Appendix J

Core Area Wastewater Treatment Program
Assessment of Liquid Train Treatment Options

Stantec

Capital Regional District Core Area Wastewater Treatment Program Assessment of Liquid Wastewater Treatment Options

Prepared for:
Core Area Wastewater

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- Jane Bird - Chair
- Don Fairbairn - Vice Chair
- Jim Burke - Project Board Member
- Brenda Eaton - Project Board Member
- Colin Smith - Project Board Member
- Dave Howe - Project Board Member
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- Larisa Hutchison - CRD General Manager – Parks & Environmental Services
- Dan Telford - CRD, Project Manager
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- Amanda Farrell - Partnerships BC
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EXECUTIVE SUMMARY

In May 2016 the CRD established a Project Board to complete a Business Case and implement the Core Area Wastewater Treatment Project, subject to CRD approvals. The Project Board's Terms of Reference outline key project scope principles including the following elements:

1. Wastewater treatment process design average dry weather flow capacity of 108 MLD to meet provincial Municipal Wastewater Regulation (MWR).
2. WWTP capacity, redundancy and wastewater overflow to meet provincial MWR effluent quality regulations.
3. WWTP meets the federal Wastewater Systems Effluent Regulations (Fisheries Act) mandatory minimum effluent quality standards that can be achieved through secondary treatment.
4. Biosolids treatment that allows for a range of beneficial uses.
5. Conveyancing system.
6. Positive measures to integrate the infrastructure within the host municipality or municipalities.

The Business Case is also to consider the following options:

1. Enhanced secondary or tertiary treatment; and
2. Integrated Resource Management elements (or IRM compatible).

The Project Board commenced their work by reviewing a summary of information compiled over the last 10 years for the Core Area Wastewater Treatment Program. The review included previous work completed by the Capital Regional District (CRD), Core Area Liquid Waste Management Committee, engineering consultants, Peer Review Team, Technical Oversight Panel ("TOP"), and Eastside and Westside Solutions Select Committees.

In the last 10 years a significant amount of work has been completed to review treatment solution sets, assess siting alternatives, and review available and emerging technologies along with their respective capital and life cycle costs. The options reviewed have included multi-plant, decentralized and single plant treatment options for liquid and solids treatment. Opportunities for resource recovery and IRM have also been investigated. A key consideration in all of the previous work has been the siting of treatment plant(s). This work forms the building blocks of a more detailed assessment of the options that were investigated by the Project Board.

The CRD is now considering its wastewater treatment options, which must form part of a new Business Case to support renewal of funding agreements. This is due to the fact that the scope and schedule for the project have changed and the Province has advised that the project is no longer in compliance with the terms and conditions of the original funding agreement. The Business Case must be completed by September of 2016 for consideration of new funding.

The CRD has also completed public consultation throughout the project with a more extensive program provided over the past year. Feedback received from the public identified key themes for the various public consultation events that have been held over the years. Key themes arising out of the public consultation has been community impacts from plant siting and cost. A chronological synopsis of the public engagement process is provided in **Section 1.5.1** of this report.

The discharge of wastewater effluent and biosolids to the environment in British Columbia is regulated under the following:

1. Environment Canada (2012). Fisheries Act, Wastewater Systems Effluent Regulations (WSER) SOR/2012-139.
2. Canadian Environmental Assessment Act
3. BC Ministry of Environment (2012). Environmental Management Act, Municipal Wastewater Regulation (MWR) 87/2012.
4. BC Organic Matter Recycling Regulation
5. British Columbia Environmental Assessment Act

Compounds of Emerging Concern (CEC) that are discharged to municipal wastewater streams include pharmaceuticals, personal care products and compounds that are not entirely removed by conventional wastewater treatment processes. CECs are currently being studied by many researchers globally however there is no consensus on the environmental and health impacts or the best treatment method to deal with these compounds. Research has indicated that tertiary treatment will remove many of these compounds but it will not remove all CECs. In Canada there are no regulations that deal with CECs. If CECs are regulated in the future, the best available technology to deal with the actual constituents present in the wastewater stream can be assessed at that time.

The design of new treatment facilities requires an estimation of the flows and loads for sizing of liquid and biosolids treatment facilities. The sizing of primary treatment facilities is governed by hydraulic requirements to pass the wet weather flows, while secondary treatment facilities are governed by the load, which is the product of the flow times the concentration of the pollutant.

Recent flow projections have shown a decline in average dry weather flows (ADWF) as assessed for the months of June 1 to August 31 from 2009-2015. The declining flow appears to have reached a low point as ADWF increased by 2 MLD from 2015 to 2016. **Table 4.1** in the report provides an overview of the declining ADWF. The lower flows are attributed to water conservation efforts and use of lower flow fixtures. The per capita flows appear to have flattened out in the last two years. At the same time the load, which governs the sizing of the secondary treatment system has been steadily increasing based on measured wastewater quality results at the Clover and Macaulay outfalls.

Table 5.1 in the report summarizes the treatment technologies that have been reviewed during the various planning studies, including an opinion judgement on the suitability of the technology for the CRD project. The use of proven technology is necessary to meet the regulatory and reliability requirements of the project. The suitability is mainly driven by available site size and the requirement to implement a proven technology.

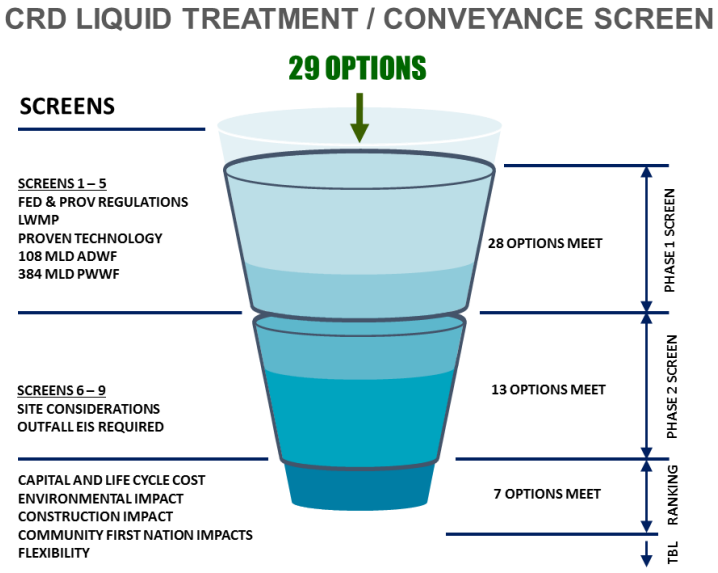
Due to the lack of large sites within the Core Area of the CRD, only high rate technologies are considered appropriate for the project. To enable comparison of costs and assessment of siting, high rate representative technologies have been selected for this evaluation. The representative technologies all use proven secondary wastewater treatment processes that will meet the regulatory discharge objectives. It is possible that these technologies could change depending on the procurement process and final siting of facilities.

This report does not review the technology options available for residual solids treatment. A separate evaluation has been completed on biosolids options including IRM opportunities for integration with other waste streams including municipal solid waste. The selection of the liquid train treatment process will not significantly impact the ultimate selected biosolids treatment process. Tertiary processes will produce approximately 2,160 kg/d of additional solids that must be treated in biosolids treatment facilities. For costing purposes, the full cost of the previously funded biosolids resource recovery centre at the Hartland Landfill has been used for the cost estimates presented in this report. These costs will be refined subject to selection of the preferred biosolids treatment option.

The biggest opportunity for IRM at the CRD exists with the potential integration of solid waste, biosolids, and organic waste at the Hartland Landfill. The Hartland site provides an excellent opportunity and location for such a facility. Other opportunities include water reuse and heat recovery, but these opportunities are very demand dependent and must be considered on a case by case basis to determine if the capital investment makes good business and environmental sense.

The Project Board requested that a comprehensive summary of all the treatment options that have been considered and evaluated to date for the Core Area Wastewater Treatment Project. A total of 29 options sets were summarized for evaluation. A three stage screening process was developed as described in **Section 8.0**.

The 29 options were screened using a Phase 1 high level screening process that evaluated the project functional requirements. The Phase 2 level of screening considered site acquisition and outfall permitting requirements. The objective was to produce a reduced list of viable options for the Phase 3 detailed evaluation that considered life cycle costs and the triple bottom line.



The 13 Options selected to undergo further evaluation are listed in **Table 8.1**.

Several of the options were eliminated because of extended time period required to permit new outfall locations and rezoning requirements, and siting limitations.

The following options were advanced to the triple bottom line assessment evaluation:

Option #	Option Description
2	Rock Bay Regional Tertiary (MBR)
4	Rock Bay Regional (Secondary)
8	McLoughlin Regional Secondary
10	Clover Point and McLoughlin Tertiary
13	East Saanich (Tertiary) and McLoughlin (Secondary)
17	McLoughlin and Rock Bay (both Tertiary MBR)
18	McLoughlin and Rock Bay (both Secondary)

Three sub options of the short listed seven options, option 4a, 8a and 18a were added for assessment. These three additional options include the addition of tertiary filtration to the secondary treatment options to assess the cost impact of tertiary addition. The options were then evaluated and ranked based on, life cycle cost, environmental impacts, construction impacts, community and First Nations impacts, and flexibility with regards to changing regulatory or process requirements. All costs were brought to 2016 dollars using appropriate inflation rates since the year of original estimate preparation to enable objective comparison. This was done in an effort to develop a short list of options for further analysis.

In consideration of all ranking factors the Project Board selected the following options for detailed Class C costing:

- Option 4 – Rock Bay Secondary
- Option 8 – McLoughlin Secondary
- Option 18 – McLoughlin Secondary / Rock Bay Secondary

The Project Board also felt there was some merit in costing tertiary filtration additions to each of the options using more cost effective disc filter technology. These options are noted as option 4a, 8a and 18a in the report.

As a further means of evaluation, a preliminary schedule was developed for each of the shortlisted options. Though not direct criteria for the TBL analysis, project schedule factors into meeting the regulatory timelines and the potential costs associated with inflation and financing costs. Option 8 or 8a is the only option that can meet the December 31, 2020 WSER deadline for the CRD to have secondary treatment in place. Both Option 4 and Option 18 would have secondary treatment in place by March 1, 2023.

Class C estimates were prepared for each of the short listed options and included conveyance costs, liquid treatment and biosolids. These costs are engineering estimates and assumed the full cost of the previously funded biosolids facilities located at Hartland. Depending on the final biosolids selection, these costs may change but will not impact the selection of the liquid treatment train. This costing approach enabled comparison with the previous funded program although it is recognized the biosolids program could change.

The capital and life cycle costs of the options short listed by the Project Board are outlined below.

Capital and Life Cycle Costs ($ million)

Option	Liquid Treatment	Biosolids Treatment	Conveyance	Total Capital Costs	Operation & Maintenance Cost	Whole Life Cycle Cost
Option 4 Rock Bay Secondary	$367	$269	$335	$971	$15.4	$1,177
Option 4a Rock Bay Tertiary Disc Filters	$381	$269	$335	$985	$15.5	$1,192
Option 8 McLoughlin Secondary	$318	$269	$273	$860	$14.7	$998
Option 8a McLoughlin Tertiary Disc Filters	$331	$269	$273	$873	$14.9	$1,013
Option 18 McLoughlin - Rock Bay Secondary	$537	$269	$243	$1,049	$18.1	$1,291
Option 18 a McLoughlin – Rock Bay Tertiary Disc Filters	$552	$269	$243	$1,064	$18.3	$1,309

* *Life Cycle Cost based on 25 year period and 4% discount rate. Life cycle costs include liquid and biosolids treatment. Costs are engineer's estimate and do not include development costs of retained risk costs. These costs will be established for the business case control budget. Total costs will vary depending on selected biosolids treatment program. Costs shown assume full cost of previously funded biosolids facility at Hartland.*

Option 8, McLoughlin Secondary is the lowest life cycle cost. Tertiary treatment at McLoughlin, Option 8a can be provided for marginal additional cost.

A triple bottom line assessment was completed for each of the short listed options as outlined in **Section 11** of the report. The TBL considered economic, social and environmental criteria but only social and environmental criteria were evaluated using a weighted assessment approach. The results of the triple bottom line assessment indicated that tertiary treatment facilities located at McLoughlin had the most favourable triple bottom line in consideration of all criterion.

1.0 INTRODUCTION

1.1 Purpose of this Report

This report has been prepared to provide the Core Area Wastewater Treatment Project Board with a summary of information compiled over the last 10 years for the Core Area Wastewater Treatment Program. The report presents work that has been completed by the Capital Regional District (CRD), Core Area Liquid Waste Management Committee, engineering consultants, Peer Review Team, Technical Oversight Panel ("TOP"), and Eastside and Westside Solutions Select Committees. A significant amount of work has been completed and is essential for consideration by the Project Board in their efforts to review, select, and ultimately recommend a treatment option(s).

This report is primarily focused on the liquid train treatment options. The biosolids train treatment options including additional opportunities for Integrated Resource Management (IRM) will be assessed in a separate report. This document summarizes the relevant regulatory and technical information related to potential options for consideration in the Business Case. A summary of completed project work is included in this report.

1.2 Project Board Terms of Reference

The Project Board Terms of Reference for preparation of the Business Case outline key project scope principles including the following elements:

1. Wastewater Treatment Process (WWTP) design capacity to meet provincial Municipal Wastewater Regulation (MWR) requirement for sewage flows with an Average Dry Weather Flow (ADWF) of 108 MLD.
2. WWTP capacity, redundancy, and wastewater overflow to meet the provincial MWR effluent quality regulations.
3. WWTP meets the national Wastewater Systems Effluent Regulations (Fisheries Act) mandatory minimum effluent quality standards that can be achieved through secondary wastewater treatment.
4. Biosolids treatment that allows for a range of beneficial uses.
5. Conveyancing system.
6. Positive measures to integrate the infrastructure within the host municipality or municipalities.

The Business Case is to also consider the following options:

1. Enhanced secondary or tertiary treatment; and
2. Integrated Resource Management elements (or IRM compatible).

The Business Case may recommend the inclusion of these elements as base scope or as separately priced optional items.

1.3 Background and History of the Core Area Wastewater Treatment Program

The Capital Regional District (CRD) has been planning the implementation of wastewater treatment solutions for many years. In the last 10 years a significant amount of work has been completed to review treatment solution sets, assess siting alternatives, and review available and emerging technologies along with their respective capital and life cycle costs. The options reviewed have included multi-plant, decentralized and single plant treatment options for liquid and solids treatment. Opportunities for resource recovery and IRM have also been investigated.

From 2009 to 2012 planning work was completed for a variety of options including decentralized treatment. The CRD Board ultimately selected a single plant option at McLoughlin Point ("McLoughlin") because it satisfied overall project and regulatory requirements and provided the best value for money for CRD tax payers. The CRD had negotiated funding agreements for $501.4 million from the provincial and federal governments. The funding agreements must be renewed prior to September 30, 2016. This level of senior government funding is amongst the highest for a wastewater treatment project in Canada. A design-build-finance procurement model was undertaken for a regional liquid treatment plant at McLoughlin and a preferred proponent was selected. The procurement was cancelled in 2014 after the CRD was unable to obtain a zoning amendment from the Township of Esquimalt for the McLoughlin Point site.

In 2014 the CRD Board decided to suspend the Seaterra Program, which had previously been given the responsibility for delivery of the Core Area Wastewater Treatment project. The availability of sites for the liquid and biosolids treatment facilities has been the most challenging issue facing the CRD, and it was felt that a new direction for the overall program should be examined. Following the suspension of the Seaterra Program, the CRD established the Eastside and Westside Select Committees to review potential wastewater treatment options for each area of the CRD. A public consultation program was used to solicit feedback from the community on potential treatment options.

In addition to the many sites that have been considered, numerous proven and emerging technologies have also been assessed by various consulting engineering firms over the past 10 years. The engineering firms involved in the most recent work include:

- Urban Systems / Carollo Engineers (2015 to 2016)
- Stantec Consulting (2009-2015)
- CH2M / Associated / KWL (2006-2009)

An independent Peer Review Team and Technical Oversight Panel were engaged to review the work completed by the consulting engineering firms and to offer additional suggestions for investigation.

Recently, the Eastside and Westside Select Committees reviewed siting and technology options for wastewater treatment plants and have completed public consultation to solicit input from the public on the overall program and siting options. The CRD must meet the 2012 Fisheries Act requirement to cease discharge of "deleterious material" to the ocean by December 31, 2020 based on the transitional authorization outlined in the Wastewater Systems Effluent Regulations (WSER) of the Fisheries Act. The discharges from Clover Point ("Clover") and Macaulay are classified as "high risk" discharges based on a

formula that is based on flows and loads. Currently there is no treatment other than fine screening at the Clover and Macaulay outfalls. The December 31, 2020 in service requirement date has recently been reconfirmed by the federal government.

The CRD is now considering its wastewater treatment options, which must form part of a new Business Case to support renewal of funding agreements. Since the scope and schedule for the project have changed, the Province has advised that the project is no longer in compliance with the terms and conditions of the original funding agreement. The Business Case must be completed by September 2016 for consideration of new funding.

