of the sites and the associated ancillary facilities. This work was done in late April and early May 2009 to ensure early spring plant species present at the sites were documented.

The following information was collected at the site:

- canopy cover (dominant tree species),
- shrub cover (dominant tall and low shrubs), and
- groundcover (dominant herbaceous species).

A ‘Site Inventory and Conservation Evaluation’ was completed for the site and associated ancillary facilities using standard “Develop With Care” checklists (MOE 2006). During the site visit, all categories outlined in the protocol were assessed, but only topics relevant to the study sites are presented in this EIS.

Wildlife

Information was compiled about wildlife use and habitats at the site and associated ancillary facilities. Information sources consulted include CDC element occurrences, Sensitive Ecosystem Inventory (SEI), Victoria Natural History Society database of important wildlife habitats, other literature, and conversations with local knowledgeable naturalists. The site was characterized using aerial photography, topographic data, and SEI mapping before field work was conducted.

Field visits were conducted at the site and associated ancillary facilities to document wildlife use, evaluate habitat conditions, and record wildlife habitat features. A “Site Inventory and Conservation Evaluation” was completed for each site and its ancillary facilities using standard “Develop with Care” checklists (MOE 2006).

Air quality

Atmospheric stability was estimated indirectly from the time of day and local measurements of wind speed, cloud cover and cloud ceiling height using meteorological pre-processors (special software that processes meteorological data and converts it into a form used in atmospheric dispersion models) such as the Environmental Protection Agency’s (EPA’s) RAMMET package.

University of Victoria climatologist Dr. Stan Tuller combined hourly wind and temperature data from the University of Victoria with cloud cover and cloud ceiling height from the Victoria International Airport, for the years 2004 and 2005, to provide an input file for RAMMET.

Odour modelling was conducted to estimate the maximum off-site odour concentrations that may result from adverse meteorological conditions. Two meteorological-input scenarios were modeled using the EPA ISC-PRIME atmospheric dispersion model. The first approach used two years of meteorological data from the University of Victoria and the ISC-PRIME complex terrain option to estimate plume elevated-terrain interactions. The second scenario modeled evening temperature inversions when little or no winds are present, allowing cool surface air to flow (“drain”) downhill. These drainage winds normally accompany the maximum odour concentrations off-site from an odour source. Although the ISC-PRIME model is not sophisticated enough to automatically generate these drainage wind fields directly from digital terrain data, the winds can be simulated by manually creating a short-term meteorological data file consisting of light, down-slope winds and a strong temperature inversion, and then using the ISC-PRIME flat-terrain option.

Archaeology and heritage

An Archaeological Overview Assessment (AOA) was conducted by Bjorn Simonsen, a Victoria based professional archaeologist, for the purpose of identifying and assessing archaeological resource potential in the study area. A field reconnaissance was completed as part of the AOA to verify the location of known or potential sites or features, and to conduct an overview assessment of their condition.

The AOA study for the Saanich East wastewater treatment program followed the methodology and process described in the *British Columbia Archaeological Assessment Guidelines*. The AOA included the following tasks and activities:

- A comprehensive review of archaeological reports and Archaeological Site Registry database information for the CRD, with a special emphasis on the potential wastewater treatment facility study area (Saanich East-North Oak Bay),
- Acquisition and analysis of archaeological site inventory records for the study area, followed by the production of ortho-maps showing the location and extent of identified archaeological site locations,
- Review of maps and aerial photographs to analyze landscape features and other physical characteristics for the purpose of determining areas with archaeological site potential,
- Review of archaeological potential mapping for the CRD (Millennia Research Ltd. 2008),
- Review of the CRD Natural Areas Atlas and Harbours Ecological Inventory and Rating (HEIR) mapping,
- Meetings and consultation sessions with the Songhees Nation and Esquimalt First Nation to solicit information from these First Nations that might be beneficial to the study. In the course of these meetings, arrangements were made to include a member of each First Nation in the field reconnaissance component of the study, and
- Completion of a comprehensive field reconnaissance of the site. Note: the field visits included archaeological personnel from Westland Resource Group and representatives from the Songhees Nation and Esquimalt, First Nation).

Letters of introduction were sent to the Chief and Councils of Songhees Nation and Esquimalt First Nation. The letters described the siting study and requested meetings to discuss First Nations' perspectives on the project and the availability of traditional use (TUS) information. Meetings were held with Songhees Nation political and legal representatives, and permission was obtained for use of previously prepared TUS reports. The Esquimalt First Nation chose not to provide TUS information for the purposes of the ESR.

The heritage structures were taken from the Provincial Designated Sites Registry, a list of formally "Designated" (and thereby protected) provincial and local municipal heritage designations, maintained by the Heritage Branch. Buildings and sites only listed in municipal heritage registers were not included in this analysis, as there is no formal protection of these types of sites.

Millennia Research Ltd. submitted an application to the Heritage Conservation Branch for a permit to conduct an Archaeological Impact Assessment (AIA) for the Saanich East site. The permit was submitted in the fall of 2009, and results of the work were not available in time to be included in this EIS.

Land use

The land use section of this EIS builds on information collected for the siting analysis, which included a review of existing planning documents, site visits, and discussions with representatives of the District of Saanich, District of Oak Bay, Capital Regional District, University of Victoria, and the Queen Alexandra Foundation for Children to understand existing and planned land uses.

The preparation of this EIS involved a review of the latest versions of the District of Saanich Official Community Plan, District of Oak Bay Official Community Plan, Cadboro Bay Local Area Plan, University of Victoria Campus Plan, draft University of Victoria Sustainability Action Plan, and zoning bylaws. News articles, media releases, letters to the editor, and information on other community initiatives were also reviewed to understand the regional and local context.

Discussions were held with municipal and regional planners, and representatives from the Queen Alexandra Foundation and the University of Victoria to understand concerns and development plans. Attendance at three public open houses enabled a better understanding of community concerns, potential impacts, and appropriate mitigation measures.

Colour ortho photography was reviewed and visits to the site were conducted to confirm the use of the land by the property owner and by local residents. These visits were undertaken numerous times and during various seasons. The most recent visits occurred during June 2009. The proposed routing for the ancillary facilities was reviewed in ortho photos and site visits to accessible areas.

Traffic

The transportation assessment was conducted by Bunt & Associates. The following study methods were used for the traffic impact analysis:

- Determine the existing conditions with respect to vehicular volumes on preferred routes to and from the site, including accident histories and bus service;
- Identify an order of magnitude estimate of current pedestrian and bicycle traffic on the preferred transportation routes;
- Forecast the type and amount of traffic that will be generated by the project during construction and operation, and identify relevant transportation and traffic related issues;
- Determine the impact of installing the ancillary infrastructure of pipes under the road surface;
- Review current and future roadway cross-section data on the preferred access routes;
- Assess the level of impact on affected neighbourhoods and road users; and
- Identify mitigation measures to reduce or avoid traffic impacts.

Visual aesthetics

The visual assessment was a subjective assessment of the changes in the attractiveness of a location as a result of construction of a wastewater treatment facility. The assessment considers the degree of landscape modification, and the compatibility of the structures with surrounding landscape features. Modifications include the removal of existing trees and shrubs, changes to slopes, and the addition of roads, buildings, lighting, and other utility structures.

Several field visits were made to the site. A visit was made in early March before deciduous foliage growth, and another visit made after summer foliage was established. Photographs were taken of the site to record and interpret potential visual impacts from a number of vantage points. These photos were used in combination with aerial photography to assess the visual impact of a treatment facility.

To gain a comprehensive understanding of the visual impact of the treatment facility and the potential effectiveness of mitigation, 3-D digital models were developed for the facility using typical design features and layouts for a treatment facility. The models were superimposed on site photographs taken from key viewpoints to provide an artist's rendering of a facility at the Finnerty-Arbutus site.

Visual mitigation options are generally considered only for the operational phase of a project because of the short-term nature of construction. When considering visual impacts from construction activities, the impact is considered irreversible only if it cannot be mitigated or removed in a reasonable period of time, typically less than two years.

6.0 SITE CONDITIONS AND IMPACT ASSESSMENT

This section presents the results of an assessment of the relevant environmental and social site conditions and effects associated with the construction and operation of a wastewater treatment facility at the Finnerty-Arbutus site. The following topics are assessed:

- geotechnical hazards,
- hydrology and water quality,
- vegetation,
- wildlife,
- fish,
- air quality,
- land use,
- archaeology and heritage,
- land use,
- traffic,
- noise, vibration, and lighting,
- human health,
- visual aesthetics, and
- reclaimed water use.

Each topic is assessed for potential effects associated with the construction and operation of the treatment facility and associated ancillary facilities. Mitigation measures are recommended to reduce or avoid adverse effects, and the magnitude, temporal extent, spatial extent, reversibility, and significance are evaluated. Table 5-1 in the Methods section provides definitions of the assessment criteria.

General site description

The Finnerty-Arbutus site is a 4.4 ha forested area located in the District of Saanich, between the University of Victoria campus and Haro Strait (Figure 4-2). The property is owned by the Capital Regional District (CRD), and was previously owned by the Queen Alexandra Foundation.

The property and surrounding wooded lands are often referred to as Haro Woods by members of the public. The wooded area is comprised of three parcels, owned by the CRD, the District of Saanich, and the University of Victoria.

The Finnerty-Arbutus property is bounded by Arbutus Road to the north and Finnerty Road to the west. Forested land, medical facilities, and fields owned by the Queen Alexandra Foundation for Children are located across Arbutus Road. Other adjacent land uses include the forested parcels owned by the District of Saanich and University of Victoria to the east, detached dwellings across Finnerty Road to the west, and University of Victoria student accommodation and a child care centre located to the south of the Finnerty-Arbutus property.

The site is part of an urban green space that is used by community members for walking, running, dog walking, orienteering, environmental study, and BMX biking. A network of informal trails has been developed on the site. Public use of the site, although common, is not a permitted use. The site is private property that was posted for no trespassing by the previous owner.

Ancillary facilities site description

Ancillary facilities associated with the treatment facility include a gravity main, which will carry effluent to the ocean outfall, and a small diameter pressurized pipe, which will convey wastewater to the treatment facility from the existing Penrhyn pump station in Cadboro Bay (Figure 4-3).

The gravity main will be constructed in existing and new rights-of-way. The main will be located underground across a field on the Queen Alexandra Foundation property and in an existing right-of-way on a residential property. The pipe will then be installed beneath the roadway of Alpine Crescent, Haro Road, and Monarch Place. The gravity main will be installed in an existing right-of-way across four residential properties before reaching the existing outfall location in Finnerty Cove.

The small diameter pressurized pipe will be constructed from the Penrhyn pump station, in Cadboro Bay, to the Finnerty-Arbutus site entirely under existing roads, including Penrhyn Street, Hobbs Street, Maynard Street, Rowley Street, and Arbutus Road.

6.1 Geotechnical conditions

Treatment facility site conditions

The ground surface of the Finnerty-Arbutus site slopes gently downward from the west to east. Maximum elevation change on the site is 8 to 9 m. Site observations corroborate historical photographs, and indicate the ground surface has not been modified significantly by excavation or fill placement. Ground disturbing activities related to creating BMX bike jumps and drainage ditches were observed. The site appears to be reasonably well-drained.

The soil stratigraphy at the Finnerty-Arbutus site consists of a relatively thin veneer of surficial topsoil, overlying a morainal deposit of hard gravelly sandy silt, and/or very dense silty sand till. The till stratum is expected to be at least a few metres thick, and may be underlain by a pre-glacial marine deposit of very dense silty sand or sandy silt, commonly called the Quadra Sediments. The groundwater table is expected to be within 3 to 4 m of the present ground surface. Exceptions to this generalized stratography are present over the south and southeast areas of the site, where a relatively thin layer of compact to dense sand is present directly atop the glacial till. The sand is believed to be a beach deposit from washing of the upslope till materials during past periods of higher relative sea level.

Given the soil stratigraphy at the site, the natural frequency is expected to be in the range of 10 hertz, with an average shear wave velocity in the upper 30 m of 400 to 500 m/sec, corresponding to a Site Class “B” as per the current National Building Code.

The site is in an area that could be affected by a Cascadia Subduction event. Information from Natural Resources Canada indicates a peak ground acceleration of 0.61 g and spectral accelerations of 1.22, 0.82, 0.38 and 0.19 g, for respective periods of 0.2, 0.5, 1.0 and 2.0 seconds respectively for a design seismic event of 2% in 50 years. The accelerations noted relate to a site Class “C”, and given that the subsurface conditions at the site correspond to a site Class “B”, depending on the spectral acceleration considered, and the period of the various facilities, some adjustments may be necessary. Seismically, these conditions are typical of the area and are unlikely to present substantial development constraints to wastewater treatment facility design.

As a result of concerns expressed about possible active faults in the vicinity of the Finnerty-Arbutus site, further specific review of available information was undertaken. The literature, including information published by the US Geological Survey (USGS) indicates the presence of numerous faults on southern Vancouver Island. There remains significant uncertainty as to whether the shallow faults referred to in the literature are close to the subject site or are active. Of particular significance is the assessment that these faults (including the well documented Devils Mountain Fault) could give rise to a 1 in 1,000 year earthquake event, given that the current building code requires design for at least a 1 in 2,000 year event. Further, recent information from Natural Resources Canada, which acknowledges the USGS information, notes that so far, current models of seismic hazard for the Greater Victoria area do not need revision.

Ancillary facilities conditions

Along the route of the new sewer force main from the Penrhyn Street Pump Station to the Finnerty-Arbutus site (via Penrhyn Street, Hobbs Street, Maynard Street, Rowley Road, and Arbutus Road) the anticipated subsurface soil conditions (considering minimal burial for the main) range from recent alluvial deposits of sands and fine gravels along most of Penrhyn Street, to alternating sections comprising: morainal deposits to hard silty sand till and/or dense gravelly sandy silt; marine deposits of stiff to very stiff silty clay; and the latter with shallow (possible outcropping) bedrock. Noted exceptions include near surface weathered or disturbed materials, possible shallow fill (the latter associated primarily with existing roadway pavement structures and infrastructure), and some near surface organics for the portion of Penrhyn Street to the east of Cadboro Bay Road. Groundwater conditions are expected to be variable, with areas of high water table conditions and possible significant seepage along the lower (eastern) portion of Penrhyn Street, particularly.

Along the route of the new gravity main from the Finnerty-Arbutus site to the Finnerty Cove outfall (crossing Arbutus Road and the Queen Alexandra property to Alpine Crescent, Monarch Place and then eastward to the shoreline), the subsurface conditions within the anticipated 4 to 5 m depth of the proposed main are expected to comprise primarily marine deposits of stiff to very stiff silty clay, with areas of shallow or exposed bedrock. Noted exceptions include surficial topsoil and weathered materials and anticipated shallow fill (the latter associated primarily with the existing roadway pavement structure along common alignments). The ground water table is expected to be within 1 to 2 m of the existing ground surface in most areas. Because the anticipated native materials are relatively impermeable, significant associated seepage is not anticipated.

Impact assessment and mitigation measures

Treatment facility construction. Landform recontouring will occur during the construction phase. Approximately 1 ha of the presently undisturbed site will be cleared and levelled. A retaining wall or earth bank 5 to 10 m high will be constructed at the western corner of the footprint. Unusual concerns relating to excavation instability or settlement associated with fill placement are not expected. The native soils at the site are relatively competent materials to support the anticipated loading associated with a wastewater treatment facility, and no unique or unusual geotechnical concerns are anticipated.

The construction of a treatment facility at this site will require significant excavation and fill placement because of the sloped terrain and the design of the facility. Native mineral soils excavated from the site could be reused for subgrade fill and the surface sands and gravels might be considered as reuse for select granular fill.

Although the groundwater table could be relatively high, it is expected that it could be depressed quite readily with ditching or conventional drainage installations. Associated seepage volumes are not expected to be excessive.

> Mitigation measures. A geotechnical review of the design should be conducted as design progresses. A drainage plan should be implemented during facility construction to address surface drainage issues.

Impacts associated with geotechnical hazards during construction are expected to occur over the medium-term and are local in extent and reversible. The magnitude is considered to be low and the impact **less than significant.**

Treatment facility operation. After construction is completed and operation of the treatment facility begins, no additional impacts on the landforms or geology of the site are anticipated. Impact of treatment facility operation, therefore, is considered **less than significant**.

Ancillary facility construction. The route of the gravity main access to the outfall follows existing pipe rights-of-way and roads. Excavations associated with installation of the sewer force main are expected to be less than 1.5 to 2.0 m, and therefore in most areas no unique conditions are anticipated. One exception is the lower (eastern) end of Penrhyn Street where near surface organics with a shallow groundwater table and relatively permeable substrate exist, and care will be necessary to avoid significant lowering of the groundwater table during and following construction.

Excavation associated with installation of the gravity main are expected to be less than about 5 m in depth, and accordingly, no unusual or unique conditions or considerations are anticipated. Depending on the actual depth of the proposed main, substantial blasting may be necessary in areas of shallow bedrock. The level of the groundwater table is not expected to pose seepage concerns, given the anticipated low permeability of the native materials.

> Mitigation measures. Mitigation measures associated with the high groundwater conditions and seepage along the lower Penrhyn Street force main installation will depend on the time of year when construction will occur, the depth of excavation required for installation of the force main, and the period of time the excavation remains open. Excavation depths should be kept to a minimum, and generally construction during the wetter winter months may be most attractive, with excavations completed and backfilled as quickly as possible. The water table is expected to be highest during the wetter winter months, and although a higher groundwater level will result in increased volumes of seepage, it is anticipated that there will be significant recharge to minimize possible subsidence in the vicinity associated with lowering of the water table in the near surface organic soils. In the long term, and depending on the depth of the force main installation (including bedding materials), measures such as installation of trench dams and use of impermeable bedding and backfill materials may be necessary to avoid long-term dewatering (lowering of the groundwater level) of adjacent areas.
>
> Mitigation measures associated with excavation for, and installation of, the gravity main will depend on the depth of excavation and the actual materials encountered along the route. In areas where significant blasting will be necessary, care will be necessary to limit the size of charge detonated per delay, to avoid or minimize the vibration effects of the blasting on adjacent facilities and structures. Shoring will be necessary for deeper

excavations in the native clay soils particularly, unless there is sufficient area on each side of the installation to permit slope excavation cuttings.

The location and geologic condition of the outfall route are subjects of a separate study, and are not considered in this EIS.

Impacts associated with geotechnical hazards during construction are expected to occur over the medium-term and are local in extent and reversible. The magnitude is considered to be low and the impact **less than significant.**

Ancillary facility operation. Operation of the ancillary facilities are not considered to affect geotechnical hazards and are considered **less than significant.**

6.2 Hydrology and water quality

Treatment facility site conditions

The Finnerty-Arbutus site slopes from west to east. The steepest parts of the property are along the western and southwestern boundaries, where it abuts Finnerty Road and University of Victoria housing and daycare facilities. Slopes here are in the 12-15% range. Most of the remainder of the property is gently sloping, with slopes of 5% or less.

The only defined drainage course on the site crosses the centre of the Finnerty-Arbutus property from west to east. The drainage is dry through most of the year, flowing only after rainfall events. This depression has become an erosion feature in recent years as a result of development of the area near Finnerty and Sinclair. The source of water is an area called “Lam Circle Ravine” in the University of Victoria *Integrated Stormwater Management Plan*. Development of University of Victoria housing and the daycare centre on the margins of the “ravine” likely increased the rates of runoff in this area. Storm drains discharge water from the housing complex and the daycare to the drainage at the boundary of the CRD-owned property.

The drainage follows a walking path along most of its length. This path appears to have provided water with a preferential path across the Finnerty-Arbutus property. Throughout most of its length, the drainage has downcut only a few centimetres, suggesting that it is of recent origin. In the central portion of the Finnerty-Arbutus site, the defined channel disappears, and the drainage water percolates into the soil. Several small depressions carry runoff to the storm water ditch along Arbutus Road. One depression discharges near a bus stop, and another near the eastern edge of the Finnerty-Arbutus parcel. This latter drainage follows the course of a walking path and a wastewater main.

As part of its Draft Terms of Reference for the Cadboro Bay Institutional Property Action Plan, the District of Saanich has included mapping of the Finnerty-Arbutus property. A map shows a feature called "Finnerty Creek" that crosses the parcel. A thorough site inspection has revealed mapping inaccuracies. The defined channel crosses only the southeastern portion of the site; it is not continuous. The feature is not a creek, but a result of recent runoff channelization from upslope development.

Many paths used by walkers and mountain bikers crisscross the Finnerty-Arbutus site. These paths and the rights-of-way for sewer lines intercept surface flow and channelize runoff during rainfall events. Where these routes reach Arbutus Road, they discharge runoff into the roadside ditch.

The sandy and loamy character of soil on the Finnerty-Arbutus property, combined with the extensive tree cover and understory vegetation, indicate that most rainfall infiltrates into the soil of the site. Only where pathways interrupt this subsurface flow, or where stormdrains concentrate runoff from upslope, is there a surface expression of water.

The quality of the water on the site is suspect, as it flows from urban areas and roadways to the south and west. No water quality sampling was conducted as part of this study.

Ancillary facility conditions

The only ancillary facilities associated with the Finnerty-Arbutus facility are the gravity main and outfall, and the small diameter pressurized pipe from Penrhyn Pump Station. The gravity main will cross the Queen Alexandra fields, a relatively flat area north of Arbutus Road. The roadside ditch along Arbutus Road is the only drainage feature affected by the gravity main. Most of the length of the gravity main will be located in roadways (such as Alpine Crescent and Monarch Place). The outfall will cross the rocky foreshore. Runoff in this area is primarily overland flow directly into Haro Strait.

The small diameter pressurized pipe from Penrhyn Pump Station to Finnerty-Arbutus will be constructed entirely in roadways. The pipe route crosses no surface water features.

Impact assessment and mitigation measures

Treatment facility construction. Excavation associated with construction of a wastewater facility on the Finnerty-Arbutus property will result in changes to the site's hydrology. Shallow subsurface flow of groundwater will be intercepted by excavation, as will small surface drainages. This water will need to be infiltrated elsewhere on the site, or conveyed to the roadside ditch along Arbutus Road. The ephemeral drainages that carry runoff from the University of Victoria property, just south of the Finnerty-Arbutus site, will need to be re-routed.

During the two-year construction period, excavations will need to be dewatered to maintain safe working conditions. This pumped water will be discharged to ground or to the roadside ditch.

Runoff water from construction excavations often contains suspended sediment. There are no sensitive downstream receiving waters or lands that would be affected by short-term increases in sediment loads.

> Mitigation measures. A Qualified Environmental Professional should be retained to refine and revise the Streamside Protection and Enhancement Area shown in the District of Saanich documents.
>
> Settlement ponds or filtration basins should be provided to reduce suspended sediments in construction drainage. Silt fencing may be appropriate to control movement of sediments. A water management plan should be prepared to minimize on-site and off-site effects of groundwater and surface water changes associated with the project. Onsite infiltration of runoff should be included in project design.

Construction-related changes to hydrology will begin with site grading and continue in the long-term. Potential changes to water quality would be greatest during grading and decline following site restoration. Drainage effects will be local, confined to the facility footprint. If onsite infiltration is successful, then no downslope effects of increased runoff are expected. Impacts on water quality are reversible following construction. The magnitude of potential construction impact on water quality and hydrology is considered low, resulting in a rating of **less than significant.**

Treatment facility operation. Operation of the facility will see runoff handled through onsite management and infiltration. The conceptual location of the facility at the lowest point on the Finnerty-Arbutus property minimizes down-gradient effect on the site, but also limits the amount of runoff reduction that could be accomplished before discharging flows into the ditch on Arbutus Road.

With onsite infiltration, operation of the facility will not result in releases of wastewater to the site or into offsite drainage facilities. Even during high rainfall events, no overflows of wastewater from the facility will occur. Chemicals used in the wastewater treatment process will be stored in secure structures.

> Mitigation measures. Onsite infiltration of runoff from the facility will minimize effects on hydrology or water quality.

Operational effects on hydrology or water quality would be measurable only during high or persistent rainfall events. Such effects will persist in the long-term. The low elevation location of the conceptual layout reduces down-gradient effects on hydrology or water quality. Changes in hydrology and water quality associated with the operation of the facility will be irreversible. The magnitude of these effects will be low, and the impact is considered **less than significant.**

Ancillary facility construction. Clearing and trenching associated with installing the gravity main and outfall could channelize runoff during rainfall events. Dewatering of trenches should be conducted in ways that does not introduce sediments into stormdrains or ditches. Standard construction techniques for handling of stockpiled soils should be sufficient to avoid erosion and sedimentation impacts.

> Mitigation measures. Sediment ponds or filtration should be employed during dewatering of pipe trenches. Stockpiled soil should be covered or otherwise protected from erosion and sedimentation.

Construction impacts of ancillary facilities on hydrology and water quality will be confined to trenches and adjacent cleared areas. Impacts will be short-term and reversible. The magnitude of these effects is low, and **less than significant.**

Ancillary facility operation. Once construction of the gravity main and outfall are complete, revegetation will protect surface soils from erosion. Minor changes in surface flow patterns may occur in the medium-term. No effects on water quality are expected.

> Mitigation measures. Standard site restoration procedures will be sufficient to protect soils from erosion. Monitoring should be conducted to ensure that pipe routes do not channelize surface runoff, resulting in erosion.

Project impacts on hydrology are limited to unpaved areas crossed by pipes, and effects will be medium-term and reversible. No effects on water quality are expected. The magnitude of effects is low, and the impact is **less than significant**.

6.3 Vegetation

Regional overview

The SENOB study area is located in the Coastal Douglas Fir (CDF) biogeoclimatic zone. This area experiences warm and dry summers and mild and wet winters. The climate extremes in the CDF are less severe than those of other coastal British Columbia regions because of the rain shadow effect created by the Vancouver Island and Olympic mountains (Meidinger and Pojar 1991).

Vegetation in the CDF is primarily forested, although some open Garry Oak woodland and rocky outcrop habitats occur in this biogeoclimatic zone. Forests in the CDF are typically dominated by Coastal Douglas-fir (*Pseudotsuga menziesii*), and depending on the microclimate, western redcedar (*Thuja plicata*), arbutus (*Arbutus menziesii*), Garry oak (*Quercus garriana*), and red alder (*Alnus rubra*) commonly occur (Meidinger and Pojar 1991).

The CDF has a large number of rare and endangered plant species. Many of the region's rare species are at the northern end of their distribution range but several rare plant species, unique to the region, also occur in the CDF.

Undisturbed forest habitats in the CDF are uncommon in the study area, with less than 1% of the entire CDF zone remaining in mature or old forest condition in British Columbia. These forests were logged in the 1900s, and cleared for agriculture and human settlement (Pojar *et al.*, 2004). The British Columbia Conservation Data Centre considers both plant communities (assemblages of plants) and individual plans when designating status. All plant communities, and natural habitats in the CDF are listed as threatened or endangered (red listed) by the BC Conservation Data Centre.

Treatment facility site conditions

The Finnerty-Arbutus site is located in a stand of mature, second growth Douglas-fir forest. The two dominant plant communities found on the site are Douglas-fir/dull Oregon grape (CDFmm/01) and Douglas-fir/arbutus (CDFmm/02). These plant communities (or natural ecosystems) are red-listed by the BC Conservation Data Centre.

The majority of the Finnerty-Arbutus site occurs in the Douglas-fir/dull Oregon grape plant community, which has a closed forest canopy of Douglas-fir, western redcedar, bigleaf maple (*Acer macrophyllum*), and arbutus. Along the south-eastern extent of the site is a narrow band of Douglas-fir/arbutus plant community, characterized by Douglas-fir, arbutus, and Garry Oak trees. Native plant species found in the understory of the site include oceanspray (*Holodiscus discolour*), dull Oregon grape (*Mahonia nervosa*), Nootka rose (*Rosa nutkana*), snowberry (*Symphoricarpus albus*), thimbleberry (*Rubus parviflorus*), sword fern (*Polystichum munitum*), and salal (*Gaultheria shallon*).

Invasive plant species, including English ivy (*Hedera helix*), Scotch broom (*Cytisus scoparius*), spurge daphne (*Daphne laureola*), Himalayan blackberry (*Rubus discolour*), and English holly (*Ilex aquifolium*) also occur in the understory. These invasive species out-compete many of the native plant species on the site.

Despite the presence of red-listed plant communities, the BC Conservation Data Centre has no records of red or blue listed, or COSEWIC listed plant species on the Finnerty-Arbutus site. No rare plant species were noted during the site investigation.

Much of the native ground cover of the site has been affected by extensive ground disturbance associated with walking trails, BMX bike trails, and jumps.

An ephemeral drainage crosses the property, and may occur in the footprint of the treatment facility. Run-off flow in this drainage feature is restricted to the winter rainy season and other large rain events.

Ancillary facility conditions

The ancillary facilities associated with the Finnerty-Arbutus site will generally be located in existing rights-of-way that have little ecological value. Any new construction work associated with the sewer trunk and outfall will predominantly occur in non-vegetated areas.

Table 6-1 summarizes the presence of sensitive vegetation elements associated with the Finnerty-Arbutus site and ancillary facilities (*i.e.* sewer trunk and outfall).

Table 6-1. Sensitive vegetation resources on or near the Finnerty-Arbutus site and ancillary facilities

	Site	Ancillary
Terrestrial ecosystems in relatively unmodified state:		
• older forests or mature forests	Yes	No
• second growth forests	Yes	No
• native grasslands/shrub/herb communities	No	No
• Garry oak woodland community	No	No
• coastal bluffs	N/A	Yes
Presence of ecosystems at risk:		
• ecological communities on Conservation Data Centre Red or Blue lists	Yes	No
• ecosystem types identified by Sensitive Ecosystems Inventory	No	No
• areas identified as environmentally sensitive by local governments	Yes	No
Presence of aquatic or riparian ecosystems:		
• seasonal or permanent watercourses (streams, creeks, rivers, ditches)	Yes	No
• seasonal or permanent wetlands, seepage areas, or vernal pools	No	No
• riparian ecosystems beside these aquatic ecosystems and vegetated gullies	No	No
Presence of vegetation species at risk and their habitats:		
• species at risk identified by COSEWIC	No	No
• species on provincial Red and Blue lists	No	No
• regionally significant plant species	Yes	No
• habitats for regionally significant plant species	Yes	No

Impact assessment and mitigation measures

Treatment facility construction. Clearing for construction of the wastewater treatment facility will result in a direct loss of approximately 1 ha of the conifer-dominated woodland of the Finnerty-Arbutus site. Additional forest clearing may be required to meet construction workspace needs and Work Safe BC danger trees requirements. The forest clearing will involve removal of mature Douglas fir, western red cedar, grand fir, arbutus, bigleaf maple, and garry oak trees. Indirect losses of mature trees and shrubs caused by windthrow, soil compaction and project-related changes to site drainage can also be expected. No recorded sensitive ecosystems or rare element occurrences will be affected by the construction or operation of the treatment facility.

It is noteworthy that the property is currently zoned RS-12 and RS-14. If detached housing were built on the property, as permitted under the current zoning, clearing impacts would be considerably greater than the forest cover losses expected for the construction of the treatment facility.

Mitigation measures. Few mitigation measures to avoid direct clearing impacts were identified. However, the removal of a small number of Garry oak trees that occur near the south western boundary of the proposed footprint could be avoided by re-configuring the facility layout.

As complete impact avoidance to the forested ecosystem is not possible, compensation measures should be considered by the CRD. These measures could include registering a protective covenant to prevent tree cutting on the remaining forested woodland, aggressive management of invasive plants, and restoration of native plant cover.

The loss of mature forest vegetation is a long-term effect, and is irreversible. The magnitude of the effect is moderate and adverse. As the impacts cannot be mitigated, the effect of constructing the wastewater treatment facility at the Finnerty-Arbutus site on vegetation will be **significant**.

Treatment facility operation. Operation of the treatment facility does not require additional removal of native vegetation. No effects of treatment facility operation on vegetation are anticipated.

Ancillary facility construction. Construction of the ancillary facilities is not anticipated to require removal of native vegetation, as the ancillary facilities will be built in existing road ways and rights-of-way. Some domestic trees and shrubs will be removed during construction of the gravity main to the outfall. Potential effects on vegetation from ancillary facility construction are **less than significant**.

Ancillary facility operation. Operation of the ancillary facilities does not require additional removal of native vegetation. No effects of ancillary facility operation on vegetation are anticipated and therefore considered **less than significant**.

6.4 Wildlife

Regional context

The project area occurs in the CDF biogeoclimatic zone, on southern Vancouver Island. The climate and island location of this region define the wildlife diversity that occurs. Black-tailed deer are the most abundant large mammal, but occasionally black bear and cougar enter rural green spaces in this zone. Forested habitats of southern Vancouver Island support a diverse array of bird species.

Mature and older second-growth forest habitats are uncommon on southern Vancouver Island, because most of the region was logged during the early to mid 1900s. Much of the land in the greater Victoria area has been developed for urban and suburban land uses.

The remaining areas of mature and old forest on southern Vancouver Island are important to many wildlife species, including Yellow-bellied Sapsucker, Hairy Woodpecker, Northern Flicker, Downy Woodpecker, Steller's Jay, Common Raven, Chestnut-backed Chickadee, Brown Creeper, Winter Wren, and Varied Thrush (Meidinger and Pojar 1991). The nest sites in mature trees, created by primary cavity excavators, such as the Pileated Woodpecker, are important for secondary cavity nesters, such as Northern Saw-whet Owl, Western Screech Owl, and California Myotis.

A greater number of non-native wildlife species occur in urban areas of the region. These species include: Rock Pigeon, House Sparrow, European Starling, Norway Rat, and House Mouse. Several native wildlife species have, however, adapted to urban habitats, including Herring Gull, Northwestern Crow, raccoon, and Little Brown Myotis (Meidinger and Pojar 1991).

Treatment facility site conditions

Most of the Finnerty-Arbutus site is a mature, second growth forest that is connected to adjacent forested parcels. The value of the understory habitat of the site to wildlife has been diminished by invasive weeds and ground disturbances. The forest canopy, however, still provides important habitat for wildlife.

Wildlife habitat features recorded on the Finnerty-Arbutus site include several wildlife trees, mature, large limbed trees, rotten logs, and other woody debris. Wildlife trees provide potential nesting habitat for woodpeckers, Northern Saw-whet Owls and Western Screech Owls (blue listed). There are also habitat features of importance to raptorial birds such as Coopers Hawks, including potential nest sites and prey. The downed rotten logs and other woody debris support a variety of invertebrates and small mammals, which are important foods for the birds breeding in the area.

Several wildlife trails occur on the site, and black-tailed deer use the forested area for security and thermal cover, as well as for feeding.

The forest provides breeding habitat for several common bird species, such as American Robin, Chestnut-backed Chickadee, Pine Siskin, Winter Wren, House Finch, Dark-eyed Junco, Golden-crowned Kinglet, Spotted Towhee, and Red-breasted Nuthatch (Hocking 2000). During an April 2009 site visit, a Barred Owl was heard vocalizing nearby, and other species noted on the candidate site included Orange-crowned Warbler and Swainson's Thrush.

Ancillary facilities conditions

The ancillary facilities associated with the Finnerty-Arbutus site will be located in existing roads and established rights of way. These areas do not contain important wildlife habitat or habitat features.

Table 6-2. Sensitive wildlife on or near the Finnerty-Arbutus site and ancillary facilities

	Site	Ancillary
Presence of wildlife species at risk and their habitats:		
• species at risk identified by COSEWIC	No	No
• species on provincial Red and Blue lists	None detected	No
• regionally significant species	Yes	No
• habitats for any of these species	Yes	No
Presence of important wildlife habitat features:		
• wildlife trees, snags, mature, large-limbed trees	Yes	Yes
• rotten logs and other woody debris	Yes	No
• man-made habitat enhancements	No	No
• hedges and shelterbelts	Yes	No
• groundwater springs and seepages	No	No
Evidence of wildlife use:		
• wildlife corridors	Yes	No
• deer habitat	Yes	No
• potential raptor nest site	Yes	No
• nearby presence of protected areas or habitats	No	No

Impact assessment and mitigation measures

Treatment facility construction. Clearing for construction of the treatment facility will result in a loss of mature second growth forest habitat of importance to wildlife. The area to be cleared will include the approximately 1.0 ha footprint plus any additional construction-phase temporary workspace. Removal of danger trees, which are often wildlife trees, may be required within 1.5

tree lengths (approximately 45 m) of the candidate site under Work Safe British Columbia regulations.