In May 2016 the CRD established a Project Board to complete a Business Case and implement the Project, subject to CRD approvals.

1.4 Previous Work and Reference Materials

A significant amount of planning and technical work has previously been completed by engineering consultants, CRD staff, an independent Peer Review Team, a Technical Oversight Panel, and more recently the Eastside and Westside Select Committees. A large team of North American subject matter experts has been engaged throughout the planning process to advise the CRD. This work forms the building blocks of a more detailed assessment of the options to be investigated by the Project Board. Most of the reference documents from previous consulting work can be found on the CRD website.

Reference reports and data from previous studies were used and augmented with more detailed assessments by the Business Case project team. The Business Case project team included business, legal, procurement, public consultation, financial, construction, and engineering advisors.

The following information was referenced by the Business Case project team.

1. Eastside Select Committee Public Consultation – Eastside Wastewater Dialogues, February 2016.
2. Westside Solutions Public Engagement Summary Document, February 2016.
3. Technical Oversight Panel Reports # 1 through #10.
4. Wastewater Treatment System Feasibility and Costing Analysis, Technical Memorandum #1 – Background and Technical Foundation, prepared by Urban Systems / Carollo, October 14, 2015.
5. Wastewater Treatment System Feasibility and Costing Analysis, Technical Memorandum #2 – Review and Refine Options Sets, prepared by Urban Systems / Carollo, November 20, 2015.
6. Phase 2 - Wastewater Treatment System Feasibility and Costing Analysis, Technical Memorandum #3 – Review and Refine Options Sets, prepared by Urban Systems / Carollo, February 5, 2016.
7. Wastewater Treatment System Feasibility and Costing Analysis, Technical Memorandum #4 – Analysis Summary, prepared by Urban Systems / Carollo, 2016.
8. Core Area Wastewater - Analysis Summary for Motions of February 26 and March 2, 2016 Cost and Option Set Alternatives, Letter Report to Larisa Hutcheson, March 4, 2016.
9. Various reports and Discussion Papers investigating decentralized treatment, resource recovery and technologies prepared by CH2M/ Associated/ KWL from 2006 – 2009.

10. Peer Review Team Report, May 6, 2009.
11. Various reports investigating decentralized and centralized treatment prepared by Stantec from 2009 – 2015.
12. LWMP Amendments # 8, 9, and 10.
13. Biosolids Management Plan, prepared by Stantec Consulting / Brown and Caldwell, November 4, 2009.
14. Wastewater Characterization and Design Loads, prepared by Stantec Consulting Ltd., January 23, 2013.
15. Resources from Waste – Integrated Resource Management, Phase 1 Study Report, February 29, 2008, prepared by IRM Study Team c/o Aqua-Tex Scientific Consulting Ltd.
16. Flow and wastewater characterization information for the Macaulay and Clover outfalls provided by CRD.

1.5 Summary of Public Consultation Program

1.5.1 Summary of Public Input 2010 - 2016

The CRD has completed public consultation throughout the project with a more extensive program provided over the past year. Communications and public engagement firm Kirk and Company reviewed the results of the public consultation between 2010 – 2016. A chronological synopsis of this information is provided below for reference.

2010 Public Consultation

In 2010 the CRD moved to reduce overall project costs by adopting a single centralized treatment plant at McLoughlin Point. Public input was sought regarding plant design and mitigation.

Two open houses were held July 6 and 8, 2010 to provide information on the selected treatment system and to seek feedback and suggestions on mitigation and community benefits.

155 residents attended the information open houses, 63 completed feedback forms were received and 11 submissions were submitted on-line.

Key themes arising from the input were:

- Concerns regarding the overall cost of the treatment facility and impacts to taxpayers, specifically Esquimalt residents and loss of property values
- Concerns regarding the lack of public consultation prior to decision being made
- Concerns regarding odours
- Concerns regarding trucking and noise
- Concerns regarding the appearance of the facility
- Concern over the lack of long term planning and constraints of the site for future growth

- Concerns regarding the overall cost of the treatment facility and impacts to taxpayers, specifically Esquimalt residents and loss of property values
- Request for resource recovery/new technologies to be integrated in the facility
- Request for involvement in future public consultation processes
- Request for the facility to be aesthetically designed and integrated into the public space

2013 Public Consultation

In June 2013, eight open houses were held to determine the degree of public support for the two candidate sites for the Biosolids Energy Centre (BEC). A total of 689 responses were received, with 61% favouring Hartland, 14% favouring Viewfield, and 24% neither or no response.

The comments and correspondence indicated that most of those participating in the consultation had concerns over locating biosolids treatment facilities in a residential neighbourhood.

Key themes arising from the June 2013 input were:

- Concern about the impact of the siting of the BEC on property values.
- Proximity of BEC facilities to residential neighbourhoods and schools, and need for a buffer zone.
- Property tax revenue loss to the Township of Esquimalt.
- Safety concerns about the facilities, including the risk of fire or an explosion.
- Traffic, noise, and dust during construction.
- Odour control and noise during the ongoing operations.
- Health concerns including proximity to residential areas and long-term effects.
- Need for a buffer zone.

In July 2013, the McLoughlin Point site was rezoned for a 108 MLD treatment plant.

Key themes expressed by speakers at the public hearing:

- Cost escalation/property taxes
- No need for treatment
- The plan is bad/ flawed
- Environmental impacts, safety, and health
- Odours, view impacts, and impacts on tourism
- Lack of meaningful consultation
- Resource recovery should be included

2014 – 2016 Public Consultation

In 2013, Township of Esquimalt amended their Official Community Plan and rezoned McLoughlin Point to allow a wastewater treatment as a permitted use for the site. In 2014 the treatment plant RFP process was carried out for a 108 MLD plant with an option to provide a larger 124 MLD plant in order to maximize the site's potential capacity. Two open houses were held in February to provide information regarding the rezoning amendment of McLoughlin Point for a plant with greater capacity. The Township of Esquimalt held public hearings on February 18 and 19, 2014 and March 20 and 22, 2014. There were a total of 116 presentations to council.

Key themes raised by speakers:

- Site too small, too close to shoreline, tsunami risk, set-backs unacceptable
- Blight on harbour, destroying beautiful waterfront
- No need for treatment plant, current system working fine
- Secondary treatment will not remove microplastics or pharmaceuticals
- No plan/design
- Escalating costs, costs per household
- Odour
- Air quality

Rezoning of the McLoughlin Point site to allow setback and height variances received a second reading, but was eventually halted in response to public input, and the plan to build one regional plant at McLoughlin Point was put on hold by the CRD Board. The CRD Board directed the Core Area Committee to develop a new process and two new advisory Select Committees were formed, the—Westside Select Committee (Colwood, Esquimalt, Langford and View Royal) and Eastside Select Committee (Oak Bay, Saanich and Victoria). The site review process produced seven different options and configurations—ranging from a one plant option to seven plant options. Through January and February of 2016, these options and costing analysis were introduced to the public for feedback through a number of consultation activities.

From January 25 through February 20 2016, a Core Area on-line survey asked respondents to comment on their highest priorities for the project as well as the acceptability of each of the seven options.

Communication tools to drive participation in the survey included a webpage with a dedicated URL, advertising, earned media, social media, postcard mailer, and a storefront information centre.

2016 Survey Results Overview

1,357 respondents completed the survey on-line and 17 submitted hard copy. (27% Westside, 69% Eastside).

Highest Priorities for Project

- Taxes 43%
- Quality of discharge 29%
- Opportunities for reuse and recovery 10%
- Location of Plants 9%

Acceptability of Options – (Very and Somewhat Acceptable)

- One Plant – secondary 61%
- One plant tertiary 56%
- Two plants 49%
- Three plants tertiary 30%
- Three plants secondary 29%
- Four plants 23%
- Seven plants 17%

Key themes

- Too costly – impact on taxpayers
- Treatment not necessary
- Survey poorly conceived, too technical, not user friendly
- Too much information – too complex for non-technical people to offer an opinion
- No P3
- Survey manipulative toward Rock Bay
- More innovative solutions needed

Community meetings were also held in January and February, 2016.

260 people attended six Westside meetings between February 10 and 16, 2016.

Key Themes: Concern regarding community impacts, costs, and fairness and frustration for taking so long to make a decision.

Eastside held six open houses and workshops and nine stakeholder meetings with community associations between January 30 and February 17, 2016.

Key Themes: Cost, location (go back to McLoughlin), no need, environmental impacts, and more innovation needed.

The top key themes arising out of all the public consultation completed to date has been cost and impacts on local communities.

1.6 Summary of Technical Oversight Panel Findings

The role of the Technical Oversight Panel (TOP) was to review the costing and feasibility studies developed by the engineering team (Urban Systems / Carollo) during the most recent 2015 – 2016 planning phase of the project, and to ensure that the studies for the wastewater treatment options included the necessary due diligence. The TOP received information from and liaised with the engineering team, and provided feedback and recommendations to the Core Area Liquid Waste Management Committee (CALWMC). Initially, their three primary functions were to:

1. Act as an independent oversight panel.
2. Review costing and feasibility studies.
3. Reports findings to the CALWMC.

Upon reviewing the costs associated with the various treatment options and configurations, the TOP concluded in their final report (#10) that the overall cost of a single liquid train plant at Rock Bay would be less than the costs of the multiple plant options. They concluded the single plant option for the 108 MLD liquid treatment plant located on the Rock Bay site would be the most cost effective in terms of both capital and operating/equipment costs. This finding is consistent with previous assessments that single plant options are more cost effective than multi-plant decentralized options. TOP recommended that treatment should be based on tertiary membrane technology to ensure that the plant will be capable of meeting future, more rigorous effluent criteria, and be able to supply effluent re-use water should a market present itself in the future.

The TOP recommended that residuals solids drying be presented as the base case for solids disposal, as opposed to anaerobic digestion, followed by mechanical dewatering (centrifuges). TOP indicated future integration with Municipal Solids Waste (MSW) would be for a future addition of a gasification process, which would deal with both biosolids and MSW waste streams. This was based on the assumption that thickened sludge from the liquid treatment plant at Rock Bay would be pumped to the Hartland MSW management site. It is expected that solid waste disposal requirements would be the driving criteria for the integration of solid waste and biosolids, as the biosolids stream only represents approximately 10% of the total solid waste stream from the CRD.

The TOP received over 20 presentations from various private vendors who presented options ranging from complete wastewater treatment and biosolids management solutions, to minor treatment components that would make up portions of a larger treatment system. The intent of these presentations was to allow an opportunity for the marketplace to be given fair consideration and to solicit any new innovative technologies from the market place for possible inclusion in future treatment facilities.

1.7 Definitions and Terminology

Wastewater treatment is a complex subject. It is useful to provide definitions and a description of commonly used terminology in wastewater treatment. The following definitions are provided for reference.

Average Dry Weather Flow (ADWF) – The ADWF is often used to rate the capacity of a treatment plant. The ADWF is the average flow during periods of dry weather when the flows are not influenced significantly by infiltration and inflow (I&I). The ADWF measurement used in planning reports for the Core Area Wastewater Treatment Program (CAWTP) is mega litres per day or million litres per day, and is commonly abbreviated MLD. The ADWF period at CRD is from June 1 to August 31.

Biochemical Oxygen Demand (BOD) – BOD is the most widely used measure of organic pollution in wastewater. It is measured using a 5-day test where dissolved oxygen used by organisms in the biological oxidation of organic matter is determined. The common unit of measure for BOD is milligrams per litre (mg/L).

Biosolids – The term biosolids is used to refer to residual solids which have undergone treatment to reduce the pathogens and stabilize the residual solids.

Compounds of Emerging Concern (CEC) consist of synthetic or naturally occurring chemicals which have the potential to enter the environment and cause known or suspected adverse ecological or adverse health effects. There are numerous such compounds and they are described in broad categories including pharmaceuticals, personal care products, plasticizers, flame retardants, and pesticides. These compounds are found in a variety of products including antibiotics, cosmetics, micro–plastics, insect repellants, and many other products used by the human population. There are thousands of these compounds and although some of these compounds are removed or reduced through conventional secondary treatment processes, many are not. Even with tertiary treatment many compounds are not removed because they are in a soluble form. Analytical capabilities have improved with technology advancement, and it is now possible to monitor many of these compounds down to the parts per trillion levels. CECs have existed for many years and with the advent of newer analytical technology their concentrations are only now being detected.

Significant research is being completed to determine the effects of CECs on human and ecosystem health. There is significant debate on the actual versus perceived impacts and the degree of exposure that is required to cause long term impacts to health and ecosystems. As of 2016 there are no Canadian regulations that require removal of CECs from the wastewater discharge. Most wastewater treatment operators have not implemented advanced treatment technologies to deal with CECs because the treatment process selection to deal with CECs is still uncertain, and available advanced technologies are costly to construct and operate. Many municipalities are promoting source control as a low cost method of CEC control.

Integrated Resource Management (IRM) considers wastewater, solid waste, and other organic waste as resources rather than waste that must be discarded. By considering these waste streams in an integrated manner there are opportunities to recover energy, nutrients, heat, reclaimed water, fuel, and other products while at the same time reducing greenhouse gas emissions. IRM is typically completed at the planning level where objectives are set for management of waste streams in an integrated manner.

IRM is not a new concept; it has existed for many years. Many communities in Europe and North America have integrated their biosolids, organic waste, solid waste, and water resources planning functions.

Liquid Waste Management Plan (LWMP) – Is a plan prepared by a municipality which allows community specific solutions for wastewater management that meet or exceed existing regulatory requirements. The LWMP is submitted to the Minister of Environment for approval.

Peak Wet Weather Flow (PWWF) – The PWWF is the hydraulic flow experienced by the treatment plant during peak periods of inflow and infiltration during wet weather events. For CRD, this typically occurs in the wet months of October through March. Some of the sewers in the CRD are very old and experience high inflow and infiltration during wet weather and portions of the collection system in Oak Bay have combined sewer systems that carry sanitary and storm flows. The CRD's LWMP requires the primary treatment of wet weather flows for up to 3x ADWF for the Clover Point outfall catchment and up to 4x ADWF for the Macaulay outfall catchment. Flows above this would be released at the two existing outfalls. The LWMP also requires that municipalities address their I&I problems to reduce their peak flow events. The PWWF is also measured in MLD. The PWWF is typically the governing criteria for sizing of wet weather primary treatment facilities.

Proven Technology – A treatment plant must perform with a high degree of reliability with a track record of performance in similar applications. For the CRD project, a definition of proven technology has been developed and includes:

"Proven Technology" is any high rate, small footprint wastewater treatment technology or process where the technology or process is currently in operation and has been continuously operating since January 1, 2011 in a similar process configuration of similar scale or complexity under similar or less favorable influent wastewater quality conditions, and has been operating with process modules the same size or larger than those proposed, and at a process loading as great or greater than that proposed. The continuous reliable performance of the plant shall be verifiable from certified daily operational data for reasonable period. The plant performance data shall demonstrate that the plant has performed satisfactorily through a variety of wet weather and dry weather operating periods while achieving regulatory effluent standards.

"Similar or less favorable influent wastewater quality conditions" means untreated raw wastewater with the same or greater treatment challenges with respect to wet weather influent variability, BOD, TSS, ammonia nitrogen, minimum temperature, and pH effluent quality parameters as that anticipated for the Project.

Any facility where a proposed proven treatment technology or process is installed and operated must be available for inspection and contact by the CRD and must have been operated in a manner that would have achieved compliance with the Effluent Guarantee and the Operational Certificate or Discharge Permit for the Project.

Residual Solids – Residual solids are produced as a by-product of liquid treatment. These residual solids include primary solids, secondary solids and tertiary solids that are wasted from the respective processes. These solids are in their raw form and contain pathogens.

Resource Recovery – Resource recovery explores opportunities to recover resources from the liquid and biosolids treatment train that have some value or beneficial use. Wastewater treatment projects typically recover resources that include reclaimed water, heat, biogas, nutrients, and stabilized biosolids.

Secondary Treatment – Wastewater treated to a secondary level is suitable for discharge to a marine environment with little to no environmental impacts. The secondary treatment process will produce an effluent that meets the regulatory requirements of 25 mg/L TSS and 25 mg/L BOD. In practice many secondary plants will produce a wastewater with TSS and BOD of 15 mg/L. For the CRD, secondary treatment

is sufficient to satisfy both the Federal and Provincial regulatory requirements. Secondary treatment sizing is governed by the pollutant load entering the plant. The pollutant load is the product of the flow in MLD times the concentration of the pollutant in mg/L. Enhanced secondary treatment in the context of the CRD project includes an additional unit process such as advanced oxidation to deal with compounds of emerging concern.

Tertiary Treatment – Tertiary treatment typically involves the addition of filtration or a membrane solids separation process downstream of secondary treatment or integral to the secondary treatment. The tertiary treatment process is capable of producing an effluent with 5 mg/L TSS and 5 mg/L BOD and less depending on the final solids separation process. Tertiary treatment is typically practiced where the receiving stream has sensitive environmental requirements or if the effluent is to be reused for irrigation or groundwater recharge. Tertiary treatment can also include removal of nutrients such as nitrogen and phosphorus if the receiving environment is sensitive to these nutrients. Tertiary treatment can remove some compounds of emerging concern. For the CRD nutrient removal is not required because the discharge will be to a deep marine outfall.