Removal of forest habitat is expected to affect wildlife in the following ways:

(a) loss of thermal and security habitat and habitat features (*i.e.*, canopy cover);
(b) loss of reproductive habitat and habitat features (*i.e.*, nest trees);
(c) direct mortality during clearing activities;
(d) sensory disturbances associated with the clearing and construction activities; and
(e) loss of habitat connectivity (movement corridors).

Mitigation measures. The loss of potential reproductive, security, and thermal habitat from this site would be long-term, and cannot be mitigated. To offset the effect, compensation to enhance wildlife habitat values in nearby green spaces could be considered. For example, removal of invasive plant species could increase the habitat quality for ground nesting birds and small mammals, which are also important food species for raptors in the area. Installing water retention features on the central drainage of the Finnerty-Arbutus site would benefit wildlife by creating habitat complexity, while also controlling erosion.

Direct mortality and effect of construction related sensory disturbances could be reduced by timing vegetation clearing work to avoid the nesting bird season (March 15 to July 31).

Clearing for treatment facility construction will cause the removal of wildlife habitat and habitat features on the facility footprint and workspace. The loss of mature forest habitat is a long-term effect, and cannot be reversed. The magnitude of the effect is moderate and adverse. As the impacts cannot be mitigated, the effect of constructing the wastewater treatment facility at the Finnerty-Arbutus site on wildlife will be **significant**.

Treatment facility operation. Operation of the treatment facility will not require additional removal of wildlife habitat. As the site is located in an urban setting, sensory disturbance effects on wildlife are assessed to be low. Overall, the effects of treatment facility operation on wildlife will be **less than significant**.

Ancillary facility construction. Construction of the ancillary facilities will not require removal of wildlife habitat or habitat features, as the ancillary facilities occur in existing road ways and rights-of-way. Potential effects on wildlife from ancillary facility construction are **less than significant**.

Ancillary facility operation. Operation of the ancillary facilities does not require additional removal of native vegetation. No sensory disturbances effects of ancillary facility operation are anticipated. Potential effects on wildlife from ancillary facility operation are **less than significant**.

6.5 Fish

No fish bearing streams cross the Finnerty-Arbutus property or the ancillary pipe routes. The marine Environmental Impact Study assesses impacts to fish habitat in the marine environment.

6.6 Air quality

Treatment facility site conditions

Atmospheric conditions determine how odour is dispersed in the atmosphere. Night time inversions generally result in a stable atmosphere and poor atmospheric dispersion, whereas solar heating of the ground during the daytime results in an unstable atmosphere and increased atmospheric mixing and dispersion. High wind speeds at any time of the day create direct dilution and mechanical turbulence resulting in good dispersion.

Figures 6-1, 6-2, and 6-3 show that wind speed, wind direction, and atmospheric stability for a site at the University of Victoria, averaged for 2004 and 2005. University of Victoria data came from the Meteorological Service of Canada's Victoria University CS station located on the eastern margin of the Cedar Hill Corner property on Cedar Hill Cross Road. Wind speed and direction were measured with an aerovane at a height of 10 m above the ground. Wind speeds are affected by a wall of trees to the east, scattered fruit trees located to the west and southwest and a low building immediately to the south-southwest. The site is open to a large field to the north and west. Overall, the relatively compromised exposure of the site means measured wind speeds are lower than expected from an open site. The Meteorological Service of Canada is no longer scheduling planned maintenance on this station, which might also contribute to low measured wind speeds.

The prevailing wind directions are typical of the Victoria area as a whole (Figure 6-1). Winter winds primarily blow toward the south and south-southwest. Summer winds primarily blow toward the east or northeast.

The summer winds blowing toward the east or northeast develop mainly in the afternoon and continue into the early night time hours. Clear summer skies combined with temperature inversions and generally light winds after sunset contribute to the high frequency of stable conditions (F stability class) for this wind direction (Figure 6-3).

The Finnerty-Arbutus site generally experiences calm wind conditions and moderate atmospheric stability. The 2004 and 2005 data show that more than 70% of the time, the wind speed is less than 2.1 m/s (Figure 6-2). The site experiences moderately high atmospheric stability (Class D) one-third of the time, and high atmospheric stability (Class F) one-quarter of the time.

The Finnerty-Arbutus site is located on a sloping terrain. The site is relatively protected from winds coming from the south and west, and more exposed to winds from the northeast than the University of Victoria site used to model the meteorological conditions.

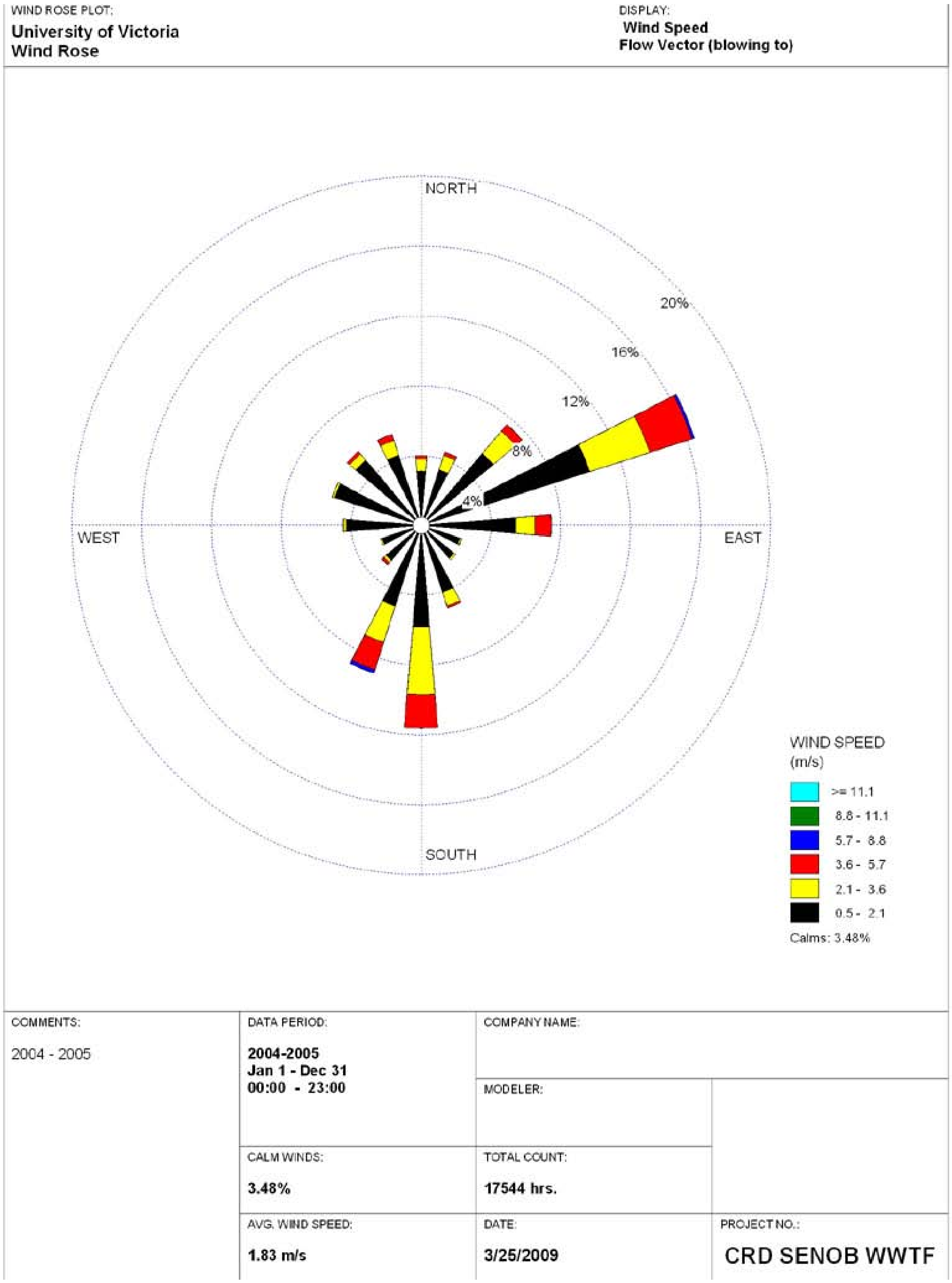
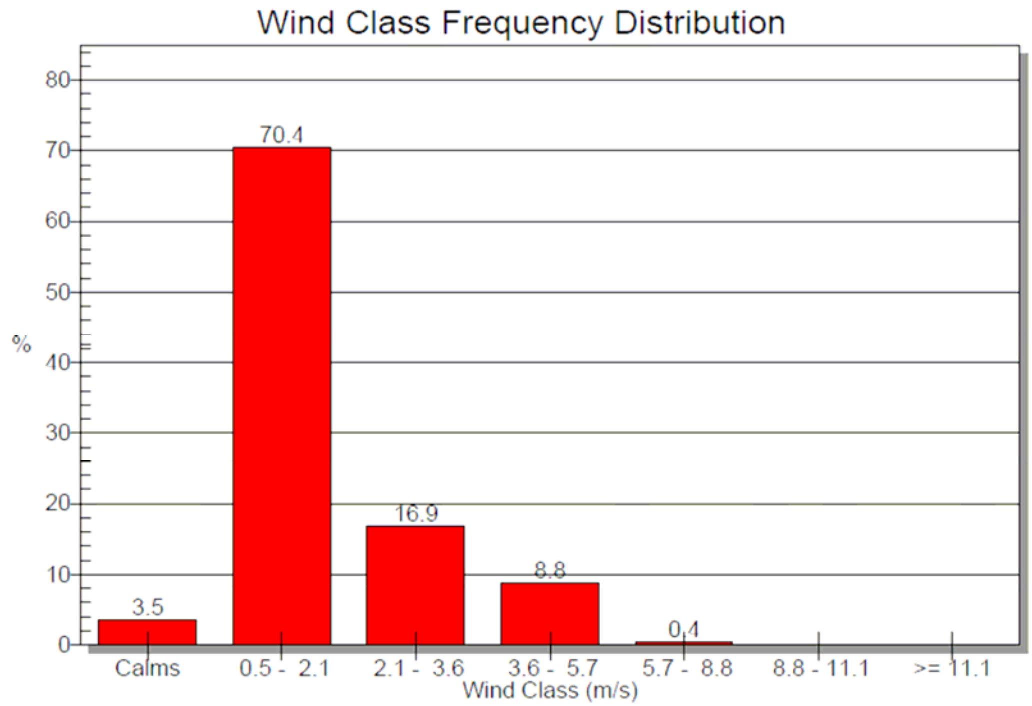
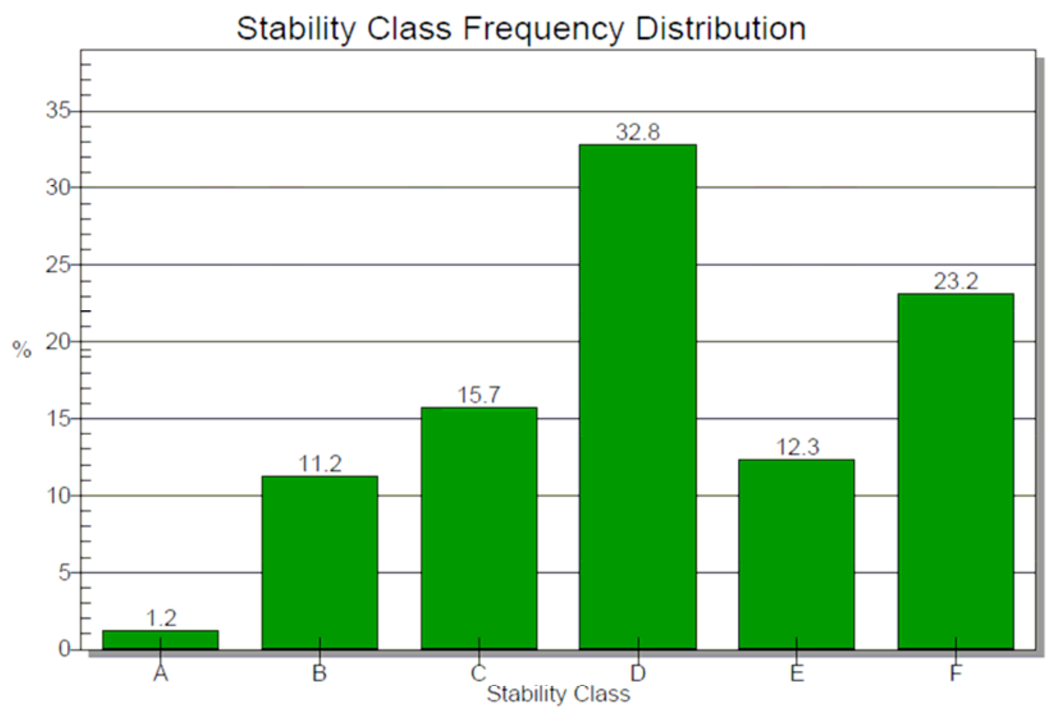


Figure 6-1. Wind Rose at the University of Victoria

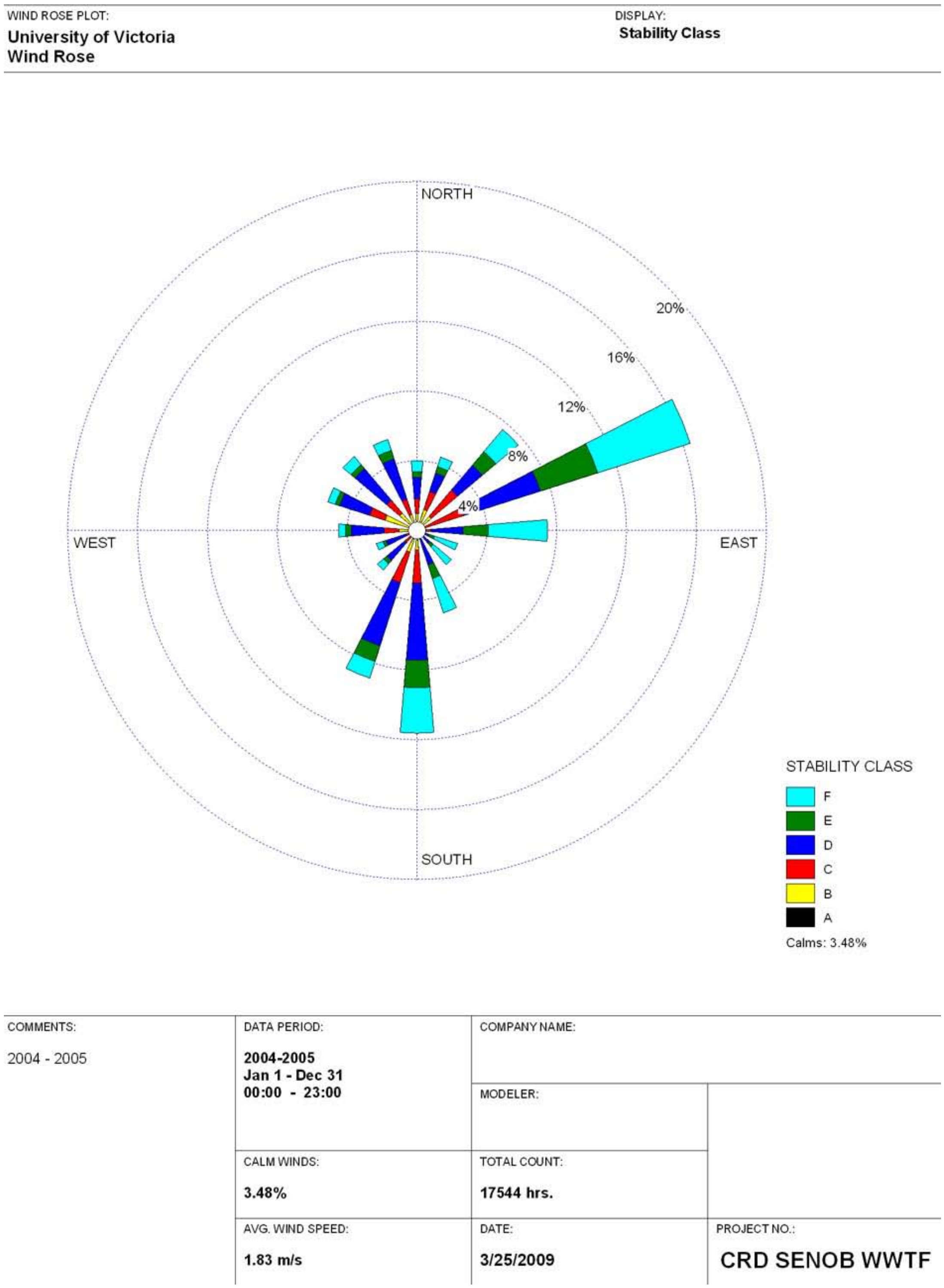


Wind Class Frequency Distribution is the frequency of wind speed



Stability Class Frequency Distribution is the frequency of atmospheric stability
A = least atmospheric stability and most atmospheric mixing
F = most atmospheric stability and least atmospheric mixing

Figure 6-2. Frequency and distribution of wind and atmospheric stability



A = least atmospheric stability and most atmospheric mixing
F = most atmospheric stability and least atmospheric mixing

Figure 6-3. Atmospheric Stability Rose at the University of Victoria

Odour modelling

Odour modeling has been conducted to estimate the maximum off-site odour concentrations that may occur during adverse meteorological conditions. Two meteorological-input scenarios were modeled using the EPA ISC-PRIME atmospheric dispersion model:

1. The first model used two years of meteorological data from the University of Victoria with the ISC-PRIME complex terrain option selected to estimate interactions between plume and elevated terrain.