Total Suspended Solids (TSS) – TSS are a measure of the colloidal solids in wastewater. The solids are usually measured using a settling test. The concentration of TSS will impact the sizing of biosolids treatment facilities. The common unit of measure for TSS is mg/L.

2.0 FEDERAL AND PROVINCIAL REGULATORY REQUIREMENTS FOR WASTEWATER TREATMENT

There are five primary Acts that regulate the site development and the discharge of wastewater effluent and biosolids to the environment in British Columbia.

1. Environment Canada (2012). Fisheries Act, Wastewater Systems Effluent Regulations SOR/2012-139
2. Canadian Environmental Assessment Act
3. BC Ministry of Environment (2012). Environmental Management Act, Municipal Wastewater Regulation (MWR) 87/2012
4. BC Organic Matter Recycling Regulation
5. British Columbia Environmental Assessment Act

The overarching planning framework for integrated liquid waste and resource management in the CRD is presented in the LWMP, and its conditional amendments, including the most recent Amendment No. 10. This document sets out the CRD's vision, as well as goals, strategies, actions, and measures needed to achieve the vision. The LWMP process typically involves extensive public consultation and review and approval of the plan by the regulatory agencies prior to implementation. A summary of regulatory considerations prepared by Bennett Jones LLP is included in **Appendix D**.

2.1 Provincial Regulation

The BC Ministry of Environment published the Municipal Wastewater Regulation (MWR) in 2012 under the Environmental Management Act. The regulation specifies the required quality of treated effluent that is either discharged to the receiving environment or is reclaimed for beneficial use. The regulation also outlines the reliability and redundancy requirements for each major process within a treatment facility.

The effluent quality guidelines outlined in the MWR are all based on daily maximum (never to exceed) values, and for the size of the proposed treatment facility, taken from daily composite samples. For the CRD, the treated effluent is assumed to be discharged to the "Marine Waters" environment, and as such the regulation stipulates that secondary treatment (defined as effluent containing no more than 45 mg/L each of BOD and TSS at any time) must be provided for all flows up to 2x ADWF. Discharge to other receiving environments including lakes and streams will require more stringent tertiary effluent requirements.

If flows in excess of 2 x ADWF occur more than once every five years, as is the case in the CRD, a LWMP or specific study must be undertaken to determine what treatment level is recommended for such occurrences. If the high flow does occur more frequently than once every five years, then on an interim basis, the equivalent of primary treatment is acceptable for that high flow period. Primary treatment is defined under the MWR as being able to provide an effluent quality with a BOD of not more than 130 mg/L and a TSS of not more than 130 mg/L. In the CRD's system, flows in excess of 2 x ADWF do occur more frequently than once every five years at the Clover Point and Macaulay Point outfalls. The CRD, through its LWMP process has

received an agreement from the regulators to provide primary treatment for flows up to 3 x ADWF for the Clover Point catchment outfall and up to 4 x ADWF for the Macaulay catchment outfall.

Requirements for disinfection and the reduction of ammonia for marine discharges are based on the designation of the area at the edge of the dilution zone. If the area is designated as shellfish bearing or recreational use water, then specific end of pipe ammonia and fecal coliform targets will be established based on the projected dispersion of the effluent within the dilution zone. This is normally established with the use of a dispersion model and the water quality guidelines outlined in the MWR (Sections 95 and 96). For the CRD there is no need for ammonia reduction due to the marine discharge.

2.1.1 Beneficial Reuse of Treated Wastewater

Beneficial reuse of wastewater will require a tertiary level of treatment. This can be provided in the form of sidestream treatment that is sized to meet the demand of the tertiary reuse water or it can be provided for the full flow. The MWR establishes effluent quality guidelines for the beneficial re-use of treated wastewater that is intended to be used for a variety of end uses, including irrigation of various crops, landscape irrigation, outside wash water, outside fountains, and toilet flushing. The quality guidelines are based on the intended use of the reclaimed water, where the categories for re-use are as follows:

1. Indirect potable reuse, being any use of reclaimed water to replenish a potential potable water source;
2. Greater exposure potential, being uses for which public contact is likely or that present a risk to the receiving environment;
3. Moderate exposure potential:
    a. for which public contact is likely minimal;
    b. for which public access to the reclaimed water is restricted and users are educated as to the risks posed by the use of the reclaimed water; or
    c. that present a moderate risk to the receiving environment.
4. Lower exposure potential:
    a. for which public access to the reclaimed water is restricted and users are not likely to have contact with the reclaimed water;
    b. that are commercial or industrial in nature and users are educated as to the risks posed by the use of the reclaimed water; or
    c. that present a low risk to the receiving environment.

In the context of a CRD wastewater treatment facility, it is assumed that either the greater or moderate exposure potential categories will be applicable for any reuse opportunities such as irrigation. For the CRD, the biggest opportunity for water reuse would be in new development or park lands. Each opportunity must be evaluated on a case to case basis to assess feasibility as the cost of reclaimed water distribution system can be prohibitive. The effluent quality required for these two categories is presented in **Table 2.1**. The treatment objectives outlined in **Table 2.1** are only required for reclaimed reuse water.

Table 2.1 - Municipal Effluent Quality Requirements for Reclaimed Water

Parameter	Greater Exposure Potential	Moderate Exposure Potential
pH	6.5 to 9.0	6.5 to 9.0
BOD_5 and TSS (mg/L)	10	25
Turbidity (NTU)	2 (avg) and 5 (max)	n/a
Fecal Coliforms (CFU/100 mL)	<2.2 (median) and 14 (max)	<100 (median) and 400 (max)

Meeting the requirements of **Table 2.1** would require use of a tertiary treatment process. This could be in the form of tertiary treatment for the entire flow or a tertiary side stream, which is designed to treat only a portion of the flow to match the demand for reclaimed water use.

Tertiary treatment can be achieved by a variety of technologies including membranes, disc filters, upflow filters, and media sand filters.

The MWR is also prescriptive with respect to monitoring requirements for both treated effluent and effluent available for beneficial reuse.

2.1.2 Operating Certificate

The Province will issue an Operating Certificate for new wastewater treatment facilities. A draft Operating Certificate has been issued as part of the LWMP. The Operating Certificate issued for new wastewater treatment plants are site specific and outline not to exceed concentrations or monthly average concentrations for various parameters depending on the location and sensitivity of the receiving environment.

2.1.3 Reliability and Redundancy Requirements

Another important area of compliance within the provincial MWR is the treatment facility's reliability requirements (installed redundancy). The MWR defines reliability in one of three categories:

1. Category I - in respect of which short term effluent degradation could cause permanent or unacceptable damage to the receiving environment, including discharges near drinking water sources, shellfish waters or recreational waters in which direct human contact occurs;
2. Category II - in respect of which permanent or unacceptable damage to the receiving environment, including discharges to recreational waters and land, would not be caused by short term effluent degradation, but would be caused by long term effluent degradation; and
3. Category III – Plants that do not fall into either Category I or II.

The CRD wastewater facilities would fall under Category I.

Table 2.2 – Component and Reliability Requirements (Section 35 (2) of MWR)

Unit Treatment Process	Category I (applicable for CRD facilities)		Category II		Category III	
	Treatment System	Back-up Power	Treatment System	Back-up Power	Treatment System	Back-up Power
Grit Removal	n/a	optional	n/a	no	n/a	no
Primary Sedimentation	multiple units[a]	yes	multiple units[a]	yes	2 minimum[a]	yes
Aeration Basins	multiple units[b]	yes	multiple units[b]	optional	single unit	no
Blowers	multiple units	yes	multiple units	optional	2 minimum	no
Secondary Clarification	multiple units[b]	yes	multiple units[a]	optional	2 minimum[a]	no
Effluent Filters	2 minimum[b]	yes	2 minimum[b]	yes	2 minimum[b]	yes
Disinfection Units	multiple units[b]	yes	multiple units[a]	yes	multiple units[a]	no
Anaerobic Digesters	2 minimum[a]	yes	2 minimum[a]	optional	2 minimum	no

For the purpose of **Table 2.2**, the remaining capacity with the largest unit out of service must be at least:

1. 50% of the design maximum flow where the notation "a" appears, or
2. 75% of the design maximum flow where the notation "b" appears.

2.1.4 BC Environmental Assessments

Wastewater treatment projects often require an environmental assessment as part of the preliminary planning work. This process typically explores the environmental impacts from development of new treatment plant at a specific location as well as impacts on the receiving environment from liquid discharges. Depending on the location and the sensitivity of the environment studies this process can take several years. New outfalls in particular require significant front end engineering work to prove their design and performance. As an example, the proposed McLoughlin Point outfall took 30 months to permit. It may be possible to obtain permits at existing outfalls which are being twinned in a shorter period of 14 months because existing dispersion models and quality monitoring data is available. It would also be reasonable to expect that new plant sites will require an environmental assessment of at least a screening level environmental assessment depending on the location and sensitivity of the site. Options requiring new outfalls would require a detailed environmental assessment which will take a minimum of 24 months to permit.

2.2 Provincial Biosolids Regulation

Residuals solids will be produced by the liquid treatment process. Following treatment residuals solids are referred to as biosolids which can be beneficially used. In British Columbia, biosolids regulations called the "Organic Matter Recycling Regulation" have been issued under the Environmental Management Act and the Health Act. The regulations provide for two classes of biosolids, Class A and Class B, whose characteristics are summarized in Table 2.3. Class A biosolids are processed to a higher degree than Class B biosolids, thus having a much lower pathogen concentration in the finished product and much less restrictive handling and land application requirements. In some respects, the regulation is similar to the U.S. EPA Regulation 503 for biosolids.

The Organic Matter Recycling Regulation also specifies requirements for Classes A and B compost as well as the maximum allowable metal concentrations in biosolids, compost, and soils following land application.

Table 2.3 – Summary of Biosolids Classification Requirements in BC's Organic Matter Recycling Regulation (OMMR)

Characteristic	Class A Biosolids	Class B Biosolids
Pathogen Reduction Requirements	<1,000 MPN per gm (dry solids basis) to be produced by one of the pathogen reduction processes listed below	<2,000,000 MPN per gm (dry solids basis) or one of the pathogen reduction processes listed below
Acceptable Processes for Pathogen Reduction	Thermophilic aerobic digestion at ≥ 55^{O}C for at least 30 min	Aerobic digestion with mean cell retention time between 40 days at 20^{O}C and 60 days at 15^{O}C
	Thermophilic anaerobic digestion at ≥ 55^{O}C for at least 10 days	Anaerobic digestion with a mean cell retention time between 15 days at 35^{O}C and 60 days at 20^{O}C
	Exposure to time-temperature processing requirements according to arithmetical formulae given in the regulation depending on the total solids concentration of the biosolids	Air drying for >3 months, during which the ambient temperature must be >0^{O}C for at least 2 months
	Alkaline stabilization by maintaining the pH within the biosolids >12 for 72 hours during which T > 52^{O}C for 12 hours, followed by air drying to >50% total solids concentration	Lime stabilization sufficient to raise the pH of the biosolids to ≥12 after 2 hours of contact
Vector Attraction Reduction Requirements	Aerobic or anaerobic digestion resulting in >38% destruction of volatile solids mass or another acceptable criterion specified in the Regulation	Aerobic or anaerobic digestion resulting in >38% destruction of volatile solids mass or another acceptable criterion specified in the Regulation

The requirement for vector (rat, birds, and animals) attraction reduction is important to ensure that there is no potential for pathogen transmission from residual solids that does not receive adequate treatment.

New biosolids treatment facilities should be designed to meet the above regulations for the specific class of biosolids and treatment process selected.

The regulations do not cover emerging technologies such as gasifiers or direct drying of residual solids. If these technologies are implemented for the CRD it is expected that assessments would have to be undertaken to satisfy the regulators that such technologies are a viable option for the CRD.

Regardless of the technology that is selected, reliability is a very important factor once the liquid train treatment process is commissioned. Solids must be wasted from the liquid train on a continuous basis to ensure satisfactory performance of the liquid train treatment process. The biosolids treatment facility must operate reliably and be prepared to accept solids from the liquid train process continuously without interruption. Once the new liquid treatment facilities are commissioned they will produce on average 29,800 kg per day of residual solids at design capacity, which must be handled without interruption and with a high degree of reliability.

2.3 Federal Regulations

The federal wastewater regulations refer to the Wastewater Systems Effluent Regulations (WSER) which falls under the Fisheries Act. These regulations came into effect in 2012. The regulations were the result of the work undertaken by the CCME from 2005 to 2009. During this time the CCME developed the Canada- Wide Strategy for the Management of Municipal Wastewater Effluent, known as "the CCME Strategy" which was endorsed by the CCME Council of Ministers on February 17, 2009. The work of the CCME Strategy established National Performance Standards, and minimum performance requirements for effluent quality from all municipal, community and government wastewater facilities that discharge municipal wastewater effluent to surface water.

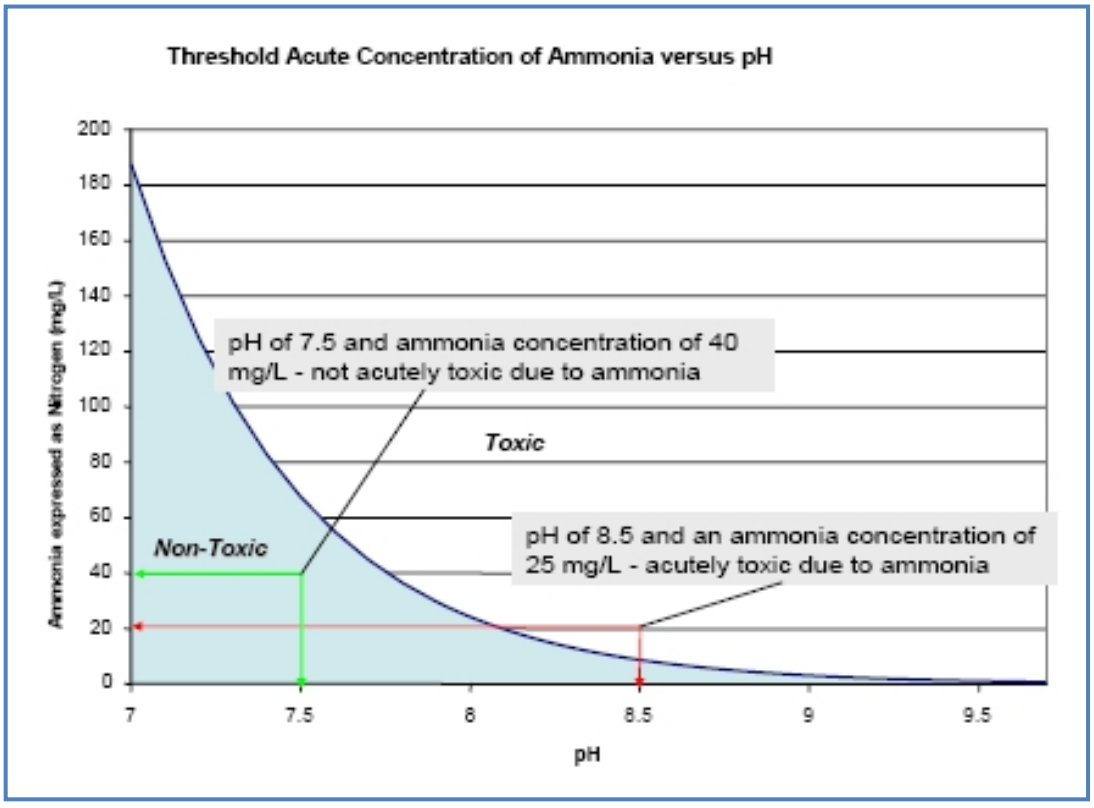
The regulations state that for facilities with average daily flows in excess of 17,500 m^3/day, the monthly average BOD and TSS concentrations cannot exceed 25 mg/L. The average monthly concentration of total residual chlorine cannot exceed 0.02 mg/L, and the maximum concentration of un-ionized ammonia must be less than 1.25 mg/L (@ 15^{o}C). These effluent parameters will govern the design of the CRD wastewater treatment process for secondary treatment. There is no requirement under the regulations to provide tertiary treatment.

Where the BC regulation states that secondary treatment need only be sized for 2x ADWF (while for flows in excess of 2x ADWF, primary treatment is sufficient), there is no parallel stipulation in the federal regulations. To meet the federal standards, it will be necessary to determine what level of treatment is required during wet weather periods so that the contaminant concentrations in the effluent satisfy the monthly average limits. Therefore, it may be necessary to consider extending secondary treatment to handle greater than 2x ADWF to ensure the federal standard is met. This will be required until a Federal-Provincial equivalency agreement comes into effect. This will be discussed further in the next section.

Wastewater facilities with flow rates in excess of 50,000 m^3/d are also required to conduct whole effluent acute toxicity testing and evaluate chronic toxicity at the edge of a specified mixing zone on a monthly basis. If a facility fails an acute toxicity test, a toxicity reduction and evaluation process is used to identify and correct the cause of the toxicity. If the whole effluent acute toxicity test failure is due to ammonia, then the need for ammonia reduction must be determined on the basis of the assimilative capacity of the receiving environment. Given the BOD and TKN concentrations previously reported for Macaulay Point and Clover

Point respectively, and making a simplistic assumption that 0.5 grams of biosolids containing 8% nitrogen will be produced for every gram of BOD removed, the conservatively high estimates for the treated effluent ammonia-nitrogen concentrations from treatment plants located at Macaulay and Clover Points would be in the order of 38 mg/L and 31 mg/L respectively. From an examination of the plot given in **Figure 2.1**, it is unlikely that the future ammonia-nitrogen concentrations in CRD's treated effluent will be an issue for disposal to marine waters. Previous discussions with Environment Canada indicate that nitrification would not be required for discharge to marine waters.

Figure 2.1 – Acute Toxicity Relationship Between pH and Ammonia-Nitrogen Concentration (Environment Canada, 2007)



The WSER also outlines the frequency of sampling required for treatment facilities of given sizes. The quantity of samples specified are used to make up the required monthly average that is reported for compliance purposes. For plants in excess of 50,000 m^3/d, the minimum requirement is for the facility to take three composite samples per week.

2.3.1 Equivalency Agreement between Federal and Provincial Regulations

Given some inconsistencies between the federal WSER and provincial MWR, the Province of BC, and the Government of Canada have been working to develop a Federal-Provincial Equivalency Agreement on Municipal Wastewater. This federal/provincial agreement enables dischargers to meet provincial requirements only, and having WSER "stand down" in deference to the equivalent provincial requirements in B.C.; thus avoiding regulatory duplication. To be deemed “equivalent-in-effect” to the WSER, the province must incorporate key aspects of the federal regulation into its regulatory framework.

Existing Operational Certificates must transition to the harmonized MWR, or the discharge will remain subject to both the federal WSER and the provincial MWR.

Discharges from a facility not currently capable of secondary treatment (Macaulay and Clover Points) would be deemed Transitionally Registered under the harmonized MWR. While transitionally registered, the discharger would continue to meet requirements in their former permit (or Operating Certificate) until the facility is upgraded, or the federal timeline is reached (2020), whichever comes first. In other words, no other sections of the MWR would apply while the discharge is Transitionally Registered. Once the upgrade deadline expires, the discharge would be deemed registered under the harmonized MWR and would be required to be compliant with the regulation. The CRD is currently operating their screened outfalls at Clover and Macaulay Point under a Transitional Authorization.

2.3.2 Compounds of Emerging Concern

Compounds of Emerging Concern (CEC) that are discharged to municipal wastewater streams include pharmaceuticals, personal care products and compounds that are not entirely removed by conventional wastewater treatment processes. CECs are currently being studied by many researchers globally however there is no consensus on the environmental and health impacts or the best treatment method to deal with these compounds. Some of the compounds are removed through adsorption on residual solids, filtration, and advanced oxidation treatment processes. However, there is no one treatment process that removes all of these compounds. Many municipalities have implemented source control education programs to deal with these compounds.

In Canada there are no regulations that deal with CECs. If CECs are regulated in the future, the best available technology to deal with the actual constituents present in the wastewater stream can be assessed at that time.

2.3.3 Canadian Environmental Assessment Act

It is unlikely that any of the sites under consideration would be subject to a review under the Canadian Environmental Assessment Act. For reference purposes the McLoughlin Point site was subject to a CEAA screening but a completion of a CEAA assessment was not required. A CEAA screening level assessment to determine if there are any environmental concerns associated will be required for any new sites.

2.3.4 Odour Control

The WSER, the BC MWR and the Organic Matter Recycling Regulation have no specific requirements for odour control. It is reasonable to assume that the public will be intolerant of offensive and nuisance odours from the new wastewater facilities and thus advanced odour control equipment needs to be installed to mitigate odours to a reasonable level. It is possible that future regulations could be promulgated employing quantitative odour monitoring such as dilutions to threshold (D/T) at the plant fence line or at the nearest downwind receptor. In any event one should assume that treatment tankage will be covered and off gases from the treatment process will be collected and treated to remove offensive odours.

Even with good odour treatment, there will be times during cleaning, maintenance or emergency conditions when odorous air may escape. While good housekeeping and maintenance can assist in mitigating these odours, it is difficult, if not impossible to guarantee that there will never be an odour event.

The treatment plant sites under consideration by the CRD are located in urban areas. Previous planning work has indicated the requirement for a high degree of odour treatment to reduce odour levels to 5 odour units at the property line.

3.0 OVERVIEW OF EXISTING CRD SEWERAGE COLLECTION SYSTEM

This section provides a summary of the existing sewerage system within the CRD. An understanding of the collection system is useful when assessing treatment plant siting and conveyance options for the Core Area Wastewater Treatment Program.

3.1 Catchment Areas

Figure 3.1 provides a high level overview of the CRD sewerage catchments, trunk sewers, and outfall systems.

The CRD collection system has two primary catchments and outfall systems. The east catchment discharges to the Clover Point marine outfall and the west catchment discharges to the Macaulay Point marine outfall.

Within the primary catchments there are also municipal sub catchments that collect and pump flows to the primary catchment trunk system through a network of pump stations. These are also a number of emergency overflow outfalls in the CRD system which are used during wet weather events. These overflows are designed to protect homes from flooding during extreme wet weather events. Flows from these overflows are not measured at the Clover or Macaulay outfalls.

Siting of plants close to the existing Clover and Macaulay outfalls is justifiable from an engineering perspective to avoid the cost of reconfiguring the municipal subcatchment infrastructure and / or pumping to plant sites located remotely from the existing outfalls. The flows at the two outfalls are significant when wet weather flows are considered. Flows of 240 MLD (4 x ADWF) at Macaulay and 144 MLD (3 x ADWF) at Clover Point must be pumped to any new treatment plant site.

3.2 Conveyance Requirements for Plant Siting Options

Several plant siting options have been considered for assessing the impact on the conveyance system of different plant locations. The site location significantly impacts the pumping power requirements as well as other issues such as the requirement to construct large diameter forcemains and outfall piping through developed areas. For comparison purposes the following information is provided.

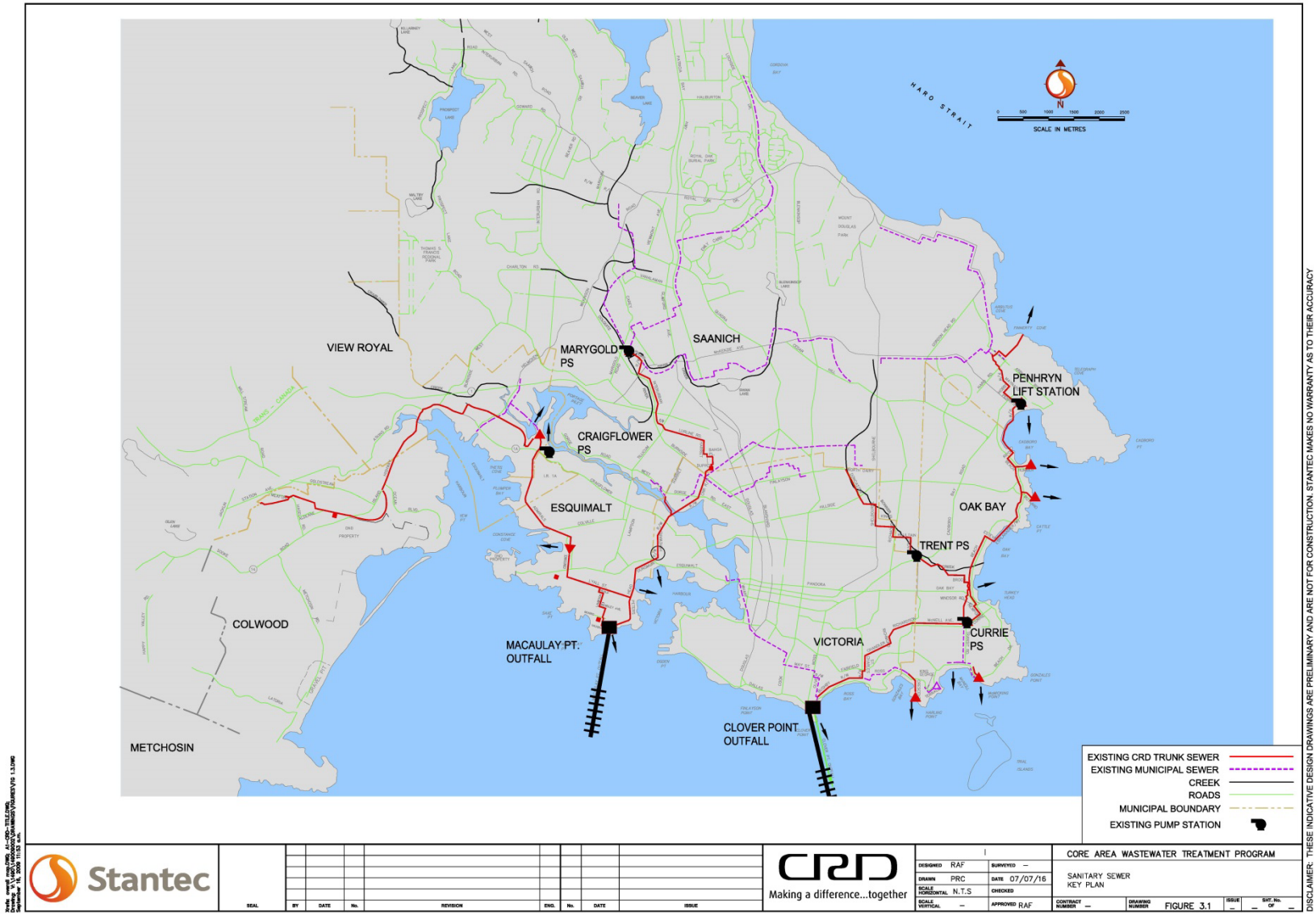
Table 3.1 – Pumping Horsepower

Plant Siting Option	Forcemain Sizes (mm)	Pump Horsepower for Peak Flow of 384 MLD	Pump Horsepower for Average Flow of 108 MLD
Single Plant at Rock Bay	2100, 1200	4306	1185
Single Plant at McLoughlin	2100, 1200	2151	611

The above assumes that wet weather and secondary treatment facilities are located at a combined site(s) as this will be the most cost effective.

Plants located near the outfalls will have lower pumping requirements than plants located near Rock Bay or any other location remote from the outfalls. In addition, treated effluent flows must be pumped back to the outfalls whereas plants located near the existing outfalls will be able to discharge flow by gravity for most of the time except possibly during extreme high tide periods depending on the final site elevation and plant hydraulic grade line.

Figure 3.1 – Sanitary Sewer Key Plan



4.0 WASTEWATER TREATMENT PLANNING PARAMETERS

4.1 Flow Projections

The design of new treatment facilities requires an estimation of the flows and loads for sizing of liquid and biosolids treatment facilities. The sizing of primary treatment facilities is governed by hydraulic requirements to pass the PWWFs, while secondary treatment facilities are governed by the load, which is the product of the flow times the concentration of the pollutant. The CRD has recently refreshed the population projections with each of the municipalities contributing to the sewer system and has developed a dry weather flow capacity requirement of 108 MLD. The development of this flow estimate has considered the current measured dry weather flows at the Clover and Macaulay outfalls as well as project population growth in the CRD. A detailed catchment flow estimate was previously completed by CH_2M, Associated, and KWL and reviewed by Stantec as part of their planning work. More recently these numbers have been refreshed by the Urban/Carollo team. This flow when combined with the wastewater characterization can be used to develop design loads for sizing of the liquid and biosolids treatment trains.

Recent flow projections have shown a decline in ADWFs as assessed for the months of June to August. **Table 4.1** provides an overview of the declining ADWFs. Flows appear to have reached their lowest point in 2015 and data for 2016 suggest dry weather flows have increased by approximately 2 MLD since 2015.

Table 4.1 – ADWF (m^3/d)

Catchment	2009	2011	2012	2013	2014	2015	2016
Macaulay	39,171	37,448	36,815	35,397	35,601	35,659	36,453
Clover	45,000	40,466	39,213	37,553	35,760	34,504	35,701
TOTAL	**84,171**	**77,914**	**76,029**	**72,951**	**71,361**	**70,163**	**72,154**

Flows for 2010 are not included in **Table 4.1** because there was a problem with an inaccurate flow meter which had to be replaced. The lower flows are attributed to water conservation efforts and use of lower flow fixtures. The per capita flows appear to have flattened out in the last two years. At the same time the load, (see **Table 4.2**) which governs the sizing of the secondary treatment system has been steadily increasing based on measured wastewater quality results at the Clover and Macaulay outfalls. This is expected because the base per capita BOD and TSS contribution is relatively constant and total load will increase with population growth even if flows decline. As the flow reduces, the concentration and total plant load increases. **Table 4.2** and **Table 4.3** support the fact of increasing loads with declining flows. Since load governs the sizing of secondary treatment facilities there is no change from the 2030 flow projection and the 108 MLD should be maintained.

Theoretically it may be possible to downsize the wet weather treatment facilities slightly but this approach is risky given the unpredictability of winter rainstorms and the fact that some areas of the CRD already experience wet weather flows in excess of 4x ADWF.

Table 4.2 – BOD (kg/d)

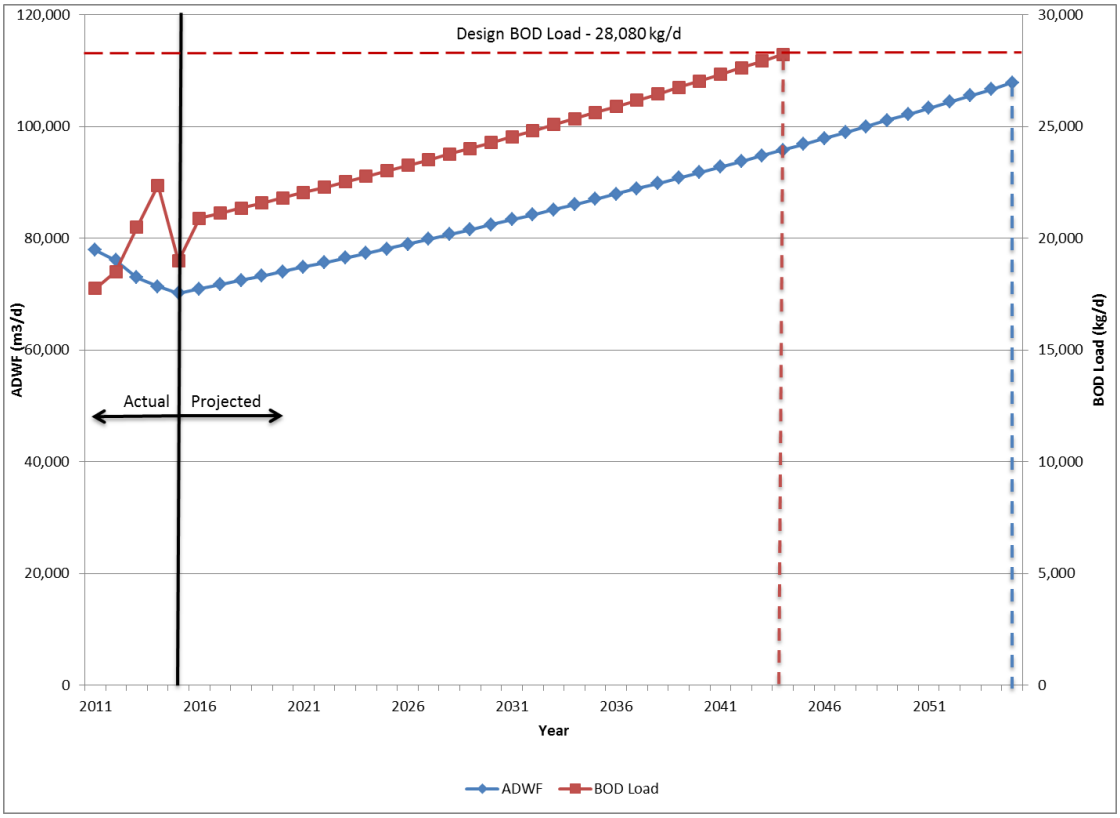
Catchment	2011	2012	2013	2014	2015
Macaulay	9,250	9,179	10,395	12,589	10,177
Clover	8,498	9,328	10,085	9,778	8,793
TOTAL	**17,747**	**18,508**	**20,480**	**22,366**	**18,971**

Table 4.3 – TSS (kg/d)

Catchment	2011	2012	2013	2014	2015
Macaulay	9,202	9,179	10,076	11,091	9,799
Clover	8,595	9,032	9,946	10,303	9,502
TOTAL	**17,796**	**18,211**	**20,021**	**21,394**	**19,301**

Over the past five years, the BOD loading has been increasing by 2.2% per year on average (8.1% per year if the anomalous 2015 data is excluded), and the TSS loading has been increasing by 2.3% per year on average (6.4% per year if the anomalous 2015 data is excluded). This is to be expected if the per capita flows have been decreasing over this same five year period As secondary treatment facilities are primarily sized based on the incoming organic load, it is anticipated that the current basis of design for secondary treatment remains valid. Based on the population growth rates outlined in the previous section, BOD load projections have also been developed. Projecting BOD loads from 2015 forward to a design load of 28,080 kg/d will yield varying design horizons, depending on the annual population growth. **Figure 4.1** presents the load projection for the 1.08% annual growth rate which indicates the plant would be at capacity in 2044. The 1.08% growth is the rate that CRD has used for estimating population growth. Higher growth rates will require expansion of the plant prior to 2044. Given the accuracy of population projections the current load projections provide a reasonable design horizon for new facilities.