2. The second model included the effect of evening temperature inversions when little or no winds are present and where cool surface air tends to flow (“drain”) downhill. These drainage winds normally give rise to the maximum odour concentrations off-site from an odour source.

The Finnerty-Arbutus site is situated on complex terrain that slopes markedly from west to east. Both of the dispersion models used in this analysis show that the highest offsite odour concentrations are produced by the complex-terrain scenario. Investigation of the meteorological data associated with the maximum offsite concentrations shows that the worst conditions arise during evening inversion conditions coupled with a gentle easterly breeze aloft that moves the odour plume to the west.

For the Saanich East-North Oak Bay facility, the ambient odour guideline is 5 odour units (OU), not to be exceeded under the worst-case meteorological conditions. Table 4-5 in the Project Description section defines the intensity of odour units. Five odour units is usually considered the limit of public acceptability. Treatment facility ventilation air scrubbing will be designed and operated so that this guideline is not exceeded during normal operation and all meteorological conditions. Figure 6-4 shows the maximum odour concentrations with sufficient odour control to reduce odour units to less than 5 OU. Under the worst-case meteorological conditions, the model estimates maximum annual 10-minute duration odour of 1 OU along most of the property line. Outside the property line, the model estimates odour between 0 and 4.3 odour units under worst-case meteorological conditions.

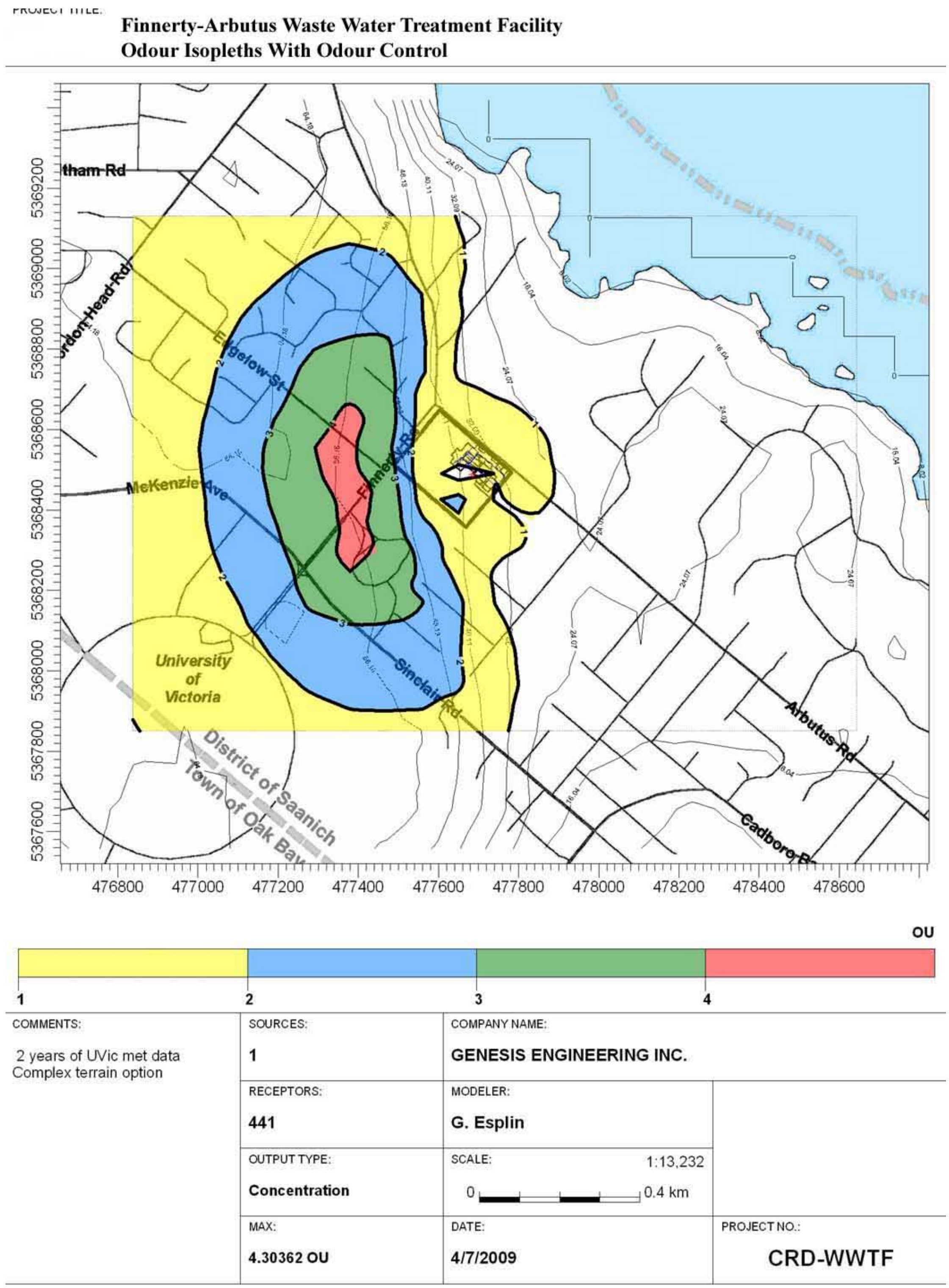


Figure 6-4. Maximum 10-minute duration odour isopleths for complex terrain

Buffer zones

Odour control at the facility will be designed to ensure that odour is not detectable at the property line (*i.e.* less than 5 odour units) under worst-case meteorological conditions. If necessary, back up systems will be used during routine facility maintenance. With these measures in place, no buffer zones will be required for odour control purposes.

Impact assessment and mitigation measures

Treatment facility construction. Construction of the facility will result in medium-term localized air quality impacts caused by dust and exhaust emissions from machinery.

> Mitigation measures. The treatment facility footprint is surrounded by a forested buffer, and is not directly adjacent to residences or institutional structures. Trucks will use box covers when transporting soil that could create dust nuisances. The CRD Code of Practice for "Construction and Development Activities" will be used to mitigate dust and air emission impacts. Additional dust control plans may be required, and will be developed as required.

Dust and air emission impacts at the Finnerty-Arbutus site are expected to occur during the medium-term construction period, and are reversible once construction is complete. Through the use of mitigation measures, the impact will be reduced and is considered low in magnitude, and **less than significant.**

Treatment facility operation. Operation of a treatment facility in a developed residential and institutional area could generate odours that would be noticeable by local residents and institutional users. The treatment facility will be designed to minimize operational odour. Typical operation of the treatment facility will result in no detectable odour at the treatment facility boundary. Annual maintenance will be conducted in during breezy weather, minimizing risk of odour impacts, though odour could be detectable in some instances. In rare cases of equipment malfunction, odour impacts of unknown magnitude and duration could affect the local area. The season and prevailing wind direction at the time would determine the potential effects.

> Mitigation measures. The odours released during facility operation could be reduced by installing a backup odour control system. Backup treatment could be provided during routine maintenance or mechanical failure. This mitigation will ensure that odour impacts during maintenance or breakdowns are reduced to low magnitude. The CRD will perform odour monitoring and meet with neighbourhood representatives to identify and address concerns about odour.

Under normal facility operations, odours will not be detectable beyond the project footprint. As previously discussed, some detectable odour could occur during annual maintenance or if equipment malfunctions. The impact is considered long-term, even though individual events will be short-term, perhaps measured in hours or days. If odour impacts do occur, they are most likely to affect the area near to the facility, and would be reversible, high magnitude, and

significant. With a backup odour control system, the odour impacts could be reduced to low magnitude, reversible, and will be **less than significant**.

Ancillary facility construction. The construction of the gravity main will introduce dust impacts for residents and institutional users near the construction area.

> Mitigation measures. Discussions with potentially affected home owners and institutional users prior to construction would help to ensure mitigation measures are appropriate to minimize potential risk to neighbours. CRD representatives will work with UVic, District of Saanich, and Queen Alexandra Foundation representatives and community groups to minimize impacts of constructing the ancillary.
>
> Dust control measures, including the use of box covers on trucks, the application of CRD codes of practice, and a dust management plan will be used to reduce effects on residents and land users.

With the application of approved mitigation measures, the impacts are considered short-term in duration and reversible. Most of the required pipes will be installed under roads, so the construction effects will be similar to other public road projects. Even with the application of mitigation measures, the magnitude of dust and emission impacts near the ancillary facility construction area will be moderate over the short-term. The impacts of ancillary facility construction will be **less than significant.**

Ancillary facility operation. No air quality effects are anticipated during ancillary facility operation, therefore, air quality is considered **less than significant.**

6.7 Archaeology and heritage

Treatment facility site conditions

The Finnerty-Arbutus property contains no previously recorded archaeological sites. An Archaeological Overview Assessment (AOA) was conducted by Bjorn Simonsen, a professional archaeologist. Mapping by Millennia Research Ltd. (2008) shows areas of archaeological potential near the eastern corner of the property.

Although no archaeological material was observed in the course of field examinations completed for the AOA by Westland Resource Group, portions of the Finnerty-Arbutus parcel within 30 m of the intermittent drainage were assessed to have a moderate to high potential for containing sub-surface archaeological deposits. The recent disturbance by dirt bikers has lowered the potential for intact archaeological deposits on portions of the site. Except for the eastern corner and the drainage, this parcel was deemed to have low archaeological potential during field examinations for the AOA.

No heritage structures or features are present on the Finnerty-Arbutus site.

Ancillary facility conditions

The local area near the Finnerty-Arbutus site, where installation of the ancillary facilities (particularly pipes) will occur, was assessed through field examinations for the AOA. Areas of moderate archaeological potential were noted near such topographic features as knolls and ridges, and the near the shoreline.

No heritage structures or features are present on the ancillary facilities routes.

First Nations lands

The CRD has entered into an information sharing process with Songhees, Esquimalt, Tsawout, and Beecher Bay Nations on project design and siting work in the core area. The Nations' interests are being recorded and submitted to MOE officials. Neither the Finnerty-Arbutus site nor the ancillary facility routes are located on Indian Reserves. No traditional use activities have been identified on lands affected by the Saanich East treatment or ancillary facilities. The CRD will continue to engage the First Nations communities during the project design phase.

A court action recently launched by the Songhees First Nation regarding a village site in Cadboro Bay is not expected to affect wastewater facilities or their operation.

Through the CRD's program of active engagement of First Nations, participating aboriginal groups have expressed concerns about the potential effects of effluent discharge on marine resources. These issues will be investigated as part of the marine component of the EIS.

Impact assessment and mitigation measures

Treatment facility construction. Tree-clearing and ground-disturbing activities associated with the construction of a treatment facility at the Finnerty-Arbutus parcel have the potential to damage, displace, or destroy buried archaeological materials and sites. Land alterations during the construction of the facility may break or displace cultural materials, such as cairns, inland shell middens, or culturally modified trees.

Construction activities that may affect archaeological resources include tree cutting, tree root removal, grading to prepare building sites, or excavation for installing below-ground facilities. Micro-topographic features, such as terraces, knolls, and ridges where buried archaeological sites are often located, are susceptible to logging, grading, and excavation. Heavy construction equipment may depress cultural soil horizons and sediments, resulting in the destruction of the context of archaeological artefacts and features (Golder Associates 2008).

> Mitigation measures. An Archaeological Impact Assessment (AIA) should be conducted before detailed facility design or ground disturbance begins, focusing on shovel testing in high-potential areas. Based on findings, site specific mitigation planning will be completed. Areas with high archaeological potential will be monitored during construction.

A detailed assessment of effects of construction on archaeological resources will be completed as part of an AIA, after a permit has been issued by the province of British Columbia. Assessment and mitigation will comply with the *British Columbia Heritage Conservation Act*. Mitigation, to avoid or reduce effects, will describe reasonable compensation for the removal, loss, disruption, modification, or alteration of archaeological and heritage resources as a result of the project.

Treatment facility operation. The activities that affect archaeological and heritage resources are likely to be limited to the construction phase of the project. It is unlikely that facility operation would affect archaeological or heritage resources and, therefore, impacts are considered **less than significant**.

Ancillary facility construction. Construction of ancillary facilities may result in the permanent loss or alteration of archaeological or heritage sites. The associated ground disturbing activities, including excavation and trenching, have the potential to damage, displace, or destroy buried archaeological materials and sites. The proposed pipe routes mainly follow road rights-of-way, where any existing archaeological remains have likely been disturbed, however, some archaeological resources may still exist. The greatest risk of encountering archaeological sites during pipe installation is near the shoreline.

> Mitigation measures. An Archaeological Impact Assessment (AIA) will be conducted in areas along the pipe corridor that have high archaeological potential in advance of ground disturbing activity. Site specific archaeological mitigation plans will be prepared after completing the AIA.

A detailed assessment of effects of construction on archaeological resources will be completed as part of an AIA, after a permit has been issued by the province of British Columbia. Assessment and mitigation will comply with the *British Columbia Heritage Conservation Act*. Mitigation, to avoid or reduce effects, will include reasonable compensation for the removal, loss, disruption, modification, or alteration of archaeological and heritage resources as a result of the project.

Ancillary facility operation. The activities that affect archaeological and heritage resources are likely to be limited to the construction phase of the project. Facility operation is not expected to affect archaeological or heritage resources and, therefore, impacts are considered **less than significant**.

6.8 Land use

Treatment facility site conditions

The Finnerty-Arbutus site is a forested parcel in a residential and institutional area, located between the University of Victoria campus and Haro Strait.

Although the Finnerty-Arbutus property is posted for no trespassing, the area is routinely used by the public for recreation. The main uses are walking, running, orienteering, environmental study, and BMX biking. The former owners stated that they removed BMX bike jumps from the site numerous times for public safety and liability reasons. Site visits confirm the continued presence of these jumps (Photo 6-3) and damage to the "no trespassing" signs.

A network of informal trails support these recreational activities, both on the site and on adjoining forested lands. These lands are considered as community green spaces by some members of the public (Photo 6-1 and Photo 6-2).

Existing underground sewer pipes cross the Finnerty-Arbutus property. Both 450 and 600 mm pipes are identified in the District of Saanich online GIS system (Saanich Online Mapping System 2009).

Photo 6-1. Finnerty-Arbutus land cover

Photo 6-2. Trails on the Finnerty-Arbutus site

Photo 6-3. 1.5 m-high BMX bike jumps on Finnerty-Arbutus site

Consistency with likely future land uses

The District of Saanich Official Community Plan (OCP) identifies the Finnerty-Arbutus site as "Institutional", consistent with the former ownership of the site by the Queen Alexandra Foundation for Children (QA). The Finnerty-Arbutus site is zoned RS-12 and RS-14, both Single Family Dwelling designations, under District of Saanich Zoning Bylaw. A portion of the site, around "Finnerty Creek", is identified as a Development Permit Area due to a floodplain and riparian area.

The Cadboro Bay Local Area Plan (LAP) identifies the Finnerty-Arbutus site as "General Residential". The LAP states that several large land parcels in the plan area are undeveloped or underdeveloped, including the subject property, and that an action plan will be developed "to address the future opportunities and implications of these properties in Cadboro Bay, Gordon Head and Saanich" (Corporation of the District of Saanich 2002). The Terms of reference for this study have been developed and approved by Council.

The LAP identifies Arbutus Road as a designated bikeway, and an area of community mobility concern as a result of "motor vehicle speed sight lines at cross streets". The plan identifies a proposed trail or walkway from Hobbs Street, along Maynard Street, and on the field at Frank Hobbs elementary school, Saanich's Arbutus Road property, and the Finnerty-Arbutus property. The proposed trail is identified as a "potential local greenway".

Rezoning of the site will be required to accommodate the construction and operation of a treatment facility.

Available buffer zones

The treatment facility will be constructed in the northeast portion of the Arbutus–Finnerty site. The location of the site will include the following buffers:

- Northwest: 95 m forested buffer will exist between the facility footprint and property boundary, adjacent to Finnerty Road.
- Southwest: 95 m forested buffer will exist between the facility footprint and property boundary.
- Northeast: The facility will be adjacent to the property boundary, bordering Arbutus Road.
- Southeast: The facility will be adjacent to the property boundary, and an undeveloped wooded parcel owned by the District of Saanich.

Adjacent land uses

Institutions and residences are the primary land uses in the vicinity of the Finnerty-Arbutus site (Figure 6-5). Specific land uses and their approximate distance from the facility footprint are:

- undeveloped wooded parcel by the University of Victoria (30 m southeast),
- UVic Lam Family Student Housing Complex (115 m south),
- UVic Child Care Complex (125m south),
- Vancouver Island Health Authority (VIHA) Ledger House (130 north) on property owned by Queen Alexandra Foundation (QA),
- QA administrative building (25 m north),
- QA sports fields and open space (25 m north),
- G.R. Pearkes daycare facility (160 m northeast),
- Sisters of Saint Ann property (260 m northeast),
- Frank Hobbs elementary school (360 m southeast),
- Arbutus Grove Children's Centre (290 m east),
- Arbutus Global Middle School (310 m southwest),
- Goward Park and Goward House (260 m and 360 m southeast), and
- detached residences (110 m northwest on Finnerty Road, 190 m northwest on Alpine Crescent, and 100 m southeast on Sutton Road).