Figure 4.1 – ADWF and BOD Load Projections (1.08% Annual Growth Rate)



4.2 Influent Wastewater Characterization

A wastewater characterization study was completed to quantify the influent parameters at the Clover and Macaulay outfalls. This information included installation of flow proportional composite samplers at each outfall to collect samples over dry weather and wet weather periods. A significant amount of data was collected and is summarized in a report prepared by Stantec titled Indicative Design / Detailed Design Wastewater Characterization and Design Loads dated January 23, 2013. The Stantec report summarizes the design loads to be used for the design of new facilities. Since the preparation of the Stantec report, Urban / Carollo reviewed 2014 influent data and concluded that the influent sampling resulted in similar loads as predicted by Stantec in 2013. Wastewater data collected since the original 2013 study supports the design loads selected for the new facilities.

To account for flow and load variability the maximum month design loads are used for design of the secondary treatment process. Based on a review of historical wastewater characterization data a factor of 1.25 was selected to account for this variability. This factor is consistent with the wastewater characterization data and is similar to other communities.

4.3 Design Flows and Loads

The loading criteria selected for the design of new facilities is summarized in **Table 4.4**. Updates of flow projections provided by the CRD indicate that approximately 56% of the flow (60 MLD) can be attributed to the Macaulay catchment and 44% (48 MLD) to the Clover catchment.

Table 4.4 – CRD Wastewater Treatment Design Loads

		Flow (mL/day)	Concentration (mg/l)	Total Load (kg/day)	Clover Pt (kg/day)	Macaulay Pt (kg/day)
Screened Wastewater Flow					48 MLD	60 MLD
	ADWF BOD	108	260	28,080	12,480	15,600
	ADWF TSS	108	240	25,920	11,520	14,400
	ADWF Volatile Solids	108	220	23,760	10,560	13,200
	Max Month BOD			34,770	15,453	19,317
	Max Month TSS			30,780	13,680	17,100
Primary Effluent						
	Max Month BOD			24,339	10,817	13,522
	Max Month TSS			13,851	6,156	7,695
Primary Residual Solids Produced for Treatment at Biosolids Facility						
	Max Month TSS			16,929	7,524	9,405
	Average Day TSS			15,550	6,910	8,640
Secondary Residual Solids Produced for Treatment at Biosolids Facility						
	Max Month TSS			15,671	6,965	8,706
	Average Day TSS			14,260	6,340	7,920

Assumptions

- *Maximum month load = 1.25 X ADWF load*
- *Primary TSS removal 55%, BOD removal 30%*
- *Residual solids yield 0.8 kg cells/kg BOD removed*
- *An additional 2160 kg /d Residual solids production is estimated from tertiary treatment*

The wastewater characterization study reviewed wet weather and dry weather flow and loading periods. The governing criteria for maximum month loading was found to be in the winter months following first flush after a dry period. During this period, although the concentration of BOD and TSS dropped off due to high infiltration and inflow, the load increased because maximum month flow was higher at 190 MLD. This flow can easily be accommodated in the secondary treatment process design because the secondary treatment facilities must be designed to accommodate 2x ADWF or 216 MLD.

4.4 Post 2030 Design Flows and Loads

Average dry weather flows have declined in the CRD for the past 5 years however load has increased. Using CRD projected annual growth rate of 1.08% would result in a requirement for additional plant capacity around year 2044. Additional capacity could also be achieved by operating in a chemically enhanced primary treatment mode year round once the plant is nearing capacity. Given the sites under consideration there is little to no room for future expansion. Most of the growth in the CRD is expected to occur on the West Shore where significant developable land is available. In the future it would make sense to construct a plant on the West Shore. This would also free up capacity at the Core Area wastewater treatment facilities.

4.5 Wet Weather Treatment

New treatment facilities for the Core Area must be designed to handle wet weather and loading conditions. Chemically enhanced primary treatment must be provided for flows as per **Table 4.5** during wet weather flow events. The sewage flows are collected in two primary catchment areas within the CRD, the Clover Point catchment and the Macaulay Point catchment. Sewers within these catchments experience high levels of I&I and consequently high PWWFs are measured at the outfalls. As part of the CRD's LWMP process, it has been determined that primary treatment will be provided for flows up to 4x ADWF for the Macaulay catchment and up to 3x ADWF for the Clover catchment. The occasional PWWFs in excess of the primary treatment capacity would be diverted at the existing outfalls. **Table 4.5** provides a summary of the wet weather flows that will require primary treatment.

Table 4.5 – Peak Wet Weather Flows (PWWF)

Catchment	LWMP Wet Weather Treatment MLD	ADWF MLD	PWWF MLD
Clover Point	3 x ADWF	48	144
Macaulay Point	4 X ADWF	60	240
Total Flow		**108**	**384**

4.6 Description of Treatment Processes

4.6.1 Primary Treatment

Primary treatment is a physical process referred to as sedimentation where settleable solids are removed from the wastewater by gravity settling. In its simplest form it involves a tank and a residual solids removal system. The residuals solids are removed and conveyed to the biosolids treatment facilities.

During high wet weather flows, such as those experienced at CRD, chemicals are often added to assist in settling of lighter suspended solids. This process is referred to as chemically enhanced primary treatment or CEPT. The residual solids removed from this process are referred to as primary sludge and are directed to biosolids treatment facilities. The primary treatment process without chemical addition typically removes 55-60% of TSS and approximately 25-30% BOD. With chemical addition the removal rates for TSS are typically much higher (75 to 80%) and BOD removal typically increases to 40-55%. The pollutants remaining after primary treatment must be treated by a secondary treatment process.

4.6.2 Secondary Treatment

Secondary treatment removes organic material from the wastewater using a biological treatment process with air addition to promote biological oxidation and reduce BOD in the wastewater. The most common secondary treatment process is the activated sludge process, but significant site area is required for this process. There are also hybrid high rate activated sludge / attached growth secondary treatment systems including moving bed bioreactors and biological aerated filters that occupy a smaller footprint than conventional activated sludge processes. These processes are suited to sites with limited land availability.

Secondary treatment is typically able to achieve a wastewater quality with a BOD and TSS of 15 to 20 mg/L.

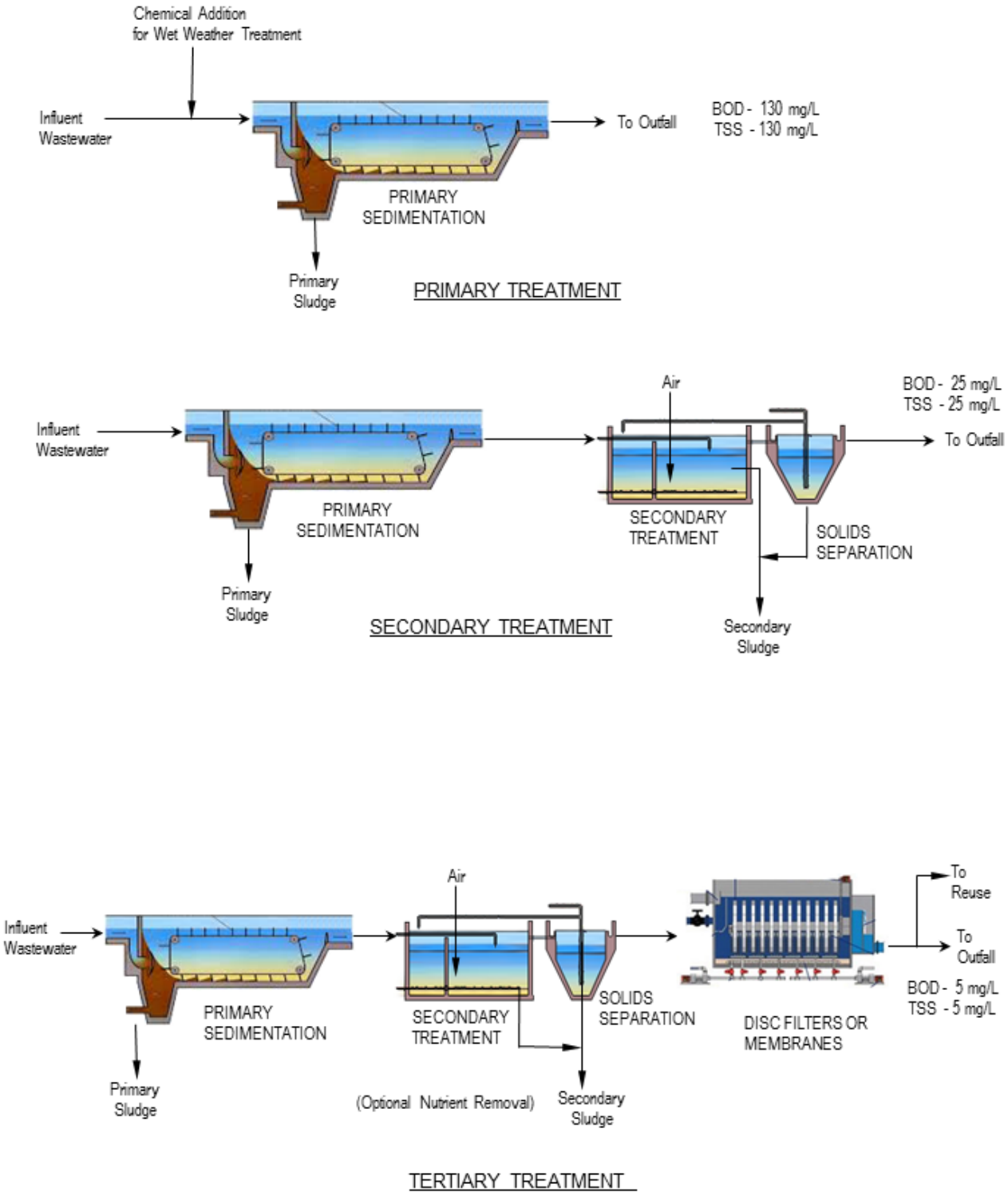
4.6.3 Tertiary Treatment

Tertiary treatment is an advanced treatment process beyond secondary treatment which produces a higher quality effluent. Tertiary treatment facilities are often designed where nutrients such as phosphorus and nitrogen must be removed because they are detrimental to the receiving stream environment. Depending on the location and receiving stream, some tertiary plants are only designed to remove nitrogen or phosphorus. Where water reuse is required for irrigation or groundwater recharge, tertiary filtration is added, but often nutrient removal is not practiced because nutrients are beneficial to plant growth. Tertiary treatment is rarely used when the discharge is to a marine environment which has higher assimilative capacity.

Tertiary treatment can be achieved through the use of membranes or other filtration processes including disc filters or sand filters. Membranes have higher energy use in comparison to conventional filtration processes such as disc or sand filters.

A process flow diagram showing the various treatment processes is provided in **Figure 4.2**.

Figure 4.2 – Process Flow Diagrams for Various Treatment Processes



5.0 LIQUID TREATMENT TECHNOLOGY OPTIONS

5.1 General

The Capital Regional District (CRD) has been planning for wastewater treatment since 2006. During this time, a significant amount of work has been completed to assess siting alternatives and review proven and emerging treatment technologies. The options reviewed included decentralized and centralized treatment options for liquid and biosolids treatment. The availability of sites large enough for combined liquid / biosolids facilities or separate facilities has been the most challenging issue facing the CRD. The majority of the sites evaluated are too small to locate combined liquid / biosolids facilities at a single side. Because of this factor, the liquid treatment has been decoupled from the biosolids treatment. Biosolids treatment will be located at Hartland landfill.

The engineering firms involved in the review of appropriate treatment technology are summarized as follows and the text below highlights the liquid treatment technology that has been examined:

- Urban Systems/Carollo Engineers (2014 to 2016)
- Stantec Consulting Ltd. (2009-2014)
- CH2M Hill/Associated Engineering/Kerr Wood Leidel (KWL) (2006-2009)

It should be noted that all firms selected representative proven technologies for treatment planning level assessments. It is recognized that technology selection can change through the project development, but the use of representative technology assists with site planning and budget estimates.

5.1.1 Urban Systems/Carollo Work Summary (2015-2016)

The most recent planning on conceptual treatment options has been completed by Urban Systems and Carollo Engineers. The liquid treatment technologies reviewed by Urban Systems/Carollo included tertiary treatment using Membrane Bioreactor (MBR) technology, and secondary treatment options using conventional activated sludge or Moving Bed Bioreactor (MBBR) technology. The MBBR technology requires a smaller footprint than conventional activated sludge.

5.1.2 Stantec Work Summary (2009-2015)

In 2009, Stantec was retained to provide Program Management and Technical Planning services for the Core Area Wastewater Treatment Program. Stantec refined the previous planning studies provided by CH2M Hill/ Associated Engineering/Kerr Wood Leidel (KWL) and evaluated 12 different centralized and decentralized options. Stantec reviewed a variety of configurations and technologies, and prepared cost estimates for each option. Triple Bottom Line (TBL) assessments were prepared for the various treatment options.

5.1.3 CH2M Hill/Associated/KWL Work Summary (2006-2009)

A comprehensive review of decentralized treatment options were undertaken by the CH2M Hill/ Associated/KWL team from 2006 -2009.

The CH2M Hill/Associated/KWL team focused on using MBR to provide distributed treatment and water reuse throughout the Core Area.

5.2 Compiled List of Treatment Technologies Reviewed

Table 5.1 summarizes the treatment technologies that have been reviewed during the various planning studies, including an opinion judgement on the suitability of the technology for the CRD project. The use of proven technology is necessary to meet the regulatory and reliability requirements of the project. The suitability is mainly driven by available site size and the requirement to implement a proven technology.

Table 5.1 – Summary of Treatment Technologies Assessed and Implementation Considerations

Technology	Implementation Considerations	Consider for CRD
Sequencing Batch Reactor (SBR)	Large footprint. Not typically used for flows >20 MLD, could be considered for smaller capacity plants.	✓
Modified Sequencing Batch Reactor	Large footprint. Not typically used for flows >20 MLD	✓
Vertreat (Deep Shaft)	Unproven at scale and not suitable for wet weather flows. Eliminated since there are no facilities operating at the scale required for CRD project.	×
Membrane Bioreactor (MBR)	Suitable for smaller sites as secondary clarifiers are eliminated. Capital and operating costs greater than secondary treatment solutions. Requires additional membranes to 2 x ADWF requirements. Effluent exceeds regulatory requirements and is suitable for water reuse.	✓
Conventional Activated Sludge	Large footprint. Was evaluated for West Shore Regional Option in 2009 study. Can be considered for smaller capacity multi-plant options in sites with sufficient space.	✓
High Rate Activated Sludge	Slightly smaller footprint than conventional activated sludge. Can be considered for smaller multi-plant options.	✓
Electro Flocculation	Unproven technology. Eliminated because it is not proven in municipal wastewater treatment at the scale required for CRD.	×
Trickling Filter	Large footprint, require larger sites. Only suitable if larger sites can be obtained.	✓
Trickling Filter / Solids Contact	Large footprint, require larger sites. Only suitable if larger sites can be obtained.	✓

Technology	Implementation Considerations	Consider for CRD
Moving Bed Bioreactor (MBBR)	Mid-size footprint suitable for smaller sites.	✓
Biological Aerated Filter (BAF)	Secondary clarifiers not required. Small footprint suitable for smaller sites.	✓
Actiflo wet weather treatment primary treatment	Small footprint and good performance. Higher operating cost for chemicals and sand media.	✓
Densadeg wet weather primary treatment	Small footprint. Higher operating cost for chemicals.	✓
Lamella Plate Settlers	Reduces primary sedimentation size. Suitable for smaller sites but requires chemicals during wet weather flow events.	✓
Rotating Biological Contactor (RBC)	Not typical for flows >5 MLD. Not suitable for high wet weather flows. Eliminated because only typically suitable for small plants.	×
Co-Mag Wet Weather Primary Treatment	Suitable for smaller sites.	✓
Bio-Mag Secondary Treatment	Small footprint, but not typically used for flows >20MLD. Technology is still embryonic and in development stage. Eliminated from consideration.	×
Ultra Violet (UV) Disinfection	Preferred disinfection technology for wastewater effluent.	✓
Tertiary Oxidation (Ozone) for Contaminants of Emerging Concern (CEC)	Suitable for oxidizing some CECs however Increased operations cost for power and peroxide.	✓
Salsnes High Rate Fine Screening	Does not provide adequate BOD reduction and too many units would be required to manage the wet weather flows. Was piloted at CRD previously.	×
Activated Sludge Algae	Emerging Technology. Eliminated because not proven in similar scale to that required for CRD.	×
Primary Treatment Only	Will not meet regulatory requirements	×
Extended Aeration Activated Sludge	Not suitable for wet weather because it does not have primary sedimentation and high flows can wash out biomass and impact treatment. Eliminated due to high wet weather flows encountered at CRD.	×
Integrated Fixed Film AS (IFAS)	Mid-size footprint suitable for consideration.	✓

A number of the technologies outlined in **Table 5.1** are suitable for secondary treatment, but require large sites that are not available in the CRD. For this reason alone, some of the technologies may not be viable options for further consideration but they may be viable for multi-plant confgurations with smaller capacities.