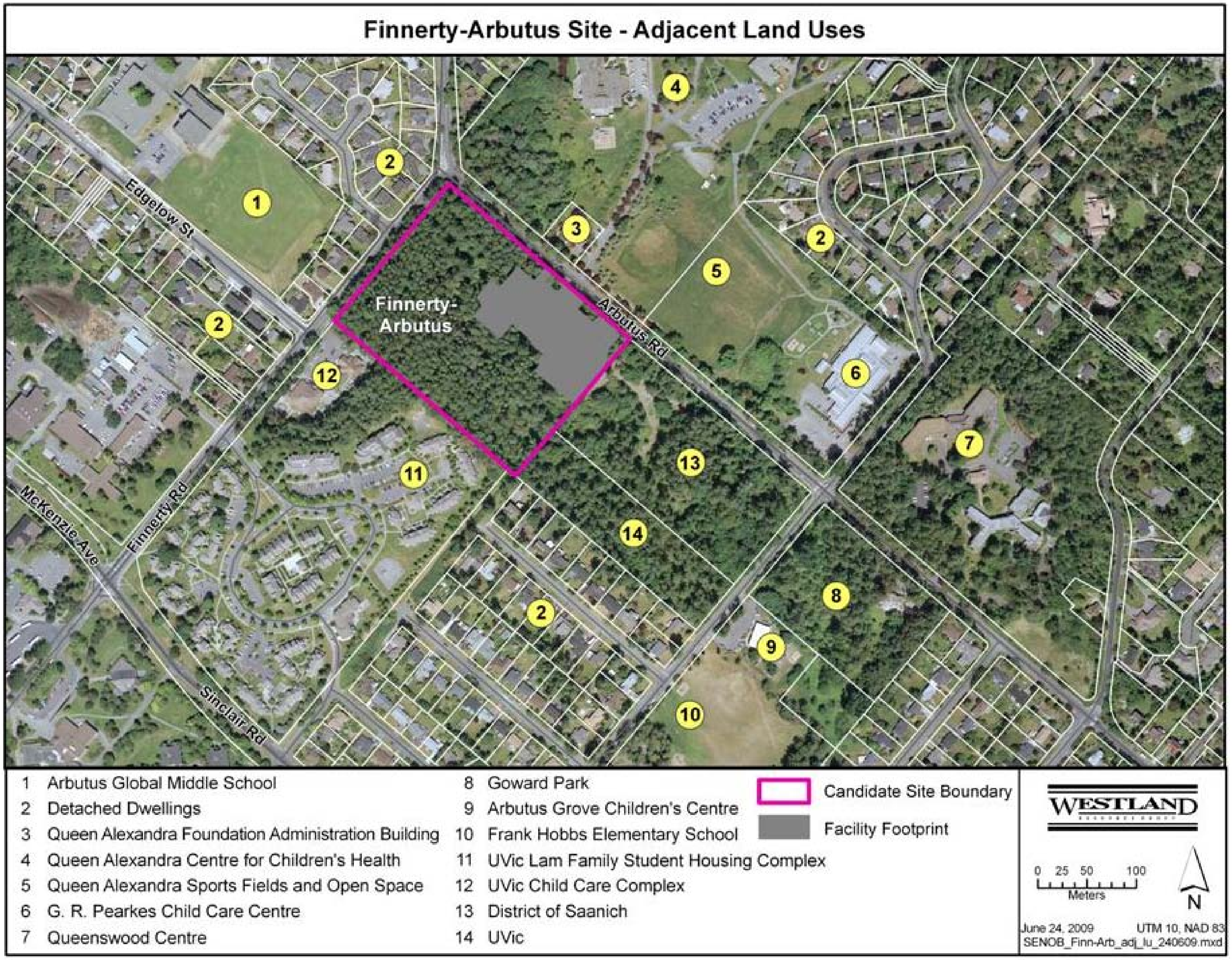


Figure 6-5. Land uses in the vicinity of the Finnerty-Arbutus site

Ancillary facility conditions

A gravity main and a small diameter pressurized pipe will be required to operate the treatment facility at the Finnerty-Arbutus site. The gravity main will be constructed in existing and new rights-of-way across the QA field (Photo 6-4), in an existing right-of-way across a residential property, under Alpine Crescent, Haro Road, Monarch Place, and in an existing right-of-way across four detached residential properties.

The small diameter pressurized pipe will be constructed from the Penrhyn pump station to the Finnerty-Arbutus site entirely under existing roads, including, Penrhyn, Hobbs, Maynard, Rowley Streets, and Arbutus Road. Land uses near this route are predominately detached residential.

Photo 6-4. Queen Alexandra Foundation grass field north of Arbutus Road

Impact assessment and mitigation measures

Treatment facility construction. During the treatment facility construction phase, community use will be restricted in and around the active construction area. Until recently, the site was owned by the Queen Alexandra Foundation (QA), which placed no trespassing signs at the entrances to the property to deter use. A pattern of community use has developed, however, which includes walking, running, dog walking, orienteering, environmental study, and biking.

> Mitigation measures. Opportunities for recreation activities may exist on the portions of the Finnerty-Arbutus site outside of the treatment facility footprint and workspace during construction. Similar recreational activities to those currently undertaken on the Finnerty-Arbutus site also occur on the adjacent District of Saanich and University of Victoria properties. Signage and newspaper advertisements will be used to inform community users of the construction schedule and those portions of the site that will have access restrictions.

Community use of the facility footprint and workspace portion of the site will be restricted during the construction period, resulting in a local, medium-term impact. Public use of the facility footprint will not be allowed, constituting a long-term, irreversible effect. The construction work space will be off-limits to the public during the construction period, representing a local, medium-term, reversible impact. The availability of nearby recreational opportunities will reduce the community impacts during the construction phase. Some authorized public uses (such as the bus stop on Arbutus Road) may be affected during facility construction. For this reason, and because some local residents consider the Finnerty-Arbutus site to be *de facto* public green space, the access limitations during construction are considered to be high magnitude and **significant.**

Treatment facility operation. Operation of the facility will alter existing land use on a portion of the Finnerty-Arbutus site resulting from the conversion from a forested site to utility use. In the facility footprint, the existing recreation opportunities will be lost. To date, the CRD has not prepared a long-term management plan for the portions of the site outside of the facility footprint.

> Mitigation measures. The facility will be constructed on only a portion of the Finnerty-Arbutus site. Community input on desired future land use for the remaining property will be sought by the CRD.

The conversion of a forested area to a utility use on the treatment facility footprint will be a local, long-term impact, and not reversible. Some community residents will consider the impact to be high magnitude. The Finnerty-Arbutus site is not public greenspace, and has been posted against trespassing. The use of the parcel for a use permitted under prevailing zoning bylaws should not be considered to be an adverse effect on unauthorized public use. The impact of operating a wastewater facility on unauthorized public use of the Finnerty-Arbutus site is considered to be **less than significant.**

Ancillary facility construction. An expanded network of pipes will be required to support the operation of the treatment facility, including a gravity main and outfall, and a small diameter pressurized pipe from the Penrhyn pump station. The construction of the gravity main will introduce land disturbance on five properties where existing rights-of-way exist. The small diameter pressurized pipe will be constructed from the existing Penrhyn pump station to the Finnerty-Arbutus site under Penrhyn, Hobbs, Maynard, Rowley Streets, and Arbutus Roads. Rights-of-way exist for the ancillary facility routes.

> Mitigation measures. Discussions with potentially affected home owners and institutional users prior to construction will help to ensure mitigation measures are appropriate to minimize potential risk to children and other users, and to minimize disturbance. CRD representatives will work with the University of Victoria, District of Saanich representatives, and community groups to minimize impacts of constructing the ancillary facilities through residential neighbourhoods. Site restoration plans will be developed with property owners.
>
> The QA field that is crossed by the gravity main can be restored for use as a field. CRD representatives will work with QA representatives to ensure that an appropriate right-of-way is secured and to minimize impacts of constructing the pipe. Pipe construction will be conducted in accordance with local municipal bylaws to minimize disturbance.

With the application of approved mitigation measures, the impacts to existing roads are considered local, short-term in duration, and reversible. The landscaping on five residential properties with existing rights-of-way crossed by the project will be altered, but impacts will be reduced through discussions with property owners and site restoration, resulting in a local, medium-term impact that is reversible and moderate in magnitude. The impacts of ancillary facility construction will be **less than significant.**

The outfall discharge location is presently under study. Once these studies are complete, outfall and gravity main routing and construction decisions will be made.
Ancillary facility operation. The types of land use activities that will permitted in rights-of-way are limited. Generally, the construction of permanent structures are not be permitted in a right-of-way.

> Mitigation measures. If new rights-of-way are required, the CRD will seek an agreements with the land owner to minimize effects. The CRD will communicate with

property owners whose land will be crossed in existing rights-of-way to reduce potential impacts. Route alternatives will be assessed in an effort to avoid effects on residential property.

With easement agreements established between the CRD and property owners, and communication with property owners whose lands will be crossed by the ancillary facilities, the long-term impact will be local, long-term, moderate in magnitude, not reversible, but **less than significant.**

6.9 Traffic

Treatment facility site conditions

The Finnerty-Arbutus site is located southeast of the Finnerty Road–Arbutus Road intersection in the District of Saanich. Truck routes and other roads in the vicinity of the site are outlined in Figure 6-6.

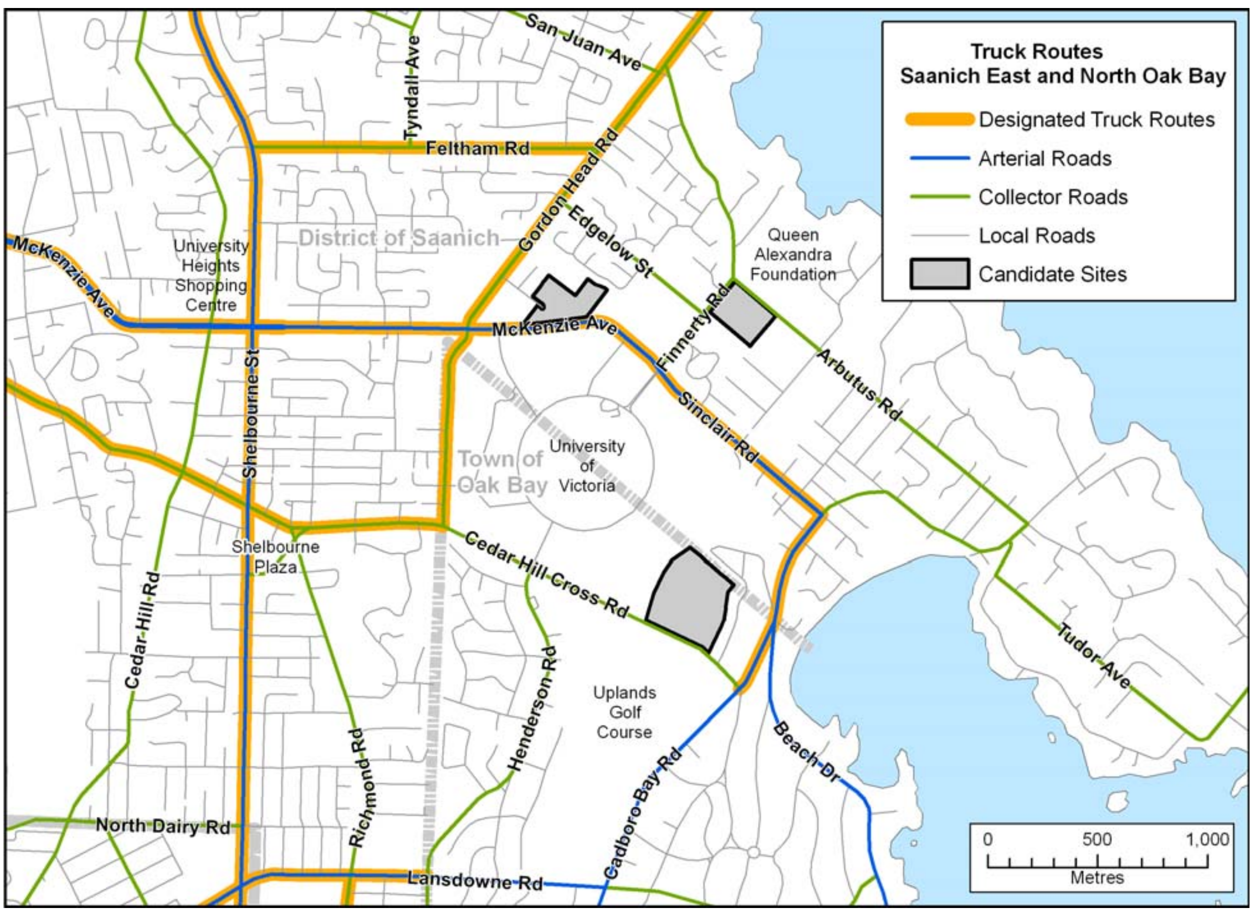


Figure 6-6. Truck routes and other roads in Saanich East

The initial traffic impact assessment for this project examines the volumes and types of vehicular traffic, road classification, proximity to designated truck routes, alternative modes of transportation, accident history, transit service, and impact on existing traffic from construction and installation of pipes underneath existing road surfaces.

These factors are considered for following time frames for this project:

- 2009 Present Conditions,
- 2010 – 2012 Construction of Phase 1 facility,
- 2030 Operation at full capacity of Phase 1 facility,
- 2030 – 2032 Construction of Phase 2 or expanded facility, and
- 2065 Operation at full capacity of expanded facility.

When considering the potential routing(s) to and from the site, designated truck routes are used where possible as well as the shortest route to designated truck routes. The Finnerty-Arbutus site will be accessed from Arbutus Road, Finnerty Road, and McKenzie Avenue. Arbutus Road and Finnerty Road have a municipal functional classification of collector roads. McKenzie Avenue has a functional classification as an arterial road and is also the nearest designated truck route.

Ancillary facility conditions

The gravity main and outfall are the only ancillary facilities associated with the Finnerty-Arbutus site. Most of the length of these two facilities will be located under roadways such as Alpine Crescent and Monarch Place (Figure 4-3).

Impact assessment and mitigation measures

Data were obtained from the District of Saanich and the Capital Regional District. The existing volumes on the road links to the facility are illustrated in Table 6-3. This table shows the current traffic volumes in vehicles per day (vpd) and vehicles per hour (vph) for the PM Peak Hour period for each road link. An assumed growth rate of 1% per annum was used to forecast these traffic volumes to 2030, when the second phase of construction is scheduled to begin. Traffic volumes for 2065 were not forecast, because there are too many uncertainties related to future transportation technologies, infrastructure, travel modes, and modal shares.

Table 6-3. Daily and PM peak hour traffic volumes for the access route to the Finnerty-Arbutus site

Road Name	Characteristic	Units	2009	Volumes	2030	Source
McKenzie Ave	Traffic - vehicular volumes	Vehicles per day (vpd)	12,495	vpd	15,399	Municipal, CRD
		Vehicles per hour (vph) - PM Peak	1,312	vph	1,617	
Finnerty Road	Traffic - vehicular volumes	Vehicles per day (vpd)	9,734	vpd	11,996	
		Vehicles per hour (vph) - PM Peak	1,023	vph	1,261	
Arbutus Road	Traffic - vehicular volumes	Vehicles per day (vpd)	4,905	vpd	6,045	
		Vehicles per hour (vph) - PM Peak	515	vph	635	

Arterial roads are expected to carry traffic volumes in the range of 10,000 to 30,000 vpd, and major collectors from 5,000 to 20,000 vpd, so the road links on the preferred routing have no capacity limitations for the forecast growth in background traffic.

Treatment facility construction. The forecast trips for the construction of the site for Phases 1 (2010 construction) and 2 (2030 construction) are shown in Table 6-4 as average trip rates per day (vpd) with an assumed 240 workdays per annum.

The construction of Phase 1 in 2010 to 2012 is forecast to generate approximately 75 two-way vpd for the site and approximately 45 two-way vpd for Phase 2 construction in 2030 to 2032.

Table 6-4. Forecast vehicular volumes for Phase 1 and 2 construction of the Finnerty-Arbutus facility

CONSTRUCTION TRAFFIC			
YEAR 2010		**Duration**	**Average two-way trips (vpd)**
Actvities	Clearing/Grubbing/Aggregates	3 months	10 trucks
	Excavations	7 months	8 trucks
	Concrete	9 months	5 - 6 trucks
	Steel	9 months	1 truck / week
	Equipment, materials	24 months	1 truck / week
	Workers	24 months	50 cars
YEAR 2030			**Average two-way trips (vpd)**
Actvities	Clearing/Grubbing/Aggregates	1 month	5 trucks
	Excavations	3 months	6 trucks
	Concrete	4 months	4 - 5 trucks
	Steel	4 months	1 truck / week
	Equipment, materials	24 months	1 truck / week
	Workers	24 months	30 cars

During construction, traffic will be disrupted on site access roads and additional parking will be required for construction workers driving to and from the site. Public safety risks may result from vehicles on roads and heavy equipment operation on the site, but standard construction practices will avoid or reduce any potential effects.

> Mitigation measures. No special access or traffic control measures are needed, beyond those applied as part of standard construction practices for projects of this nature. With the use of flaggers and signage, the risk to the public from vehicle movement is greatly reduced. The construction site will be fenced to prevent access by walkers, mountain bikers, or other members of the public. Flaggers will be present during school hours to ensure that students, particularly those walking to elementary or junior secondary schools, do not gain access to the site.
>
> If the clearing and grubbing stage can create enough parking on-site for all construction workers then there would be negligible impact. If there is not enough space to accommodate all the parking on-site, it is recommended that van-pooling, ride-sharing and park and ride programs be developed to reduce the number of trips or that additional parking be developed elsewhere. Nearby residents are typically notified in advance of disruptive construction activities.

The Phase 1 construction traffic of 75 vpd represents an increase of traffic of 0.60%, 0.77%, and 1.53% on McKenzie Avenue, Finnerty Road, and Arbutus Road respectively over current volumes. Increases in the range of 1% are considered negligible, and the impact on Arbutus Road will be low. The 45 vpd construction trips associated with Phase 2 construction are all well below 1% and are also considered negligible. The spatial impact will be local and of medium-term duration. While the traffic will be continuous over the construction period, it can be reduced by creating parking areas elsewhere. No residual effect would occur, and this impact is considered **less than significant**.

Treatment facility operation. As shown in Table 6-5, the number of site-generated trips for the operation of the facility is quite small and, when compared to the existing and forecasted vehicular trips on the road links in the preferred routing, these trips will have a negligible impact. The preferred routing reflects the truck traffic volumes involved with project construction and the need to use designated truck routes. Because operations staff will live in various parts of the region, they will not be constrained to a particular travel route. Staff's distributed travel network would reduce traffic impacts even further.

Table 6-5. Forecast vehicular volumes for Phases 1 and 2 operation of the Finnerty-Arbutus facility

OPERATIONAL TRAFFIC			
YEAR 2030			**Average two-way trips (vpd)**
Activities	Truck Loads		
		Screenings / Grit	1 truck / week
		Chemical	8 - 9 trucks / year
	Employees		12 cars
YEAR 2065			**Average two-way trips (vpd)**
Activities	Truck Loads		
		Screenings / Grit	1-2 trucks / week
		Chemical	1 truck / month
	Employees		15 cars

Mitigation measures. No mitigation measures are required.

Although traffic effects will be continuous and long-term, the magnitude of the effect is low, and the resulting rating is **less than significant**.

Ancillary facility construction. Ancillary facility pipes will be buried in the road corridor, most probably underneath the travel lanes, using cut and cover methods. Public safety issues associated with installing pipes in roadways and along rights-of-way are primarily associated with operation of heavy equipment and the presence of open trenches. Flaggers will be available during the day to manage vehicles and pedestrians near the worksite. Barriers or flagging is typically erected to alert people to the presence of open trenches.

Construction will disrupt vehicular traffic on affected routes. The extent and severity of disruption will be a function of the traffic volumes and available opportunities to keep some lanes open or to reroute traffic. All the roads potentially affected by the construction of ancillary facilities have two lanes, so it is assumed that one lane could remain open to accommodate alternating directions of traffic.

> Mitigation measures. Standard procedures for managing vehicular traffic in a construction zone will be implemented, which would result in one lane remaining open to alternating directions of traffic. Construction will be restricted to single blocks at a time and scheduled outside of peak periods of vehicular activity.

The impact will be local, of short-term duration, and continuous during the construction period. Considering volumes of traffic affected, the result is a low impact on the local and collector routes. One-way alternating traffic will be permitted and there will be no residual impact, resulting in a rating of **less than significant**.

Ancillary facility operation. There will be no impact from the operation of the ancillary facilities, because the pipes will be underground.

> Mitigation measures. Road surfaces will be restored to operational standards and no additional mitigation measures will be required.

The impact will be local and continuous. There will be no measurable residual effect and the impact is considered **less than significant**.

6.10 Noise, vibration, and lighting

Treatment facility construction. Construction of the treatment facility will involve the use of heavy machinery, compressors, pumps, concrete pouring equipment, and other equipment to prepare the site and build the treatment facility. During the construction period, noise and vibration impacts will affect neighbouring residents and institutional uses. Especially sensitive receptors in proximity to the proposed treatment facility footprint are users of the QA facility and University of Victoria daycare.

Peak construction activity will occur in the first 9 months during the excavation and concrete pouring phase. The project is expected to take 18- to 24 months to complete. After the 9-month peak construction activity has occurred, the construction activities will be similar to the construction of utility or industrial buildings. Construction activities will comply with the applicable municipal bylaws for hours of work and noise levels. Work will usually occur on weekdays from 7 am to 5 pm with no work on Saturdays, Sundays, or holidays (except in an emergency or where a critical piece of work must be completed in a specified work window). If required, lighting will be oriented to reduce effects on residents and institutional users.

> Mitigation measures. Discussions will be undertaken with the QA, VIHA, University of Victoria, neighbouring residents, and other institutional users during project planning and before construction to confirm noise mitigation measures.

Noise and vibration impacts will mainly occur during the 9-month site preparation period, but may occur occasionally at other times during the construction phase. As a result, the impact is considered to be local and medium-term. Generally, the noise and vibration effects will be moderate in magnitude, but could be higher for patients at QA facilities and University of Victoria daycare due to sensitive receptors at those two facilities. The noise and vibration effects are reversible once construction is complete. With adherence to the mitigation measures discussed with QA, VIHA, and University of Victoria representatives, noise and vibration impacts are considered **less than significant**.

Treatment facility operation. Operation of the treatment facility will generate noise, vibration, and lighting issues. Noise generating equipment will include:

- air-driven pumps,
- compressors,
- fans and blowers,
- diesel-driven pumps, and
- standby diesel power generators.

The nearest residence is 100 m southeast of the treatment facility. A house converted to a Queen Alexandra Foundation administrative building is located approximately 25 m from the footprint.

Noise from the treatment facility will not exceed 45 dB and 55 dB at the edge of the facility footprint at night and day, respectively. Sound attenuation will be installed in the buildings housing noise-generating equipment and on diesel engine exhaust to ensure that decibel levels remained below 45 dB at the property line. Noise levels will meet the local municipal bylaw requirement and WCB-OSHA criteria for worker safety. All noise-generating equipment will be installed in soundproofed rooms to meet these requirements.

All installed vibrating equipment will be contained in isolated structures that meet vibration limits acceptable in residential areas. Because the wastewater systems to be used at the treatment facilities do not include excessive vibrating equipment and are typical of current operating systems found elsewhere, vibration issues are not anticipated and if present can be mitigated.

The lighting plan for the Finnerty-Arbutus facility is expected to include normal post top sodium vapour lighting standards similar to those on residential streets. All lighting will be directed downward and will have shields installed to prevent lighting of the night sky.

In accordance with corporate activities for environmental sustainability, facility planning will incorporate energy efficiency and BC Hydro power smart initiatives and the applicable Leadership in Energy and Environmental Design (LEED™) standards for green buildings. For example, LED lighting that uses low energy and emits low UV light could be specified.

> Mitigation measures. No specific mitigation measures are needed, aside from the specified design measures.

Noise, vibration, and lighting impacts will be long-term in duration and local in spatial extent. With appropriate design and maintenance, noise, vibration, and lighting impacts are considered to be low magnitude. The operation of the facility will result in changes to the existing conditions that are not reversible, but are **less than significant.**

Ancillary facility construction. The construction of the gravity main will introduce noise, vibration, and lighting impacts for residents and institutional users near the construction area.

The small diameter pressurized pipe will be constructed from the existing Penrhyn pump station to the Finnerty-Arbutus site under Penrhyn, Hobbs, Maynard, Rowley Streets, and Arbutus Roads. Standard construction practices will be followed.

> Mitigation measures. Discussions with potentially affected home owners and institutional users prior to construction will help to ensure mitigation measures are appropriate to minimize potential risk to children and other users, and to minimize disturbance. CRD representatives will work with the University of Victoria, District of Saanich, and community groups to minimize impacts of constructing the ancillary through residential neighbourhoods. Restoration plans will be developed with property owners. Pipe construction will be conducted in accordance with local municipal bylaws to minimize disturbance.

With the application of approved mitigation measures, the impacts are considered short-term in duration and reversible. For the ancillary facilities constructed under roads, the construction will be similar to other public road projects. Even with the application of mitigation measures, the magnitude of noise, vibration, and lighting impacts near the ancillary facility construction area will be moderate over the short-term and moderate magnitude. The impacts of ancillary facility construction will be **less than significant.**

The outfall discharge location is presently under study. Once these studies are complete, outfall and gravity main decisions will be made and impacts can be assessed.

6.11 Human health

Current research on human health and wastewater treatment facilities

Wastewater treatment is one of the great public health advances of modern times. The liveability of our cities depends in large measure on the effectiveness of wastewater treatment and effluent management. However, wastewater management is not without some health risks.

Recent health research reports indicate that microbial aerosols released from wastewater treatment facilities may constitute health risks for treatment facility workers, but there is no conclusive evidence of risk to nearby residents (Carducci et al. 2000; Heinonen-Tanski et al. 2009; Fracchia, et al. 2006; Lee et al. 2006; Brandi, et al. 2000; Health Canada 2009). This research indicates that the level of risk depends on work practices, worker hygiene, wastewater treatment processes, facility design, and environmental factors. More specifically, health risks depend on the exposure pathways (*e.g.*, equipment failure or emissions of gas, liquids, or solid waste) and the kind of potential risk factor (*e.g.*, gases, chemicals, bacteria, odours). Inhalation of aerosols originating from wastewater has been reported to be the primary source of worker exposure (Brown 1997).

Health Canada (2009) indicates that the probability of exposure to health risks associated with the construction and operation of wastewater treatment facilities ranges from very rare to moderate to unknown. Health Canada lists potential health impacts on urban areas and recreational users adjacent to wastewater treatment facilities (Table 6-6).

Table 6-6. Potential health impacts associated with wastewater treatment facility construction and operation

Exposure	Nature of exposure	Effects on health	Population at risk	Probability of occurrence	Biological-Environmental monitoring indicators
Gas emissions or emissions to air	Nitrogen oxide ($NO_{x)}$)	Irritation of respiratory tract	Urban and suburban areas	Rare to moderate	Ambient air measurements
	Dioxins, furans	Some carcinogenic compounds	Unknown	Rare or unknown	Ambient air measurements; epidemiological studies
	Polycyclic Aromatic Hydrocarbons (PAHs)	Some carcinogenic compounds	Workers and local population	Unknown	Ambient air sampling; beno[a]pyrene and other PAH concentrations
Nuisances	Odours	Quality of life	Vicinity	Rare to moderate	Complaints, perception

Source: Health Canada. Canadian Handbook on Health Impact Assessment – Volume 4: Health Impacts by Industry Sector. Chapter 8 Wastewater and Sludge Management.

The physical design of traditional wastewater treatment facilities can include open settlement tanks, aeration basins, sludge handling processes, and areas of mechanical agitation of waste material. Such layouts are typically not designed to prevent the dispersion of wastewater aerosols, (Brown 1997) and may release localized airborne microbes and fungi that are measurable within 20 m of the facility (Heinonen-Tanski 2009 and Brandi et al. 2000).

Research on health risks to wastewater treatment workers indicates that the workers have an increased risk of exposure to bacteria, funguses, parasites, and viruses that can cause intestinal and lung infections (Center for Construction Research and Training 2004). These illnesses, sometimes referred to as “sewage worker’s syndrome,” include infections of the airway, gastrointestinal system, central nervous system, and joint pain (Thorn et al. 2002 and Carducci et al. 2000). The researchers call for clinical investigations to determine exact causes of reported symptoms.

The Saanich East wastewater treatment facility will be entirely enclosed, and would include advanced odour control and air filtration systems. This enclosed design will eliminate the exposure microbial aerosol releases outside the treatment facility. The ventilation system will filter air vented from the interior of the facility to the outside. This ventilation system will not be connected to the odour control system in the facility.

The odour control system will be comprised of proven and reliable technology. One such system that could be used, a three stage chemical scrubber, includes absorption, adsorption, filtration, entrapment, and chemical conversion systems that remove disease-causing organisms to varying degrees of efficiency. Chemical scrubbers typically use an acid followed by hypochlorite and water to removed amine and reduced sulphur compounds; sometimes a caustic is also used. This system provides a barrier to most viruses and bacteria. Next, the activated carbon filter absorbs residual molecular organic compounds not completely oxidized by the scrubber. It is unlikely that disease organisms will pass through the odour treatment system and pose a risk to nearby residents (Kelly, pers. comm.).

Potential biological vectors of disease transfer from traditional wastewater facilities may include birds, rodents, and insects. Because the Saanich East facility would be enclosed, however, the risk of disease transfer by birds, rodents, or insects is negligible.

Impact assessment and mitigation measures

Treatment facility construction. Health risks during construction are limited to exposure to dust and noise. Dust control measures will be implemented if dust is generated during construction. The forested character of the site will limit wind transport of dust to nearby residential areas.

Members of the public stated that autistic children living near the Finnerty-Arbutus site or that are present in the Queen Alexandra Ledger House could be upset by the noise of construction activity. The homes and facilities housing autistic children are more than 100 m from the construction site. It is not certain that the generally moderate level of site grading and foundation noise over a period of six to twelve months, punctuated by intermittent louder noises, would constitute a serious mental health risk. The facility construction following completing of the foundation stage will be relatively quiet.

> Mitigation measures. Nearby residents are typically notified in advance of disruptive construction activities. The project contractor will communicate regularly with managers of the Queen Alexandra facility to discuss construction activities and ways to avoid the

potential disruption of health centre activities. Efforts will be made to avoid dust or loud noise during periods deemed sensitive by the Queen Alexandra facility managers.

The potential health effects of construction noise or dust would occur only during the construction interval, and are considered medium-term. Spatially, the greatest health risks would occur immediately adjacent to the construction worksite, with the risk diminishing with distance from the site. These impacts are reversible. Health effects are considered to be of moderate magnitude because of the proximity of the Queen Alexandra facilities. With appropriate controls of construction activities, public health effects are considered **less than significant**.

Treatment facility operation. Few public safety risks will be associated with treatment facility operation. The facility will be fenced to minimize public entry, and the equipment at the facility is enclosed. Health risks would be limited to treatment facility workers who may come into contact with untreated wastewater or microbial aerosols. The enclosed facility will prevent direct transmission of disease organisms to residents. The three-stage odour control system reduces the risk of viruses, bacteria, or other contaminants being discharged by air from the facility. The distance between the treatment facility and other residences or institutions (more than 100 m) further reduces public health risks.

Mitigation measures. No measures are needed to protect public health during facility operation beyond those included in facility design specifications and standard operating procedures.

The spatial extent of public health impacts are limited to the wastewater facility itself. The temporal extent is local, and any impacts will be reversible. The magnitude of public health impacts are negligible, and are considered **less than significant**.

Ancillary facility construction. Aside from temporary noise and dust during pipe installation, no public health effects will be associated with ancillary facility construction.

Ancillary facility operation. Once the pipes are in service, no public health or safety impacts will occur.

6.12 Visual aesthetics

Treatment facility site conditions

The Finnerty-Arbutus site is forested and on a moderately sloping hillside adjacent to Arbutus Road. The parcel, and neighbouring forested parcels are used for informal recreation by the local community and contain a network of paths dominated by BMX jumps (Photo 6-5). The forest understory varies from open areas lacking vegetation, to areas of dense ocean spray and big-leafed maple. The surrounding area is forested to the south, west and north of the site. To the northeast and east, on the north side of Arbutus Road, there is an open grassy slope. The closest neighbouring structure is a residential style office building at the entry to the Queen Alexandra facility. The nearest dwellings are east of the site, and largely screened by existing vegetation and break of slope. Visibility from roads is restricted to Arbutus Road, a two-lane collector road with no sidewalks (Photo 6-6). Traffic volumes are low to moderate, and Arbutus Road is not a truck route. There are two bus stops, one on either side of Arbutus Road adjacent to the facility, from which people could view the site.

Photo 6-5. Existing forest interior of site showing understory vegetation and BMX bike jump

Photo 6-6. Existing conditions looking northwest along Arbutus Road toward site (forest at left side of road near the car)

The viewsheds crossed by the ancillary facilities include roadways, the Queen Alexandra fields, and detached residences in Cadboro Bay and the Queenswood neighbourhood.

Impact assessment and mitigation measures

Treatment facility construction. The visual character of the site will be altered by construction of the treatment facility. Constructing the facility requires clearing and levelling of approximately 1 ha of the 4.4 ha parcel and will result in approximately 25% of the site being converted from forest to utility structure, parking, and other paved and landscaped areas. Little alteration will be made to the remainder of the site. Informal users of the site (it is private property with no authorized public access) will have views of the construction through the forest. Construction site lighting during winter months will intrude into the forest.

Visual impacts of construction on the site from outside the parcel will be screened by forest vegetation from all directions except east, northeast, and Arbutus Road. Across Arbutus Road, a dispersed line of deciduous trees and a minor break of slope partially screen the site from the nearest residential area 200 m to the east, and the Queen Alexandra buildings to the northeast (200 m) and southeast (250 m). Unobstructed views of the facility will only be obtained from Arbutus Road and the residential style office directly opposite and 30 m from the site.

Mitigation measures. During construction, no mitigation of visual impacts is feasible.

Based on this analysis, the visual impact resulting from construction of the treatment facility construction is considered to be short-term, irreversible, and of high magnitude due to the loss of forest landscape. For this reason the visual impact on the Finnerty-Arbutus site is considered to be **significant**.

Treatment facility operation. Operation of a treatment facility on the site will transform a forested viewscape to one of forested background with utility structures in the foreground. The structures will be visible from Arbutus Road and from vantages to the east, northeast, and southeast. Existing trees and terrain will substantially screen the facility from those viewpoints, with the exception of Arbutus Road and the adjacent office building. During the hours of darkness, facility lighting will introduce artificial illumination into the area.

> Mitigation measures. Careful building design and finish that incorporates analogous woodland colours could reduce the visual impact of the building against a forest backdrop. Planted shrubs and naturally regenerating forest edge vegetation will largely screen views of the facility through the forest. Careful positioning and use of lighting will minimize artificial illumination in the forest. The addition of vegetative screening and landscaping along Arbutus Road, and control of lighting will substantially mitigate the impact of the facility from Arbutus Road and other areas in visual range. Photo 6-7 and Photo 6-8 illustrate post-construction views of the facility from the office on Arbutus Road looking south and from the grassy area through a row of trees looking east.

Based on this analysis, the visual impact of the treatment facility on the site is considered to be long-term and irreversible, and of moderate magnitude due to the loss in forested landscape. For this reason the visual impact on the Finnerty-Arbutus site is considered to be **significant**. It is noted that relocating the buildings further into the forest will effectively screen the facility from external viewers, but will consequently increase the visual impact on informal users of the site. Such relocation will, on balance, reduce the visual impact to **less than significant** levels.

Figure 6-7. Overview of Finnerty-Arbutus facility

Photo 6-7. Rendered view of facility looking southeast across Arbutus Road

Photo 6-8. Rendered view of facility looking southwest across Arbutus Road

Ancillary construction. Construction of ancillary sewer pipes will result in approximately 2,700 m of pipe being laid along the suburban streetscapes of Queenswood and Cadboro Bay. Views of construction equipment and construction traffic will be localized and of moderate duration (occurring over a two year period). These impacts are medium-term, reversible, of low magnitude, and considered to be **less than significant**.

Ancillary operation. All ancillary infrastructure associated with this site are underground, so considered to have no visual impact and are, therefore, **less than significant**.

6.13 Use of reclaimed water

Facilities for toilet flushing and irrigation that use reclaimed water will be designed and operated in accordance with the *Municipal Sewage Regulation* Appendix 3 to Schedule 7 “Health And Safety Criteria For Use Of Reclaimed Water” and the “Code of Practice for the Use of Reclaimed Water”.

The Capital Regional District will ensure that the University of Victoria or other users develop reclaimed water information related to the use of reclaimed water, and submit the information to the Capital Regional District, the Regional Environmental Protection Manager and the Chief Medical Health Officer, Vancouver Island Health Authority at least 30 days prior to initiating use of reclaimed water. Copies of the information and communications material will be provided to all users at least once every year.