5.3 Representative Secondary Treatment Technologies

To enable comparison of costs and assessment of siting, high rate **representative** treatment technologies have been selected for this evaluation. These technologies are not the only technologies that could be considered for the project but they do provide a reasonable spectrum of proven technologies for the purpose of establishing budgets. The representative technologies all use proven secondary wastewater treatment processes that will meet the discharge objectives, are proven technology, and have been constructed at numerous other locations in North America and Europe. One the biggest factors impacting technology selection is the size of the available sites. All of the available sites that have been considered for CRD to date have limited area and as such only high rate technologies which can be constructed within a limited site area can be considered. For multiple plant options where the individual capacity of a plant is smaller, it may be possible to consider more conventional technologies but this would require assessment on a case by case basis depending on the site that is being evaluated. Other considerations with respect to the siting including the shape of the land parcel under consideration and access to the sites for maintenance vehicles and trucks which require a larger turning radius.

The following narrative describes three potential technologies for consideration by the CRD. These technologies have been selected because they are proven technology and provide a reasonable cross section of proven technologies which will satisfy the regulatory requirement for the project.

High Rate or Conventional Activated Sludge (CAS)

The high rate or conventional activated sludge system is the most widely used process for secondary treatment worldwide, is quite flexible for incorporation of future technology, and can be constructed for a reasonable capital cost and operated at an acceptable operating cost. It also has the advantage of being able to increase the future capacity without additional process tankage by placing MBBR in the aeration tanks or being retrofitted with other higher rate technologies. The issue with CAS is that it requires significant space, which is not available at most of the plant sites that the CRD is considering but it may be suitable for multi plant sites. It may be a viable option for two or greater plant configurations due to their smaller capacity.

Membrane Bioreactor (MBR)

For a MBR process, a bioreactor tank will be followed by a membrane tank containing hollow fibre ultra filtration membranes or membrane plates to achieve separation of the activated sludge from the liquid effluent by applying a vacuum across the semi permeable membranes. A portion of the separated sludge will be returned to the bioreactor as Return Activated Sludge (RAS) to seed the biological processes. The remainder of the sludge, referred to as Waste Activated Sludge (WAS), will be wasted and pumped to Hartland for treatment.

The pore size on the membranes is typically < 2 microns providing a physical barrier to organic and inorganic solids and even to microorganisms including most bacteria. The MBR plant effluent quality will be very high, 2 mg/L BOD and < 2 mg/L TSS. During storm flows up to 2x ADWF, the combined MBR and CEPT effluent will easily meet the effluent requirements for discharge to the marine environment. Because of the high activated sludge concentration, long sludge age of greater than 20 days and the process configuration, nitrification (ammonia conversion to nitrates) will occur ensuring no effluent toxicity to fish. The MBR plant effluent will be suitable for reuse as irrigation on golf courses and parks. The portion of the effluent used for

these purposes will be disinfected using UV irradiation and probably chlorination to retain an appropriate residual chlorine level. While MBRs are capable of producing high quality effluent, their energy consumption is high and membranes must be replaced every 8 to 10 years at a significant cost. MBR plants are also operationally more complex.

Biological Aerated Filter (BAF)

A BAF provides a compact design for sites with limited area. There is no requirement for secondary clarifiers so space can be saved. BAF is an attached growth process where a polystyrene or shale filter bed in the order of 3 to 4 metres is used as a filter media. The reactor also uses compressed air which is introduced into the filter bed to satisfy oxygen demand of aerobic microorganisms. The yield of excess sludge is similar to activated sludge, with between 0.8 to 0.9 kg solids / kg of BOD removed. In a typical design, multiple filter cells are used so that one can be backwashed approximately once every 24 hours. The backwash is directed to dirty wash water tanks and solids are removed and directed to thickening facilities. The BAF process is capable of meeting provincial and federal effluent requirements. Tertiary effluent capable of 5/5 mg/L BOD / TSS can be achieved by adding filtration to the BAF process. This can easily be accomplished by using disc or sand filters.

BAF treatment plants have been installed at Kingston, Thunder Bay and Windsor, Ontario and in Canmore, Alberta. There are also a number of installations in the USA and Europe. Several suppliers can provide BAF process equipment. For restrictive sites, the BAF is a viable option however, the filter tanks are quite deep, which requires significant excavation thereby resulting in increased capital costs.

Process flow schematics for each representative process option are provided in **Figures 5.1** to **5.3**.

Figure 5.1 – Process Flow Diagram – Conventional Activated Sludge

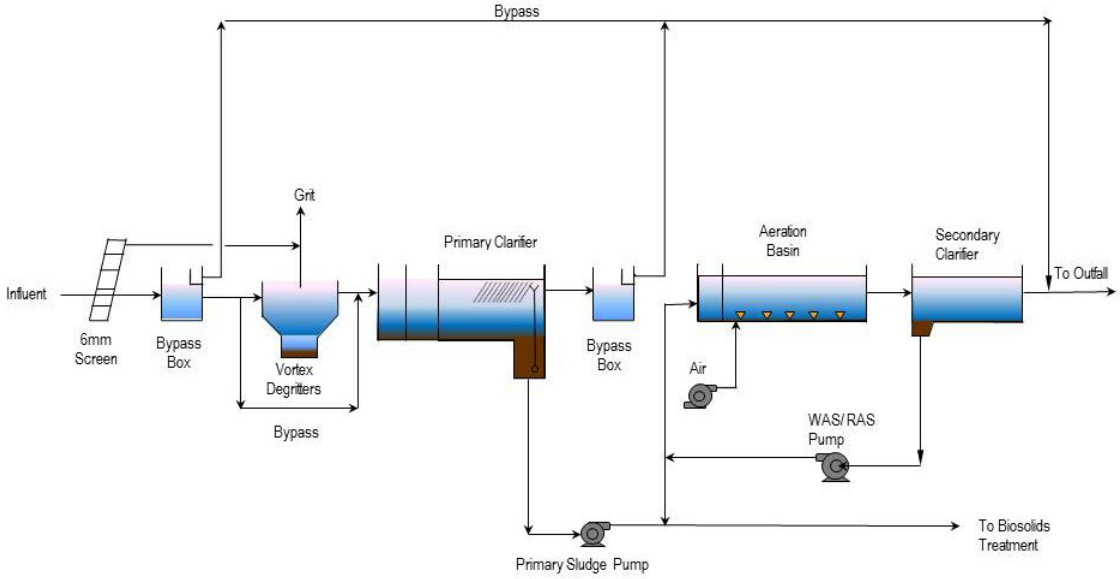


Figure 5.2 – Process Flow Diagram – Membrane Biological Reactor

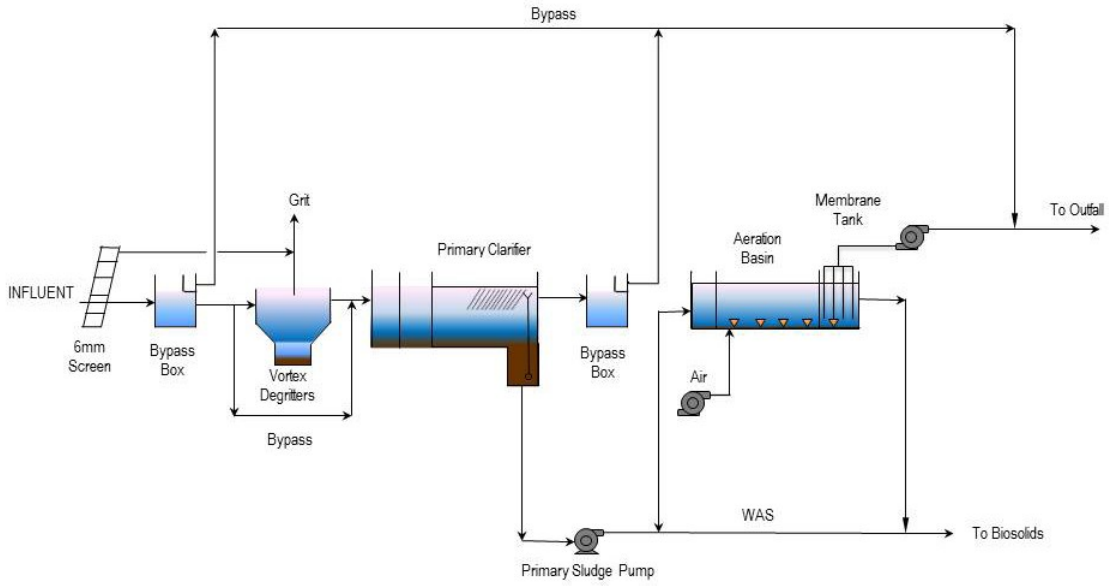
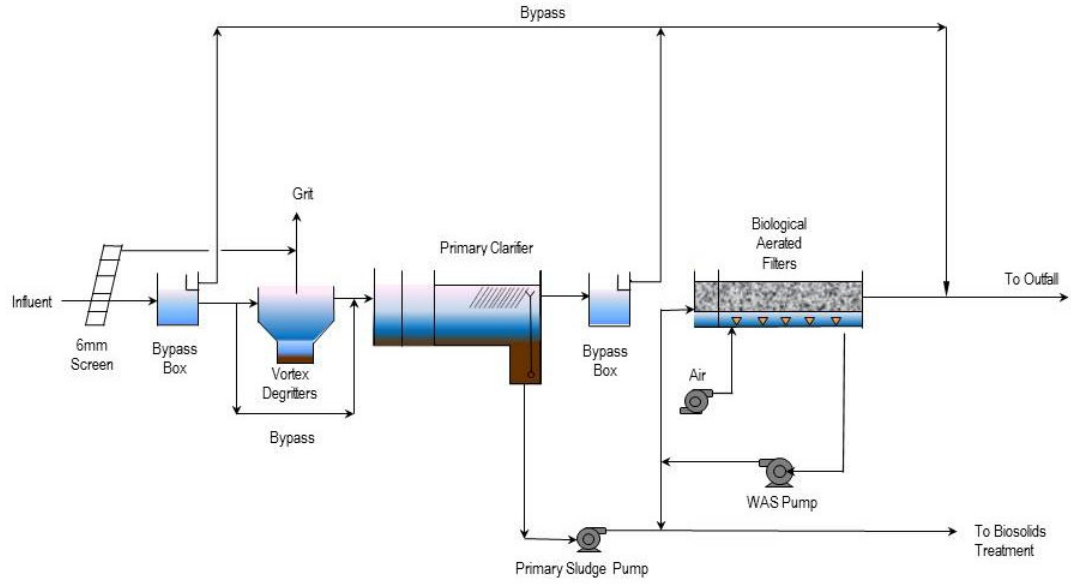


Figure 5.3 – Process Flow Diagram – Biological Aerated Filter



5.4 Wet Weather Treatment Technologies

For the initial evaluations and costing high rate primary treatment technologies with the capability for chemically enhanced primary treatment (CEPT) during wet weather flows are considered suitable for the sites under consideration by CRD. Conventional primary sedimentation tanks were also assessed but their space requirement at sites under consideration preclude their use. Two potential high rate primary treatment options that could be considered include:

- Lamella sedimentation
- Ballasted sedimentation

These options are considered appropriate because they occupy a smaller footprint than conventional primary sedimentation facilities. The lamella plate option was selected for costing purposes because it can operate without chemicals up to 2 times ADWF during normal operations.

6.0 BIOSOLIDS TREATMENT TECHNOLOGY OPTIONS

Residual solids processing and treatment facilities have been assumed to be located at the Hartland Landfill site for all potential liquid treatment options. This report does not review the technology options available for biosolids treatment. A separate evaluation has been completed on biosolids options including IRM opportunities for integration with other waste streams including municipal solid waste. The selection of the liquid train treatment process will not significantly impact the ultimate selected biosolids treatment process. Tertiary processes will produce approximately 2,160 kg/d of additional solids that must be treated in biosolids treatment facilities. For costing purposes, the funded biosolids resource recovery centre at the Hartland Landfill was carried in the initial funding applications and has therefore been included in the cost estimates outlined in this report. These costs will be refined subject to selection of the preferred biosolids treatment option.

The residuals solids will be pumped from the selected liquid treatment site to the Hartland landfill site. This will require construction of a 200 mm pipeline and 4 pumping stations due to the elevation difference between the sites under consideration and the selected biosolids treatment plant at Hartland.

7.0 INTEGRATED RESOURCE MANAGEMENT

Integrated Resource Management (IRM) and resource recovery has long been part of the practice of wastewater engineering and there are many examples where integration of solid waste, biosolids, and other organic waste has been practiced for many years. By considering the various waste streams at a planning level and in an integrated manner, synergies can sometimes be achieved to optimize the solutions for dealing with multiple waste streams.

In Europe there are a number of locations where municipal solid waste and organics are used as fuel substrates for waste to energy facilities. The CRD has already made strides in sustainable IRM practices through their capture of gas from the Hartland Landfill, their source separated organics program and their water conservation program that has been very successful in reducing water consumption and sewage flows.

In arid climates such as California, integrated water resource management is being practiced where wastewater is treated using advanced treatment processes and is used to recharge groundwater aquifers. An example of this is located in Orange County, California where wastewater is given advanced treatment and used to recharge aquifers. Other local examples of resource recovery include the Whistler Wastewater Treatment Plant, where heat is extracted from the treated wastewater and used as part of the district heating system for a residential development in close proximity to the plant as well as supplying heat for on-site buildings. For biosolids management, Whistler composts their residual solids with organic waste to produce a beneficial landscape amendment.

IRM is also practiced in industry where wastewater is processed and reused for cooling water and industrial processes. The food industry processes organic solid waste for energy production.

The biggest opportunity for IRM at the CRD exists with the potential integration of solid waste, biosolids, and organic waste at the Hartland Landfill. The Hartland site provides an excellent opportunity and location for such a facility. Other opportunities for consideration by the CRD include water reuse and heat recovery, but these opportunities are very demand dependent and must be considered on a case by case basis to determine if the capital investment makes good business and environmental sense.

A number of resource recovery opportunities exist that could be part of an IRM strategy. These opportunities have been previously examined in the Biosolids Management Plan prepared by Stantec and Brown and Caldwell in November 2009. The options explored in the Biosolids Management Plan included:

- Gasification
- Pyrolysis to produce BioOil
- Drying and pelletizing of biosolids to produce fuel
- Waste to Energy thermal processing
- Anaerobic digestion to produce a Class B or Class A biosolids
- Raw sludge drying for fuel use for thermal processes or cement kilns
- Production of beneficial reuse products such as struvite fertilizer, soil amendment

- Co-digestion of organic wastes to enhance biogas production
- Biogas scrubbing and sale to gas utility
- Struvite Recovery
- Biocell treatment of biosolids and organic wastes
- Incineration
- Landfilling of residual solids

Many of the above options are considered further in the assessment of biosolids treatment options report.

The provision for future IRM initiatives can be accommodated into the selection of any liquid treatment technology but it must be evaluated in a separate business case to confirm feasibility.

8.0 ANALYSIS AND SCREENING OF WASTEWATER TREATMENT OPTIONS

8.1 Options Assessment

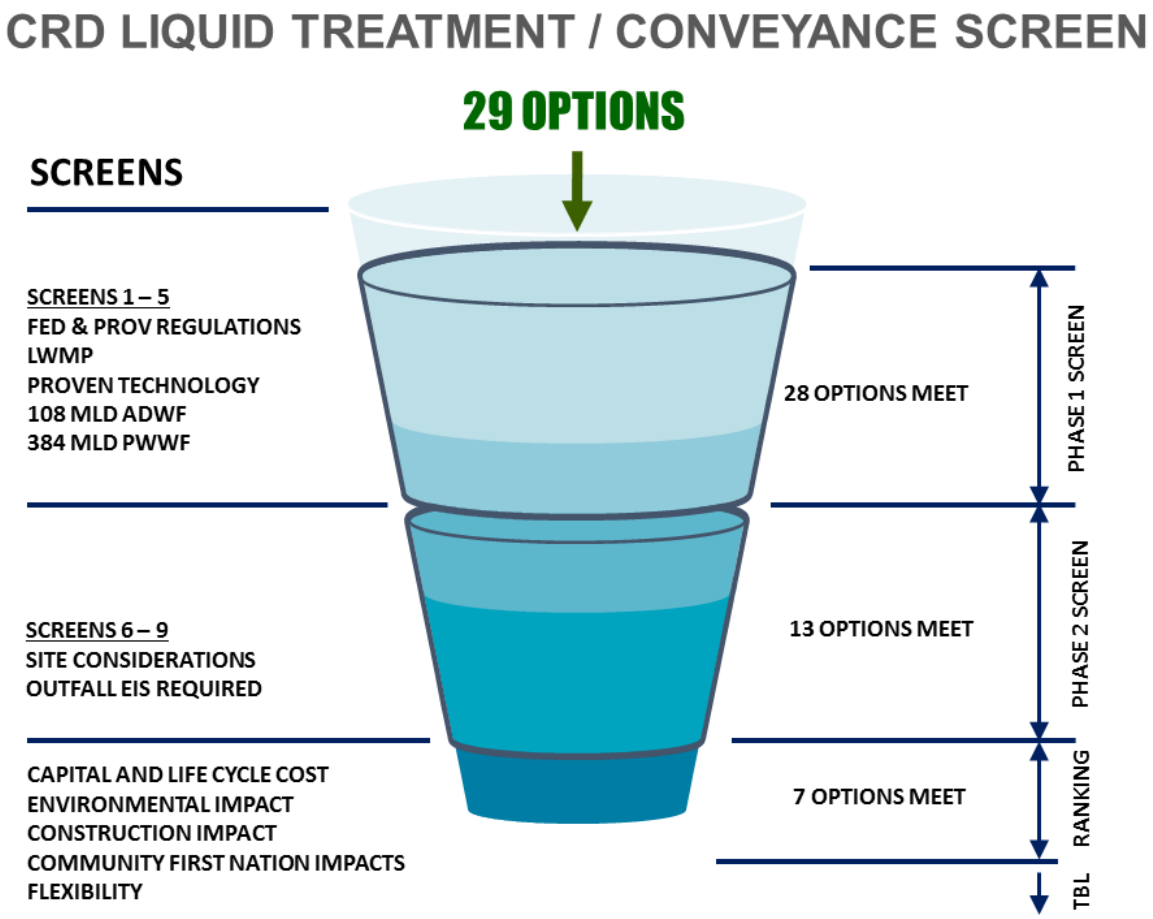
The Project Board requested a comprehensive summary of all treatment options that have been assessed to date for the Core Area Wastewater Treatment Project. All options were to be considered and evaluated. In addition, new options that warranted further assessment were also to be assessed. The evaluation in this report was focused on liquid train treatment, as biosolids will be evaluated under a separate assessment process. Liquid train treatment options will produce a similar quantity of residual solids and are not expected to impact the selection of viable biosolids treatment processes for the CRD.

The consulting team compiled a list of all previous work completed since 2006 including the most recent work completed as part of the Eastside and Westside Select Committees and the Technical Oversight Panel. A summary matrix was developed to outline the attributes of each option. A total of 29 options were considered as part of the evaluation process. The options ranged from multi-plant decentralized treatment options to single plant regional options. **Table 8.1** summarizes all of the options evaluated by the current consulting team and previous consultants since 2006. The approach used for the overall evaluation is described in **Section 8.2.**

8.2 Evaluation Approach

The 29 treatment plant options were summarized for evaluation. The 29 options be screened using a Phase 1 high level screening process which did not consider the project cost or schedule to provide an objective evaluation of all options. The Phase 1 screening evaluated options for core technical and regulatory requirements. Phase 2 screening included site considerations and the requirement for outfall EIS permitting to develop a shorter list of viable options for further evaluation. Options which passed the Phase 2 screening requirements were subjected to a Phase 3 ranking evaluation where life cycle costs, environmental impacts, community impacts and other considerations were assessed. This screening and ranking process is illustrated in **Figure 8.1** and described in more detail below.

Figure 8.1 – CRD Liquid Treatment / Conveyance Screens (Phase 1, Phase 2 and Phase 3



Phase 1 of the screening process included the following project functional considerations:

1. **Federal and Provincial Regulations** – the ability of a given technology to meet the federal Wastewater System Effluent Regulations (WSER) and the provincial Municipal Wastewater Regulation (MWR);
2. **Liquid Waste Management Plan (LWMP)** – the ability of the given technology and site to fit within the guidelines outlined in the CRD's approved LWMP;
3. **Proven Technology** – the proposed technology must have a verifiable service record of continuous operation at a scale similar to CRD;
4. **Average Dry Weather Flow (ADWF) Capacity** – the ability of the technology and related site(s) to be able to treat, at least a total combined capacity of 108 MLD ADWF; and
5. **Peak Wet Weather Flow (PWWF) Capacity** – the ability of the technology and related site to be able to treat at least 384 MLD PWWF.

Phase 2 of the screening process included advancing options that were capable of meeting all five of the first phase screening criteria to a second level of screening which included the following considerations:

1. **Site Considerations** – including the adequacy of the site size for a treatment plant of the required capacity, the likelihood of securing an interest in the site, and whether re-zoning of the site would be required;

2. **Outfall EIS Requirement** – would a new Environmental Impact Study (EIS) be required for the option's outfall(s) or could an option undergo a fast track approval for options where existing outfalls were being twinned to increased capacity. Available data from long term monitoring of existing outfall sites and previous modeling would assist in fast tracking approvals.

The options that passed Phase 1 and Phase 2 screens were advanced to Phase 3 ranking evaluation, which examined the following factors:

1. **Life Cycle Cost** – an examination of the capital, operation and maintenance and life cycle costs. Life cycle costs were considered over a 25 year period and were calculated using a 4% discount rate.

2. **Environmental Impact** – carbon footprint and resource recovery potential of the option;

3. **Construction Impacts** – short term impacts to residents and businesses during construction based on a hi, medium, or low assessment;

4. **Community and First Nation Impacts** – would the construction or operation have any community or First Nation impacts; and

5. **Flexibility** – ability of the option to meet changing regulatory and process requirements or undergone modification in the future should regulations change.

The results of the Phase 1 and 2 screening are presented in the Section 8.3, along with the rationale for how the final options were selected.

8.3 Phase 1 and Phase 2 Option Screening Evaluation

The list of 29 options that underwent the screening process included 9 single (regional) plant options, 10-two plant options, and 11 multi-plant options ranging from 3 to 10 plant distributed plant site options. All of these options are outlined on **Table 8.1**.

Following Phase 1 screening only one of the 29 initial options was eliminated due to inability to meet wet weather treatment capacity. This was to be expected, as the majority of options developed over the past ten years should have been capable of meeting these definitive project technical requirements.

The 28 remaining options were then subjected to Phase 2 of the assessment, where a further 15 options (white background in Table 8.1) were eliminated leaving 13 for further evaluation (shaded green and yellow in Table 8.1). Many of the 15 options were eliminated due to unrealistic site availability considerations, the requirement for significant environmental remediation at the selected sites, or onerous Environmental Impact Study (EIS) requirements for the outfall(s).

The required outfall environmental impact assessment is a significant consideration in the screening of the remaining viable options. Previous experience has indicated that new outfalls on Vancouver Island take at least 24 months to permit (the recent McLoughlin outfall EIS took 30 months). Options which used the Clover, Macaulay or proposed McLoughlin outfalls were considered more favourable because even if twinning an existing outfall to increase capacity was necessary, these options should be permitted more easily because there is a significant amount of historical monitoring data at the outfall sites and dispersion models are available.

While many of the options assessed would require that an Environmental Impact Assessment (EIA) or at least an initial environmental screening assessment be undertaken, some of the options were viewed as having less onerous assessment requirements due largely to their favourable locations at existing outfall sites and the number of required outfalls.

The 13 options short listed from the Phase 1 and Phase 2 screening and their option number identification, selected to undergo further evaluation were:

Option #	Option Description	Number of Plants
2	Rock Bay Regional Tertiary (MBR)	1
4	Rock Bay Regional Secondary	1
7	Holland Park Regional Secondary	1
8	McLoughlin Regional Secondary	1
10	Clover Point and McLoughlin Tertiary (MBR)	2
13	East Saanich (Tertiary) and McLoughlin (Secondary)	2
16	McLoughlin and Holland Park (both Secondary)	2
17	McLoughlin and Rock Bay (both Tertiary MBR)	2
18	McLoughlin and Rock Bay (both Secondary)	2
19	Colwood / Langford Tertiary (MBR), Esquimalt First Nations Tertiary (MBR) and Rock Bay (Secondary)	3
20	Colwood / Langford Tertiary (MBR), Esquimalt First Nations (Secondary) and Rock Bay (Secondary)	3
21	Clover Point (Primary), McLoughlin Tertiary (MBR) and Rock Bay Tertiary (MBR)	3
22	East Saanich Tertiary (MBR), McLoughlin (Secondary) and West Shore Tertiary (MBR)	3

Table 8.1 – Initial Screening Summary Matrix

Notes

1 Initial screening for Liquid Plant(s) and Conveyance only. Options eliminated shown in white background.

2 Assume Biosolids at Hartland Landfill unless otherwise noted.

3 Options advanced to Phase 3 ranking are shown in yellow and green. Yellow shaded options require further evaluation at Phase 3 stage of evaluation.

			PHASE 1 - SCREENING EVALUATION					PHASE 2 - SCREENING EVALUATION				
Number	Option Description	Facilities / Technologies	Screen 1 "Hard" Fed and Prov Regulations	Screen 2 "Soft" Regulations i.e., LWMP	Screen 3 Proven Technology	Screen 4 Capacity 108 ML/day ADWF	Screen 5 Peak Wet Weather Capacity of 384 ML/d	Screen 6 Site			Screen 7 Outfall EIS Required	Comment
								Ownership	Size	Zoning		
SINGLE LIQUID PLANT OPTIONS												
1	Rock Bay Central Secondary Facility, tertiary sidestream	Activated Sludge with 10 MLD MBR tertiary	Pass	Pass	Pass	Pass	Pass	Option	N	N	Yes	Site is too small for activated sludge process, option eliminated.
2	Rock Bay Central Tertiary (MBR)	Rock Bay MBR Tertiary Treatment for full flow	Pass	Pass	Pass	Pass	Pass	Option	Y	N	Yes	Twinning Clover assume fast track EIS approval at 14 months
3	Rock Bay Tertiary	Rock Bay Tertiary Plant for full flow, outfall upsize deferred	Pass	Pass	Pass	Pass	Fail	Option	Y	N	Yes	Twinning Clover assume fast track approval at 14 months, fail on screen 1 wet weather capacity, option eliminated.
4	Rock Bay Secondary	Single 108 MLD plant at Rock Bay using secondary activated sludge or BAF technology. Layout completed for space planning only.	Pass	Pass	Pass	Pass	Pass	Option	Y	N	Yes	Twinning Clover assume fast track approval at 14 months. Could also use permitted McLoughlin outfall.
5	West Shore Regional Plant	108 MLD secondary activated sludge on West Shore, Biosolids on West Shore site	Pass	Pass	Pass	Pass	Pass	N	Y	N	Yes	Site has been purchased by developer, tunnel required to convey flows, option eliminated.
6	Regional Plant at Upper Harbour (Steel Pacific)	Saanich East wet weather storage tank. 108 MLD Upper Harbour BAF Secondary Plant with small MBR sidestream for water reuse. Thermophilic Anaerobic Digestion in Upper Harbour at combined site	Pass	Pass	Pass	Pass	Pass	N	Y	N	No	Private owned site and will need 2 year contaminated site cleanup Assumes McLoughlin outfall used. Option eliminated due to schedule.
7	Holland Park Regional	108 MLD Regional Plant at Holland Park	Pass	Pass	Pass	Pass	Pass	N	Y	N	Yes	Potential new option, may face less public opposition than Clover site zoning implication to be reviewed.
8	McLoughlin Secondary	108 MLD BAF Secondary Plant at McLoughlin Wet weather treatment facilities with capacity of 412 MLD at McLoughlin Storage attenuation tank at East Saanich Pump Upgrades for Clover and Macaulay Conveyance to deliver flows to McLoughlin	Pass	Pass	Pass	Pass	Pass	Y	Y	Y	No	Environmental permits in place, CRD owned site.

			PHASE 1 - SCREENING EVALUATION					PHASE 2 - SCREENING EVALUATION				
Number	Option Description	Facilities / Technologies	Screen 1 "Hard" Fed and Prov Regulations	Screen 2 "Soft" Regulations i.e., LWMP	Screen 3 Proven Technology	Screen 4 Capacity 108 ML/day ADWF	Screen 5 Peak Wet Weather Capacity of 384 ML/d	Screen 6 Site			Screen 7 Outfall EIS Required	Comment
								Ownership	Size	Zoning		
TWO LIQUID PLANT OPTIONS												
9	Rock Bay and Colwood	80% of flow to secondary (AS) treatment and 20% to tertiary (MBR)	Pass	Pass	Pass	Pass	Pass	N	Y	N	Yes	Option on Rock Bay Site only, small site required for Clover, requires new outfall, site not adequate for AS, option eliminated.
10	Clover Point and McLoughlin Tertiary	1 tertiary plant at Clover Point and 1 tertiary plant at McLoughlin Point	Pass	Pass	Pass	Pass	Pass	Y	Y	N	No	LWMP Amendment 10 option
11	West Shore Regional Plant and small plant in East Saanich	16.6 MLD Saanich East MBR Plant, 108 MLD secondary activated sludge on West Shore, Biosolids on West Shore site	Pass	Pass	Pass	Pass	Pass	N	Y	N	Yes	Westshore site has been purchased by developer, site not available, option eliminated.
12	2 regional plants and 2 wet weather plants, one at Clover Point and one at Macaulay Point	16.6 MLD MBR Tertiary Plant at Saanich East 108 MLD secondary Plant (CAS) on West Shore 75 MLD Wet Weather Plant at Clover Point 92. MLD Wet weather plant at Macaulay Point Biosolids on combined West Shore Site – Thermophilic Anaerobic Digestion	Pass	Pass	Pass	Pass	Pass	N	Y	N	Yes	Not enough room at Macaulay to construct plant, adjacent land owned by DND and would take considerable time to secure, option eliminated.
13	East Saanich and McLoughlin	East Saanich – 16.6 MLD MBR McLoughlin – 92 MLD secondary BAF Thermophilic Anaerobic Digestion at Hartland with IRM	Pass	Pass	Pass	Pass	Pass	Y/N	Y	N	Yes	East Saanich site proposed for storage. New outfall required for East Saanich plant.
14	Upper Harbour West Shore	Saanich East storage Upper Harbour – 108 MLD BAF secondary with heat recovery and water reuse West Shore – 7 MLD MBR Thermophilic Anaerobic Digestion in Upper Harbour at combined site	Pass	Pass	Pass	Pass	Pass	N	y	N	Yes	Upper Harbour is private owned site. Site is contaminated and requires minimum 2 year clean up, option eliminated due to schedule.
15	Saanich East, Upper Harbour	Saanich East 16.6 MLDMBR Plant Upper Harbour – 98 MLD BAF Secondary with heat recovery and water reuse Thermophilic Anaerobic Digestion in Upper Harbour at combined site	Pass	Pass	Pass	Pass	Pass	N	Y	N	Yes	Upper Harbour is a privately owned site. Site is contaminated and requires minimum 2 year clean up. Option eliminated due to schedule. Saanich East site faced previous public opposition.
16	McLoughlin Point Holland Park	60 MLD McLoughlin Secondary 48 MLD Holland Park Secondary	Pass	Pass	Pass	Pass	Pass	N	Y	N	No	Potential new option, may face less public opposition than Clover but zoning to be reviewed.