At this time, not enough information is available about the intended uses of reclaimed water to assess potential adverse effects. Once specific users, locations, and uses for reclaimed water have been identified, an environmental assessment will be conducted.

7.0 CUMULATIVE EFFECTS ASSESSMENT

For the purposes of this EIS, cumulative effects refer to the regional or sub-regional effects of constructing and operating a wastewater treatment facility in combination with the effects of other existing or planned developments.

The area considered in this cumulative effects assessment includes Gordon Head, Mt. Tolmie, and Oak Bay north of Lansdowne Road. Most of this area has been developed for housing, though the University of Victoria, Queen Alexandra Foundation facilities, and numerous public schools constitute a substantial institutional presence. Several large natural areas have been protected in this subregion, including Mount Douglas Park, Mount Tolmie Park, and several ocean waterfront areas in Gordon Head, Cadboro Bay, and Oak Bay. Some residual forest areas remain on lands owned by the University of Victoria and District of Saanich. Virtually all forest lands have been logged at least once; old growth is limited to scattered trees and small residual stands in parks. Few open streams remain; most have been enclosed in storm drains. The natural landscape in this suburban area has been largely replaced by roads, structures, lawns, and other landscaping.

Environmental effects of a wastewater facility

The geotechnical setting, hydrology, water quality, vegetation, and wildlife taken together form the "environment" of the study area. Even without a detailed analysis of the study area, examination of aerial photographs or a cursory field inspection leads to the conclusion that existing development in the study area constitutes a high magnitude, long-term, irreversible impact on the environment that must be considered **significant.**

A treatment facility and its supporting ancillary infrastructure will affect a total of 2 to 3 ha of land. This small footprint makes a slight contribution to the magnitude of cumulative effects in the study area. The kinds of contribution made by the treatment and ancillary facilities to cumulative effects include:

- Increased area of impervious surface, which could alter hydrology. The specified treatment of runoff (infiltrated on site, minimizing runoff) would mitigate this impact.
- Removal of mature trees. This impact will occur on the Finnerty-Arbutus site, and the loss of vegetation is not considered mitigable. With less than 1% of the entire Coastal Douglas-fir Zone remaining in mature or old forest condition in British Columbia, any further removal is a cause for concern.
- Loss of wildlife habitat associated with the mature forest. Wildlife habitat has been replaced or severely altered in the study area, and further losses will jeopardize the survival of forest-dependent species.

Offsetting the physical environmental impact of building a treatment facility is the ability to treat wastewater relatively near to its source (the Gordon Head and Cadboro Bay neighbourhoods) and to recover water and energy for reuse. The marine environment will benefit from discharge of much cleaner effluent than is the case today, and a longstanding impact on the sea will be mitigated.

In light of the existing significant cumulative effect of development in the study area, the relatively small contribution of the wastewater facilities to those impacts, and the offsetting marine benefits of treatment, the contribution of the wastewater facility to cumulative environmental effects is considered **less than significant.** A caveat to this determination is the need to make every effort to avoid removal of mature Coastal Douglas-fir vegetation communities in siting the wastewater facility.[1]

Social effects

Cumulative effects of development on social phenomena in the study area are less clear than are environmental effects. The effect of development on social topics considered in this EIS—archaeology, heritage, traffic, health, visual aesthetics, air quality, noise, vibration, lighting, and land use—will be the subject of debate among experts. It is beyond the scope of this EIS to, for example, quantify specific health and safety conditions throughout the cumulative effects study area. Fortunately, such an assessment is not required to understand the following potential contribution of the proposed wastewater treatment facility to the cumulative effects of existing conditions.

- The cumulative effects of existing development on archaeological and heritage resources in the study area can be considered adverse and **significant**. Although it is unlikely that the wastewater facility will contribute to further damage of loss of archaeological or heritage resources, the topic will be investigated in detail in an Archaeological Impact Assessment (AIA) study.
- Even during the busy construction period, traffic associated with the wastewater project will constitute less than 2% of vehicles on major roads, and much less during facility operation. Traffic congestion is a serious issue in the study area, but the wastewater facility will not materially contribute to the problem except temporarily during construction.

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[1] It bears mention that the study of environmental impacts of the CRD's proposed wastewater project greatly exceeds the level of review of nearly all other existing developments in the study area. Private and public lands continue to be cleared of the scant remaining mature Coastal Douglas-fir forest for housing, roads, highway interchanges, golf courses, agriculture, utility corridors, other urban development, and even commercial logging. This clearing typically proceeds without mitigation, compensation, or even, in most cases, consideration of its ecological or cumulative effect.

- Compared with the aggregate impacts of urban form and design of existing development and societal activities in the study area that affect public health, noise, vibration, lighting, and air quality, the wastewater facility's contribution will be negligible,
- The visual aesthetics effects of the proposed wastewater facility will be small in comparison with the appearance of other structures throughout the study area,
- Wastewater treatment has the potential to release unpleasant odours that could affect a portion of the study area, but the CRD is committed to a goal of eliminating noticeable odours from the Saanich East facility.

The effects of development in the study area on socially-important issues are recognized to be serious and in need of investigation and action. The analysis conducted in this EIS, however, indicates that the contribution of the wastewater facility to the cumulative social effects of development in the study area will be of low or negligible magnitude and **less than significant.**

8.0 RECOMMENDATIONS

This section summarizes the mitigation measures identified in this EIS, recommends contents for an Environmental Protection Plan (containing environmental instructions for facility construction and operation), and confirms the CRD's commitment to following these recommendations.

8.1 Mitigation measures

The CRD commits to the following mitigation measures for the construction and operation of the Saanich East wastewater treatment facility and associated ancillary facilities:

- A geotechnical investigation and review of the design will be conducted.
- A drainage plan will be implemented during facility construction to address surface drainage issues.
- Excavation depths for the force main will be minimized.
- If there is a risk of long-term dewatering of adjacent areas, trenching dams and impermeable bedding and backfill materials will be used.
- In areas where significant blasting will be necessary, the size of charge detonated per delay will be limited to avoid or minimize the blast's vibration effects on adjacent facilities and structures.
- A Qualified Environmental Professional will be retained to review, refine, and if necessary, revise the Streamside Protection and Enhancement Area on the site shown in District of Saanich documents.
- Settlement ponds or filtration basins will be constructed as needed to reduce suspended sediments in construction drainage. Sediment ponds or filtration will be used during dewatering of pipe trenches. If needed, silt fencing will used to control movement of sediments.
- A water management plan will be prepared to minimize on-site and off-site effects of groundwater and surface water changes.
- Onsite infiltration of runoff will be included in the project design to minimize effects on hydrology and water quality during facility operation.
- The site will be restored quickly following land disturbing activities to protect soils from erosion. Stockpiled soil will be covered or otherwise protected from erosion and sedimentation.
- Pipe trenches will be monitored during rainfall events to avoid erosion or sedimentation.

- The CRD will consider re-configuring the facility layout to minimize the removal of Garry oak trees near the southwestern boundary of the facility footprint.
- The CRD will consider onsite compensation measures for the impacts to the forested ecosystem. These measures could include registering a protective covenant to prevent tree cutting on the remaining forested woodland, management of invasive plants, or restoration of native plant cover.
- The CRD will consider onsite compensation to enhance wildlife habitat values in nearby green spaces. These measures could include removal of invasive plant species to increase the habitat quality for ground nesting birds and small mammals, or installing water retention features on the Finnerty-Arbutus site drainage to create habitat complexity and control erosion.
- Vegetation clearing will occur at times other than the nesting bird season (March 15 to July 31).
- The CRD Code of Practice for "Construction and Development Activities" will be implemented to mitigate dust and air emission impacts. Additional dust control plans will be developed as necessary.
- The facility will be constructed in accordance with Saanich bylaws.
- Truck boxes will be covered when transporting soil that could create dust nuisances.
- The CRD will consider the need for a backup odour control system for use during routine maintenance or mechanical failure.
- The CRD will monitor odour during facility operation and meet with neighbourhood representatives to identify and address odour issues.
- An Archaeological Impact Assessment (AIA) will be conducted before detailed facility design or ground disturbance begins. Site specific mitigation planning based on the AIA findings will be implemented.
- Areas with high archaeological potential will be monitored during ground disturbing activities.
- Nearby residents will be notified in advance of potentially disruptive construction activities. Signs and newspaper advertisements will be used to inform the community of the construction schedule and restricted access areas.
- The CRD will seek community input into the use of the portions of the Finnerty-Arbutus site outside of the facility footprint.
- The CRD will communicate with potentially affected home owners and institutional users prior to construction to ensure mitigation measures are appropriate to minimize adverse effects.

- Facility construction will be conducted in accordance with local municipal bylaws.
- The CRD will communicate with property owners whose land will be crossed by ancillary facility pipes to identify ways of reducing adverse effects.
- Pipe route alternatives will be assessed in an effort to avoid or reduce adverse effects on residential properties.
- The QA field that is crossed by the gravity main will be restored for use as a field. The CRD will work with QA representatives to secure a new right-of-way and to minimize impacts of constructing the pipe route in the existing right-of-way.
- Standard procedures for managing vehicular traffic in construction zones will be implemented, seeking to minimize effects on traffic flows and safety.
- Traffic flaggers and signs will be used during construction. Flaggers will be present during school hours.
- The construction site will be fenced to prevent access by walkers, mountain bikers, or other members of the public.
- If insufficient space is available on the Finnerty-Arbutus site to accommodate parking during construction, alternative measures will be implemented to reduce the number of vehicles or to provide additional parking elsewhere.
- Road surfaces will be restored to operational standards following construction.
- Discussions will be undertaken with the QA, VIHA, the University of Victoria, other institutional users, and neighbouring residents during project planning and before construction to confirm noise mitigation measures.
- The CRD will engage the public in building design and finish to reduce the visual impact of the building against a forest backdrop.
- Shrubs will be planted and naturally regenerating forest edge vegetation will be protected to screen views of the facility through the forest and along Arbutus Road.
- Lighting will be positioned to minimize artificial illumination in the forest.

8.2 Environmental Protection Plan

An Environmental Protection Plan (EPP) contains:

- general instructions,
- drawings and diagrams, and
- contingency plans.

An Environmental Protection Plan (EPP) will be developed by the CRD specifically for the Saanich East facility. The EPP will incorporate the appropriate requirements of the CRD's existing procedures and manuals that are applicable to the construction and operation phases of the Saanich East facility. The EPP will outline environmental standards and cover adherence to all applicable permits, use and handling of approved materials, construction practices, proper disposal of waste, and conformance to the Workplace Hazardous Materials Information System (WHMIS) and other pertinent regulations. The standards will be incorporated into the contracts, and compliance will be a legal obligation for contractors.

The EPP for the Saanich East facility will contain a set of instructions that are developed to avoid or minimize adverse clearing and construction effects of the project on the environment.

The mitigation measures described in Section 6 of this EIS and the forthcoming marine EIS will be incorporated in the EPP. The EPP will apply to each phase of the project, including clearing, grading, construction, operation, and restoration.

The EPP will be written in construction specification format so that it is clear and can be easily interpreted and followed in the field by contractors, trade and environmental inspectors, regulatory inspectors, and other government representatives. The use of the construction specification format also allows the instructions contained in the EPP to be directly included in the construction contract bid documents and specifications.

Before commencing work on the Saanich East facility, workers will receive environmental orientation and training describing requirements related to safety and environment.

The Environmental Protection Plan will include a series of contingency plans covering:

- wet soils,
- soil erosion or siltation,
- flooding or excessive flow,
- accidental spills,
- fire,
- accidental release of drilling mud during horizontal direction drilling,
- wildlife incidents,
- discovery of plant species or wildlife species of concern during construction, and
- discovery of archaeological or heritage resources during construction.

8.3 CRD commitment

By accepting this EIS, the CRD commits that it will make best efforts to implement the recommended actions identified in Section 8.1. Acceptance of the EIS also obligates the CRD to develop an Environmental Protection Plan as described in Section 8.2, and to implement the actions described in the EPP.

The timing and sequence of the implementation actions will be linked to the schedules for planning, design, construction, and restoration stages of the wastewater project. The actions will be subject to approval by the CALWMC or Board of the CRD, and will be contingent on availability of adequate funds to conduct the tasks.

9.0 PREPARERS OF THE REPORT

The EIS was prepared by Westland Resource Group and affiliated consultants, with the involvement of CRD personnel. The study team was headed by senior planners and environmental scientists at Westland, a Victoria-based environmental consulting firm. Expertise was provided in the following areas:

- land use planning and analysis,
- biology (vegetation and wildlife),
- hydrology and water quality,
- community effects (noise, odour, light and glare),
- archaeology and heritage,
- Geographic Information Systems-based mapping and spatial analysis,
- traffic and roads,
- facility design, construction, and operation,
- odour dispersion modelling,
- geotechnical analysis,
- archaeology, and
- meteorology.

All of the consultants in the Westland team have professional registrations in their respective fields and are experienced in conducting studies of this type. Westland was selected to conduct the EIS after a competitive proposal process conducted by the CRD.

The follow section presents biographies of the Westland team.

David Harper, Ph.D., P.Ag., CPESC, MCIP, is the Project Manager for the siting and environmental assessments. He led several elements of the project, including municipal planning issues, neighbourhood and socioeconomic impacts, First Nations issues, facilitation of meetings with the Core Area Liquid Waste Management Committee (CALWMC), oversight of the GIS analysis, report preparation, quality assurance, and administration. Dr. Harper, with Westland Resource Group, has more than 30 years of experience in community and environmental planning, resource and watershed management, site location studies, impact assessment, and public involvement for the private sector and for local and senior governments. He led the development of the ESR concept with the District of Saanich, managed preparations of ESRs in several municipalities, and has participated in siting and impact assessment studies for industrial clients throughout British Columbia.

He is a Registered Planner, a Professional Agrologist, and a Certified Professional in Erosion and Sediment Control.

Wayne Biggs, M.Sc., P.Ag., R.P.Bio., is the Project Biologist and Assistant Project Manager for the siting and environmental assessments. He is responsible for identifying sensitive ecosystems, vegetation communities, wildlife habitats, and other ecosystem elements for the siting study and ESRs. Mr. Biggs is a Registered Professional Biologist and a Director of Westland Resource Group. He has more than 30 years' experience as an environmental consultant in British Columbia. He has conducted numerous environmental planning, biological inventory, habitat resource mapping and restoration projects in the province, and participated in the CRD biosolids facility site selection and ESRs. He was involved in the development of the ESR concept for the District of Saanich, and has participated in preparation of ESRs in the region. He has worked with the CRD on several engineering projects, including the septage disposal siting study and the Hartland Road composting study.

Carmen Holschuh, M.Sc., R.P.Bio. is a biologist with Westland Resource Group and is the Vegetation and Species at Risk Specialist for the project. Ms. Holschuh has conducted environmental impact assessments on Vancouver Island and throughout British Columbia, including inventory and site characterization, potential impact identification, mitigation planning, and evaluation of the significance of impacts. She has experience in environmental research design, data collection and analysis, field-based wildlife and vegetation inventories, and species at risk assessment and management. Ms. Holschuh has conducted many biological studies on Vancouver Island, including identifying and mapping sensitive habitats for CRD Parks, habitat and species inventories on proposed development sites in the CRD that assessed potential project impacts and guided the form and location of development.

Rahul Ray, B.Sc., DEIA, M.R.M, is an Environmental Planner with Westland Resource Group and is Community Planning Specialist for the project. Mr. Ray has co-ordinated socioeconomic studies for major industrial projects in federal and provincial environmental regulatory processes, leading to the assessment of potential effects and identification of mitigation measures. He is familiar with collecting and analyzing information on land and resource use, public health, demography, community infrastructure, and services. Mr. Ray has participated in a broad range of resource management projects across British Columbia, often involving multi-stakeholder groups created to address complex resource issues. He has experience working collaboratively with representatives from government, industry, communities, environmental groups, and First Nations. Mr. Ray has an educational background and experience in land use planning and environmental and social impact assessment.

Steve Young, B.Sc., Dip.E.M.A, M.En.S., is Westland Resource Group's Geographic Information System and Mapping Specialist, and has more than 17 years' experience working as a professional ecologist and GIS specialist in the environmental sector. He is the Spatial Analyst for the CRD project. Mr. Young has been analyzing spatial phenomena and making maps in the land and resource management field in British Columbia for the past eight years. His accomplishments include creating maps and spatial analyses for numerous Land and Resource Management Plans and environmental assessment applications. In the CRD, Mr. Young has mapped old growth forest remnants, marbled murrelet habitat, Sensitive Ecosystem Inventory areas, and the proposed Victoria Harbour Pathway. His specialties include cartography, analytical programming, web mapping, and forestry and protected areas analyses.

Tara Lindsay, B.Sc., is an Assistant Environmental Planner for Westland Resource Group, and is a Data Analyst for the project. She has five years' experience managing and conducting environmental projects in the CRD. She has training and experience collecting environmental data, producing and analyzing Geographic Information Systems data and maps, collecting field and published data, facilitating meetings, and engaging and educating the public. She is highly skilled with graphic and analytic computer programs. Ms. Lindsay is educated in geography through the University of Victoria and has conducted public engagement initiatives in the CRD. She has worked extensively on environmental projects funded by Environment Canada and has prepared environmental assessments for major industrial projects. Her work has included collaboration with federal, provincial, and local governments, non-governmental organizations, businesses, and the general public.

Richard H. Dixon, P. Eng. is the project's Transportation Engineer. A Professional Engineer, he has had extensive experience in transportation projects over the past 30 years in a variety of public and private positions. He was involved in the traffic impact component of the ESR for the CRD's Biosolids Facility Site Comparison, which examined the impacts of candidate sites on local transportation infrastructure, changes to traffic volumes, and potential mitigation measures. Mr. Dixon's experience includes the Transportation Master Plan for the Town of View Royal and the analysis of the impacts of the redevelopment of the Town & Country Shopping Centre from 230,000 to almost 700,000 square feet. Other significant projects have involved the proposed redevelopment of the Bamberton Lands as a community of approximately 3,200 residences and transportation demand management plans for the Pacific Sport Institute.

Harlan Kelly, P.Eng., is a Principal at Dayton & Knight Ltd. is the Solids Handling and Treatment Specialist for the concept designs. Mr. Kelly has 35 years of direct experience in wastewater treatment and has prepared more than 40 pre-design and facility plans for British Columbia communities and more than 50 wastewater treatment studies, including residuals, liquid, odour, fermentation, and sludge-biosolids systems. Mr. Kelly has planned, designed, supervised, and administered construction work for large and small sewage works. He has advised on full design and construction digestion projects for Vail, Colorado, Edwards, Colorado and Sunrise, Florida as well as Sendai, Japan. He is currently completing the Golden Heart WWTP

Engineering Audit in Fairbanks, Alaska. Mr. Kelly has assisted the CRD in planning treatment plant layouts and preparation of Core Area wastewater treatment and decentralized treatment. He was Project Manager for the CRD's Sludge Management Options Study, and worked with Westland on the Siting Study and ESR for biosolids facilities.

Allan Gibb, Ph.D., P.Eng. is a Wastewater Treatment Specialist for the project, and is responsible for concept designs and regulatory compliance. Dr. Gibb has 17 years of experience in wastewater treatment, planning, and in process design for residuals and liquid handling. His academic, operations, and professional career has encompassed all facets of wastewater treatment. In addition to facility planning and process design, he has extensive experience in treatment plant operations and performance optimization. Dr. Gibb has been involved in the preparation of several Liquid Waste Management Plans and treatment plant pre-design studies in British Columbia, and he fully understands regulatory issues relating to wastewater treatment. He will be responsible for issues relating to treatment and discharge requirements for the wastewater and biosolids treatment facilities.

Gordon J. Esplin, M.Sc., P.Eng., is the Principal and Senior Engineer of Genesis Engineering Inc., a company devoted to advanced environmental technology and to solving air pollution problems. He is the Air Emissions Specialist for the project. Mr. Esplin has more than 30 years' experience, and is an expert in odour control measurements and odour control modelling. His experience includes air pollution dispersion modelling for Vancouver International Airport, pulp mills, shipyards, landfills, and large wastewater treatment facilities. Previously, Mr. Esplin was Head of the Air Quality Division of B.C. Research Inc. He prepared the odour emissions and air dispersion modelling, impact assessment, and mitigation components of the ESR for the CRD's biosolids study.

C. N. Ryzuk, M.Eng., P.Eng. is the Geotechnical Engineer for the project. The Principal of C. N. Ryzuk and Associates, he applied his substantial local knowledge and experience to identifying geotechnical conditions and issues associated with the treatment facilities. Mr. Ryzuk has worked extensively in the CRD on large and small geotechnical site investigations. He is one of the most experienced geotechnical engineers in the Capital Region, and has been responsible for geotechnical assessments and recommendations affecting some of the largest and most complex structures on southern Vancouver Island.

Bjorn Simonsen, B.A., M.A. is the Heritage and Archaeology Specialist for the project. Mr Simonsen is the Principal of The Bastion Group Heritage Consultants, and has more than 35 years of experience in the cultural resources management field in Canada, including 10 years as British Columbia's Provincial Archaeologist. He is a well known and respected professional in the fields of cultural resources management and archaeological research and site management. Mr. Simonsen has also managed the day-to-day operation of five historic sites in Greater

Victoria, including Helmcken House, Craigflower Farm, and the Emily Carr House. He has conducted archaeological impact assessment studies, heritage resources feasibility and management studies, First Nations economic development initiatives, and treaty and land claims related work. He worked with Westland on the ESRs for the CRD's candidate biosolids treatment facilities. In the course of his work, Mr. Simonsen has authored more than 300 reports on various aspects of British Columbia's First Nations culture and archaeological heritage and has an excellent working relationship with numerous First Nations communities throughout the province.

Thomas Munson, M.Sc., Dipl. E.R., of Westland Resource Group supported the archaeological and heritage component of the siting and environmental assessments. Mr. Munson has worked with First Nations in the Yukon Territory, British Columbia, and Colombia, South America for much of the past 20 years. His has assessed development impacts on archaeological and cultural sites, conducted ethno-botanical field studies, traditional use research, multi-party treaty negotiations, and environmental impact assessments. Mr. Munson has worked as an Archaeological Field Technician in Greater Victoria, conducting fieldwork and preparing Archaeological Impact Assessment (AIA) reports on the Bear Mountain Resort development area, a sewer trunk project in North Saanich, Portage Cove Regional Park, and proposed private property developments. He has worked alongside members of the Esquimalt Nation, Songhees First Nation, Tsartlip First Nation and Tseycum First Nation, and other First Nations in the Lower Mainland and British Columbia interior.

Stanton Tuller, Ph.D., is an accredited consulting meteorologist in topics including applied climatology, climate impact assessment and wind engineering and a professor at the University of Victoria. His major research interests are in the area of applied climatology including effects of ground surface alterations on the overlying climate, human thermal bioclimate, microclimatic and applied effects of onshore winds and time and space variations in wind. Current research focuses on changes in coastal wind speed and wind power over the period of observational record. Dr. Tuller supplied data and support for the odour modelling performed by Genesis Engineering.

The facility project description, describing methods of constructing and operating the treatment facility and ancillary conveyance infrastructure, was provided by staff of CRD Environmental Services and Stantec Consulting Ltd., most of whom are professional engineers or have other professional registrations.

10.0 REFERENCES

Associated Engineering (BC) Ltd., CH2M Hill, and Kerwood Leidal Associates Ltd. June 12, 2008. *Core Area Wastewater Management Program – Program Development Phase – Report to Minister of Environment.* Prepared on behalf of the Capital Regional District.

Associated Engineering (BC) Ltd., CH2M Hill, and Kerwood Leidal Associates Ltd. March 21, 2007. *Discussion Paper No. 5 – Core Area and West Shore Sewage Treatment Wastewater Management Options*. Prepared for the Capital Regional District.

Australia Department of Environmental Protection. March 2002. *Odour Methodology Guideline*.

AXYS Environmental Consulting Ltd. 2005. *Sensitive Ecosystems Inventory (SEI): East Vancouver Island and the Gulf Islands (includes 2002 Disturbance Mapping)*. Prepared for Environment Canada, Ministry of Sustainable Resource Management, and Ministry of Water, Land and Air Protection. Available at: http://a100.gov.bc.ca/pub/acat/public/viewReport.do?reportId=2124 (accessed April 2009).

B.C. Conservation Data Centre. 2008. *BC Species and Ecosystems Explorer*. B.C. Ministry of Environment. Victoria, B.C. Available at: http://a100.gov.bc.ca/pub/eswp/ (accessed April 2009).

Barnett, Homer. 1955. *The Coast Salish of British Columbia*. Eugene: University of Oregon.

Bell, Randall. 2008. *Contaminated waterways and property valuation*. Appraisal Journal.

Bernick, Kathryn. 2001. *Status of Archaeological Resources*. A Report for the Te'mexw Treaty Association. Victoria, BC.

Boas, Franz. 1891. *The Indians of British Columbia: Lkungen, Nootka, Kwakiutl, Shuswap. Sixth Report on the Northwestern Tribes of Canada*. Report of the British Association for the Advancement of Science, pp. 553-715.

Brandi, G., M. Sisti, and G. Amagliani. 2000. Evaluation of the environmental impact of microbial aerosols generated by wastewater plants utilizing different aeration systems. *Journal of Applied Microbiology*, 88: 845-852.

British Columbia Treaty Commission website. Accessed December 2007. Available at: http://www.bctreaty.net/files/nations_negotiations.

Brown, J. 1997. *Health hazard manual: Wastewater treatment plant and sewer workers*.

Cadboro Bay Residents Association. 2008. "Caddie Bay News." Winter edition.

Campbell, Harrison S., Jr. and Darla Munroe. 2007. *Greenways and Greenbacks: the impact of the Catawba Regional Trail on property values in Charlotte, North Carolina*. Southeastern Geographer.

Capital Regional District. December 2009. *Core Area Liquid Waste Management Plan Amendment*. Prepared for the Ministry of Environment.

Capital Regional District. March 2009. *Project Description under the Canadian Environmental Assessment Act for the CRD's Core Area Wastewater Treatment Program Saanich East – North Oak Bay Wastewater Treatment Facility*. Prepared for the Canadian Environmental Assessment Agency.

Capital Regional District. September 10, 2008. *Discussion Paper – Design flow Tables*. 033–DP-2.

Capital Regional District. June 12, 2008. *The Core Area Wastewater Management Program – Program Development Phase.*

Capital Regional District website. *First Nations Engagement*. Accessed April 2009. Available at: http://www.wastewatermadeclear.ca/publicinput/firstnations.htm.

Carducci, A., E. Tozzi, E. Rubulotta, B. Casini, Cantiani, E. Rovini, M. Muscillo, and R. Pacini. 2000. Assessing airborne biological hazard from urban wastewater treatment. *Water Research* 34: 1173-1178.

The Center for Construction Research and Training. 2004. *Biological hazards in sewage and wastewater treatment plants: Hazard alert*. Retrieved May 25, 2009 (http://www.elcosh.org/docs/d0200/d000283/d000283.pdf)

CH2M Hill and Associated Engineering (BC) Ltd. February 23, 2009. *Memorandum: Conceptual Design Option 1 Summary Table*.

Delacy, P. Barton. 2004. *A LULU of a case: gauging property value impacts in rural areas (attitudes of residents)*. Real Estate Issues.

District of Oak Bay. 1997. *The Official Community Plan: A Vision for Oak Bay*. Consolidated to September 29, 2008.

District of Saanich. 2008. *Sustainable Saanich: Official Community Plan*.

District of Saanich. 2002. *Cadboro Bay Local Area Plan*.

Duff, Wilson. 1969. *The Fort Victoria Treaties*. British Columbia Studies 3: 3-57. Victoria, BC.

Easton, Norman. 1985. *The Underwater Archaeology of Straits Salish Reef-netting.* Master of Arts Dissertation, University of Victoria, Victoria, BC.

Ecosystem Valuation website. *Ecosystem Valuation*. Accessed May 2009. Available at: www.ecosystemvaluation.org.

English, Cindy, and Millennia Research. 1996. *Traditional Use Study, Victoria Approaches, Vancouver Island Highway Project.* Harmony Human and Environmental Studies and Millennia Research Inc., Victoria, BC.

Found, J. and M. M'Gonigle. 2005. *Uncommon Ground: Creating Complete Community at the University of Victoria.* Prepared for POLIS Project on Ecological Governance.

Fracchia, L., S. Pietronave, M. Rinaldi, and M.G. Martinotti. 2006. Site-related airborne biological hazard and seasonal variations in two wastewater treatment plants. *Water Research* 40: 1985-1994.

Golder Associates Ltd. 2008. *Heritage Overview Assessment – Interior to Lower Mainland (ILM) Transmission Project*. Prepared for British Columbia Transmission Corporation, Burnaby, BC.

Goward House website. Available at: http://www.gowardhouse.com.

Greater Victoria School District website. Available at: http://www.sd61.bc.ca/school.aspx?schno=0030. Accessed May 12, 2009.

Health Canada. 2009. *Canadian handbook on health impact assessment – Volume 4: Health impacts by industry sector*.

Heinonen-Tanski, H., T. Reponen, and J. Koivunen. 2009. Airborne enteric coliphages and bacteria in sewage treatment plants. *Water Research* 43: 2558-2566.

Hill-Tout, Charles. 1907. *Report on the Ethnography of the Southwestern Tribes of Vancouver Island, B.C.* In: Journal of the Royal Anthropological Institute 37: 306-374.

Hocking, M. 2000. *Campus Ecology: Natural Areas of the University of Victoria Campus*. University of Victoria Sustainability Project. Available at: http://uvsp.uvic.ca/resources/uvsp_hocking%20report.pdf (accessed April 2009).

Jenness, Diamond. n.d. *The Saanich Indians of Vancouver Island*. Manuscript # 1102-6. New York: American Museum of Natural History.

Keddie, Grant. 2003. *Songhees Pictorial. A History of the Songhees People as Seen by Outsiders 1790-1912.* Royal BC Museum, Victoria, BC.

Kerrwood Leidal Associates Limited. January 2009. *Existing and Future Scenarios: Populations, ICI Equivalents and Inflow and Infiltration.* Discussion Paper 033-DP-1.

Kowbel, R., L. Neville, S. Richter, L. Schultz, and J. Ranns. 2009. *Haro Woods Restoration Proposal*. University of Victoria.

Lee, J.A., J.C. Johnson, S.J. Reynolds, P.S. Thorne, and P.T. O'Shaughnessey. 2006. Indoor and outdoor air quality assessment of four wastewater treatment plants. *Journal of Occupational and Environmental Hygiene* 3: 36-43.

Loveys, J. July 22, 2009. *Public Consultation Summary Report Saanich East-North Oak Bay Wastewater Treatment Facility Siting Core Area Wastewater Treatment Project.* Prepared for the Capital Regional District's Core Area Liquid Waste Management Committee.

Meidinger, D. and J. Pojar. 1991. *Ecosystems of British Columbia.* Prepared for British Columbia Ministry of Forests. Victoria, BC.

Metcalf & Eddy, Inc. 2003. *Wastewater Engineering, Treatment and Reuse*. 4th Ed. revised by G. Tchobanoglous.

Millennia Research Ltd. 2008. *Archaeological Potential Modelling for the Capital Regional District*. Prepared for Capital Regional District and BC Archaeology Branch. Victoria, BC.

Ministry of Environment (MOE). 2006. *Develop with Care: Environmental Guidelines for Urban and Rural Land Development in British Columbia*. Victoria, BC.

Monahan P., V. Levson, P. Henderson, and A. Sy. 2000. *Earthquake Hazards Mapping of Greater Victoria.* Prepared for: British Columbia Ministry of Energy, Mines and Petroleum Resources, Victoria, BC.

National Research Council. January 6, 2009. *Reducing Risk from Natural Hazards. LIDAR success story - In search of active faults in the Victoria metropolitan area*.

Nicholls, Sarah. 2004. *Measuring the impact of parks on property values: new research shows that green spaces increase the value of nearby housing.(Research Update)*. Parks and Recreation.

Pojar, J., S. Flynn, and C. Cadrin. 2004. *Accounts and Measures for Managing Identified Wildlife: Douglas Fir/Dull Oregon Grape Account*, version 2004. Prepared for: British Columbia Ministry of Environment, Victoria, BC.

Pope, D. March 5, 2009. "Campus Urban Agriculture Collaborative Hopes to Produce Food on Stagnant Land." Martlet.

Province of British Columbia. 2007. *Municipal Sewer Regulation* (MSR), B.C. Reg. 305/2007.

Province of British Columbia. 1989. *British Columbia Archaeological Impact Assessment Guidelines*. Victoria, BC.

Queenswood Centre website. Available at: http://www.queenswoodcentre.com. Accessed May 12, 2009.

Ready, Richard and C. Adballa. 2003. *GIS Analysis of Land Use on the Urban-Rural Fringe: The Impact of Land Use and Potential Land Disamenities on Residential Property Values and on the Location of Residential Development in Berks County, Pennsylvania*. Staff Paper for the Dept. of Agricultural Economics and Rural Sociology, Pennsylvania State University.

Saanich Online Mapping System. http://www.gov.saanich.bc.ca/resident/gis/index.html. Accessed multiple times.

Sirmans, G.S., David A. Macpherson, and Emily N. Zietz. 2005. *The Composition of Hedonic Pricing Models*. Journal of Real Estate. Vol. 13, Issue No. 1.

Stantec. November 2009. *Core Area Wastewater Treatment Program Effluent Reuse and Heat Recovery for the University of Victoria and Surrounding Area.* DRAFT. Prepared for the Capital Regional District.

Suttles, Wayne. 1951. *Economic Life of the Coast Salish of Haro and Rosario Straits.* Ph.D. Dissertation. University of Washington, Seattle, WA.

Te'Mexw Treaty Association. 2003. *Te'mexw Mapping Project*. Te'mexw Treaty Association and LGL Limited. Sidney, BC.

Thorn, J., L. Beijer, and R. Rylander. 2002. Work related symptoms among sewage workers: A nationwide survey in Sweden. *Occupational Environmental Medicine* 59: 562-566.

United States Geological Survey. January 30, 2009. *Active Tectonics of the Devils Mountain Fault and Related Structures, Northern Puget Lowland and Eastern Strait of Juan de Fuca Region, Pacific Northwest*.

University of Victoria (UVic). 2009. *Sustainability Action Plan: Campus Operations: 2009-2014*. Draft 2.

University of Victoria. 2009. "UVIC Plans Major Upgrade to Athletics and Recreation." Media Release. January 8, 2009.

University of Victoria . 2003. *University of Victoria Campus Plan*. Victoria, British Columbia.

University of Victoria website. Available at: http://www.uvic.ca. Child care section. Accessed May 12, 2009.

Vancouver Island Health Authority website. Available at: http://www.viha.ca/qaops/what_we_do/. Queen Alexandra section. Accessed May 2009.

Workers' Compensation Board of British Columbia (WCBBC). February 2000. *Construction Noise, Engineering Section Report*.

Personal Communications

Bednarski, Jan. Natural Resources Canada. Personal communication. June 26, 2009.

Keddie, Grant. 2008. Personal communication, Royal BC Museum.

Kelly, Harlan G., P. Eng. Dayton & Knight Ltd., Consulting Engineers, North Vancouver, British Columbia. Telephone conversation. June 23, 2009.

McDonald, Kari. Engineer, City of Calgary, AB. Contact person for the Pine Creek Water Management Centre. Telephone conversation. June 25, 2009.

Mogensen, Norm. Local resident, and coordinator with the Haro Woods invasive plant removal program. Phone conversation on May 19, 2009.

Spearing, Judy. Local resident and volunteer on the Haro Woods invasive plant removal program with knowledge of native plants. Phone conversation on May 19, 2009.

Stanley, H. Personal communication. June, 2009.

Tam, Ted. Project Manager, Harbour Solutions, Halifax Regional Municipality. Telephone conversation on June 25, 2009.

Vancouver Island Health Authority representative. Personal communication. May, 2009.