			PHASE 1 - SCREENING EVALUATION					PHASE 2 - SCREENING EVALUATION				
Number	Option Description	Facilities / Technologies	Screen 1 "Hard" Fed and Prov Regulations	Screen 2 "Soft" Regulations i.e., LWMP	Screen 3 Proven Technology	Screen 4 Capacity 108 ML/day ADWF	Screen 5 Peak Wet Weather Capacity of 384 ML/d	Screen 6 Site			Screen 7 Outfall EIS Required	Comment
								Ownership	Size	Zoning		
17	McLoughlin / Rock Bay MBR Tertiary	McLoughlin - 60 MLD Tertiary , Rock Bay 48 MLD Tertiary	Pass	Pass	Pass	Pass	Pass	Y	Y	Y	No	Potential new option. Use existing Clover Outfall and proposed McLoughlin outfall or Macaulay outfall.
18	McLoughlin / Rock Bay Secondary	McLoughlin - 60 MLD Secondary , Rock Bay 48 MLD Secondary	Pass	Pass	Pass	Pass	Pass	Y	Y	Y	No	Potential new option for secondary treatment. Use existing Clover and Macaulay outfalls or proposed McLoughlin outfall.
THREE LIQUID PLANT OPTIONS												
19	Colwood / Langford, Esquimalt Nation and Rock Bay Secondary	Rock Bay 80% to secondary, 20% tertiary sidestream at Esquimalt and Rock Bay.	Pass	Pass	Pass	Pass	Pass	N	Y	N	Yes	CRD has an option on Rock Bay land. Could use permitted outfall but new outfall required for Colwood / Langford. EIS only required for Colwood / Langford option
20	Colwood / Langford (tertiary), Esquimalt Nation and Rock Bay (both secondary)	Up to 30% of Colwood Langford is tertiary and small scale sidestream reuse, also included at Rock Bay and Esquimalt. The majority of flow is secondary.	Pass	Pass	Pass	Pass	Pass	N	Y	N	Yes	Significant conveyance requirement to implement. Could use McLoughlin permitted outfall but new outfall required for Colwood / Langford.
21	Clover Point Primary, McLoughlin and Rock Bay Tertiary	2 tertiary plants and 1 primary plant	Pass	Pass	Pass	Pass	Pass	y	y	N	Yes	Satisfies technical screens but 3 plants required. Could use McLoughlin and Clover outfalls. Fast track EIS possible.
22	Option 1 A – 3 Plants located at East Saanich, McLoughlin, West Shore	East Saanich – 16.6 MLD MBR tertiary McLoughlin – 84.2 MLD BAF Secondary 24 MLD West Shore – MBR Thermophilic Anaerobic Digestion in Upper Harbour.	Pass	Pass	Pass	Pass	Pass	N	Y	N	Yes	Satisfies technical screens but 3 plants required, multiple outfalls required, McLoughlin has permitted outfall, East Saanich outfall extension, West Shore requires new outfall and EIS.
23	Option 1A Refinement3 Plants located at East Saanich, McLoughlin, West Shore	East Saanich – 16.6 MLD MBR tertiary McLoughlin – 84.2 MLD BAF Secondary 24 MLD West Shore – MBR tertiary Thermophilic Anaerobic Digestion at Hartland	Pass	Pass	Pass	Pass	Pass	N	Y	N	Yes	Multiple outfalls and EISs required, option eliminated.
24	Option 1D - 3 Plants Upper Harbour Saanich East West Shore	East Saanich – 16.6 MLD MBR Upper Harbor Steel Pacific-91.2 MLD secondary BAF West Shore MBR- 7 MLD Thermophilic Anaerobic Digestion in Upper Harbour at combined site	Pass	Pass	Pass	Pass	Pass	N	Y	N	Yes	Upper Harbour site is privately owned. Steel Pacific requires environmental remediation, minimum 2 year clean-up. Option eliminated due to schedule.

			PHASE 1 - SCREENING EVALUATION					PHASE 2 - SCREENING EVALUATION				
Number	Option Description	Facilities / Technologies	Screen 1 "Hard" Fed and Prov Regulations	Screen 2 "Soft" Regulations i.e., LWMP	Screen 3 Proven Technology	Screen 4 Capacity 108 ML/day ADWF	Screen 5 Peak Wet Weather Capacity of 384 ML/d	Screen 6 Site			Screen 7 Outfall EIS Required	Comment
								Ownership	Size	Zoning		
25	Option 1 – 3 Plants Option Macaulay or McLoughlin, South Colwood, Saanich East, Clover Point Wet Weather	Macaulay/ McLoughlin MBR Tertiary- 100.8 MLD South Colwood WWTP MBR Tertiary – 38 MLD Saanich East WWTP MBR Tertiary- 17 MLD Clover Point Wet Weather – 254 MLD Biosolids -Thermophilic Anaerobic Digestion	Pass	Pass	Pass	Pass	Pass	N	Y	N	Yes	South Colwood site not available, purchased by developer, multiple outfalls required and EIS required. Option eliminated.
FOUR & GREATER LIQUID PLANT OPTIONS												
26	4 Plants Rock Bay, Colwood, East Saanich and Esquimalt Nation	Treats 75% of flow to secondary level and 25% to tertiary levels. Tertiary effluent is available for reuse in each of 4 areas.	Pass	Pass	Pass	Pass	Pass	N	Y	N	Yes	Need for new outfall on west shore, multiple outfalls required. Option eliminated due to multiple sites, EIS requirements and schedule.
27	5 Plants Macaulay/ McLoughlin, South Colwood, Saanich East, Ogden Point, Juan De Fuca	Macaulay McLoughlin – 23 MLD MBR Tertiary Saanich East- 17 MLD MBR Tertiary South Colwood – 1- MLD MBR Tertiary Ogden Point – 37.3 MLD MBR Tertiary Juan De Fuca – 56 MLD MBR Tertiary Biosolids – Thermophilic Anaerobic Digestion	Pass	Pass	Pass	Pass	Pass	N	Y	N	Yes	Multiple sites, most not available, multiple outfalls required. Option eliminated due to multiple sites, EIS requirements and schedule.
28	7 Plants: Rock Bay, Colwood, East Saanich, Esquimalt Township, View Royal, Langford and Core Saanich	Treats up to 45% of flow to tertiary quality with all flows on West Side treated to tertiary level.	Pass	Pass	Pass	Pass	Pass	N	Y	N	Yes	Multiple sites, most not available, multiple outfalls required. Option eliminated due to multiple sites, EIS requirements and schedule.

			PHASE 1 - SCREENING EVALUATION					PHASE 2 - SCREENING EVALUATION				
Number	Option Description	Facilities / Technologies	Screen 1 "Hard" Fed and Prov Regulations	Screen 2 "Soft" Regulations i.e., LWMP	Screen 3 Proven Technology	Screen 4 Capacity 108 ML/day ADWF	Screen 5 Peak Wet Weather Capacity of 384 ML/d	Screen 6 Site			Screen 7 Outfall EIS Required	Comment
								Ownership	Size	Zoning		
29	10 Plants Macaulay / McLoughlin, South Colwood, Saanich East, Ogden Point, Juan deFuca, Windsor Park, Westhills, Florence Lake, Lang Cove, Roderick	Macaulay / McLoughlin 12 MLD MBR Tertiary South Colwood 8 MLD MBR Tertiary Saanich East 15 MLD MBR - Tertiary Ogden Point – 20 MLD MBR Tertiary Juan de Fuca –m 13.5 MLD MBR Tertiary Windsor Park- 12 MLD MBR Tertiary Westhills- 8 MLD MBR Tertiary Florence Lake -4 MLD MBR Tertiary Lang Cave – 8 MLD MBR Tertiary Roderick – 21 MLD MBR Tertiary Biosolids Thermophilic Anaerobic Digestion	Pass	Pass	Pass	Pass	Pass	N	N	N	Yes	Multiple sites, most not available, multiple outfalls required. Option eliminated due to multiple EIS requirements and schedule.

The 13 short listed options were evaluated and the three plant options (4 of them) were ranked lower than all of the other options due to their higher life cycle cost and greater construction and post-construction impacts, and as such, they did not make the short list of options for further evaluation. A description of the options not carried forward for further consideration and the rationale for elimination are discussed below:

Option 7 – Holland Park Regional: The existing zoning was reviewed and current zoning of the property is R1-B which does not permit wastewater treatment facilities. A rezoning would be necessary and could take an extended period of time. This option was not presented to the public in the 2016 public consultation program and because it is a park, it may face public opposition. The site would also likely require an EIS or at least a screening level environmental assessment.

Option 16 – McLoughlin and Holland Park: Holland Park site has the same considerations as Option 7.

Option 19 – Colwood / Langford, Esquimalt First Nation and Rock Bay Secondary: This option was eliminated because there are EIS requirements associated with outfalls as well as the new sites.

Option 20 – Colwood / Langford Tertiary (MBR), Esquimalt First Nations (Secondary) and Rock Bay Secondary: same comments on Option 19.

Option 21 – Clover Point (Primary), McLoughlin Tertiary MBR and Rock Bay Tertiary MBRs: This option was eliminated because there is limited space at Clover Point for primary treatment and it would likely have to be built underground.

Option 22 – East Saanich, McLoughlin, West Shore: This three plant option was eliminated because only one of the three sites, McLoughlin has an outfall EIS. The West Shore and East Saanich sites would require an EIS. The site availability for a new plant in East Saanich is also uncertain.

After the elimination of the options noted above the following options were advanced to the to the triple bottom line (TBL) evaluation as discussed in Section 11 of this report to ensure that environmental and social considerations were factored into the overall assessment.

Option #	Option Description
2	Rock Bay Regional Tertiary (MBR)
4	Rock Bay Regional (Secondary)
8	McLoughlin Regional Secondary
10	Clover Point and McLoughlin Tertiary (MBR)
13	East Saanich (Tertiary) and McLoughlin (Secondary)
17	McLoughlin and Rock Bay (both Tertiary MBR)
18	McLoughlin and Rock Bay (both Secondary)

8.4 Phase 3 Option Evaluation and Ranking

The remaining seven options were then evaluated and ranked based on life cycle cost, environmental impacts, construction impacts, community and First Nations impacts, and flexibility with regards to changing regulatory or process requirements as outlined in **Table 8.2.** All costs were brought to 2016 dollars using appropriate inflation rates since the year of original estimate preparation to enable objective comparison

In consideration of all criteria including TBL assessments (see Section 11.0), the Project Board selected the following options for preparation of Class C estimates.

- Option 4 – Rock Bay Secondary
- Option 8 – McLoughlin Point Secondary
- Option 18 – McLoughlin Point Secondary (60 MLD), Rock Bay Secondary (48 MLD)

The single secondary plant at Rock Bay was shortlisted as the site appears to be favourable for the construction of a single secondary plant and the CRD has an option to purchase the land. The site has also undergone initial public consultation. The McLoughlin regional plant was carried forward for further analysis as this is the best developed of the six options in terms of identified layout and cost (by virtue of having been the LWMP Amendment No. 8 option that had previously been partially procured). The McLoughlin plant also had the most favourable triple bottom line. The two plant option at McLoughlin / Rock Bay is similar to the McLoughlin / Clover option that was carried in Amendment No. 10, but provides more favourable construction conditions as there would be no requirement to construct a costly underground plant, as there would be at Clover Point.

The Project Board also felt there was some merit in costing tertiary filtration additions to each of the options using more cost effective disc filter technology. As noted below subset options of the three short listed options noted as 4a, 8a, and 18a were also carried forward for detailed costing and TBL evaluation at the request of the Project Board. The options that were carried forward for detailed class C cost estimates were:

- Option 4 – Rock Bay Secondary
- Option 4a – Rock Bay Tertiary Disc Filter
- Option 8 – McLoughlin Point Secondary
- Option 8a – McLoughlin Point Tertiary Disc Filter
- Option 18 – McLoughlin Point Secondary (60 MLD), Rock Bay Secondary (48 MLD)
- Option 18a – McLoughlin Point Tertiary Disc Filter (60 MLD) and Rock Bay Tertiary Disc Filter (48 MLD)

Table 8.2 – Phase 2 - Ranking Criteria for Liquid / Conveyance

Notes

1. Initial screening for Liquid Plant(s) and Conveyance only.
2. Assume Biosolids at Hartland Landfill unless otherwise noted.
3. Life Cycle costs calculated using 4% discount rate.
4. Capital Costs in 2016 dollars, excluding escalation to midpoint of construction.
5. Options show in red eliminated. Options shown in green on final short list.

			PHASE 3 – RANKING CONSIDERATIONS								
Number	Option Description	Facilities / Technologies	Cost ($ Million)			Environmental Impact		Construction Impact	Community / First Nation Impacts	Flexibility	Comment
			Capital	O & M	Life Cycle	Carbon Footprint	Resource Recovery Potential				
SINGLE LIQUID PLANT OPTIONS											
1	Rock Bay Central Secondary Facility, Tertiary Sidestream	Activated Sludge with 10 MLD MBR tertiary	$1,056	$22.3	$1,366	Med	Med	Hi	Med	Hi	Site is too small for activated sludge process, option eliminated.
2	Rock Bay Central Tertiary (MBR)	MBR Tertiary Treatment for full flow	$1,159	$27.1	$1,535	Hi	Hi	Hi	Med	Hi	Resource recovery high only if there is a market for reclaimed water.
3	Rock Bay Tertiary	Tertiary Plant for full flow, outfall upsize deferred	$1,104	$27.1	$1,480	Hi	Hi	Hi	Med	Hi	Twinning Clover assume fast track approval at 14 months, fail on screen 1, option eliminated.
4	Rock Bay Secondary	Single 108 MLD plant at Rock Bay using secondary activated sludge or BAF technology.	$984	$19.0	$1,248	Med	Hi	Hi	Med	Hi	Site is sufficient for 108 MLD
5	West Shore Regional Plant	108 MLD secondary activated sludge on West Shore, Biosolids on West Shore site	$966	$18.4	$1,222	Med	Med	Med	Low	Med	Site has been purchased by developer, tunnel required to convey flows, option eliminated.
6	Regional Plant at Upper Harbour (Steel Pacific)	Saanich East wet weather storage tank. 108 MLD Upper Harbour BAF Secondary Plant with small MBR sidestream for water reuse. Thermophilic Anaerobic Digestion in Upper Harbour at combined site	$984	$17.0	$1,220	Med	Med	Med	Med	Hi	Private owned site and will need 2 year contaminated site cleanup Assumes McLoughlin outfall used. Option eliminated due to schedule.
7	Holland Park Regional	108 MLD Regional Secondary Plant at Holland Park	$857	$17.0	$1,093	Low	Med	Med	Low	Med	Likelihood of approval small, site is zoned residential.

Number	Option Description	Facilities / Technologies	PHASE 3 – RANKING CONSIDERATIONS								
			Cost ($ Million)			Environmental Impact		Construction Impact	Community / First Nation Impacts	Flexibility	Comment
			Capital	O & M	Life Cycle	Carbon Footprint	Resource Recovery Potential				
8	McLoughlin Secondary	108 MLD BAF Secondary Plant at McLoughlin Wet weather treatment facilities with capacity of 412 MLD at McLoughlin Storage attenuation tank at East Saanich Pump Upgrades for Clover and Macaulay Conveyance to deliver flows to McLoughlin	$822	$17.0	$1,058	Low	Med	Med	Low	Med	This option has lowest life cycle cost. Environmental permits are in place.
TWO LIQUID PLANT OPTIONS											
9	Rock Bay and Colwood	80% of flow to secondary (AS) treatment and 20% to tertiary (MBR)	$1,115	$23.4	$1,440	Med	Med	Med	Med	Hi	Option on Rock Bay Site only, small site required for Clover, requires new outfall, site not adequate for AS, option eliminated.
10	Clover Point and McLoughlin Tertiary	1 tertiary plant at Clover Point and 1 tertiary plant at McLoughlin Point	$1,078	$25.6	$1,434	Hi	Hi	Hi	Low	Med	Option carried in LWMP Amendment #10.
11	West Shore Regional Plant and small plant in East Saanich	16.6 MLD Saanich East MBR Plant, 108 MLD secondary activated sludge on West Shore, Biosolids on West Shore site	$1,052	$23.2	$1,374	Low	Med	Low	Low	Med	West Shore site has been purchased by developer, site not available, option eliminated.
12	2 regional plants and 2 wet weather plants, one at Clover Point and one at Macaulay Point	16.6 MLD MBR Tertiary Plant at Saanich East 108 MLD secondary Plant (CAS) on West Shore 75 MLD Wet Weather Plant at Clover Point 92 MLD Wet weather plant at Macaulay Point Biosolids on combined West Shore Site – Thermophilic Anaerobic Digestion	$1,040	$23.3	$1,364	Low	Med	Hi	Med	Med	Not enough room at Macaulay to construct plant, adjacent land owned by DND and would take considerable time to secure, option eliminated.
13	East Saanich and McLoughlin	East Saanich – 16.6 MLD MBR McLoughlin – 92 MLD secondary BAF Thermophilic Anaerobic Digestion at Hartland with IRM	$995	$18.9	$1,251	Med	Med	Med	Med	Med	East Saanich site proposed for storage. New outfall required for East Saanich plant.
14	Upper Harbour West Shore	Saanich East storage Upper Harbour – 108 MLD BAF secondary with heat recovery and water reuse West Shore – 7 MLD MBR Thermophilic Anaerobic Digestion in Upper Harbour at combined site	$1,133	$19.1	$1,398	Med	Med	Med	Med	Hi	Upper Harbour is private owned site. Site is contaminated and requires minimum 2 year clean up, option eliminated due to schedule.

Number	Option Description	Facilities / Technologies	PHASE 3 – RANKING CONSIDERATIONS								
			Cost ($ Million)			Environmental Impact		Construction Impact	Community / First Nation Impacts	Flexibility	Comment
			Capital	O & M	Life Cycle	Carbon Footprint	Resource Recovery Potential				
15	Saanich East Upper Harbour	Saanich East 16.6 MLD MBR Plant Upper Harbour – 98 MLD BAF Secondary with heat recovery and water reuse Thermophilic Anaerobic Digestion in Upper Harbour at combined site	$1,116	$19.5	$1,387	Med	Med	Med	Med	Hi	Site is contaminated and requires minimum 2 year clean up
16	McLoughlin Point Holland Park	60 MLD McLoughlin Secondary 48 MLD Holland Park Secondary	$936	$18.9	$1,198	Low	Med	Med	Low	Med	Potential new option, may face less public opposition than Clover but zoning to be reviewed.
17	McLoughlin Point / Rock Bay Tertiary MBR	McLoughlin - 60 MLD Tertiary, Rock Bay 48 MLD Tertiary	$1,030	$25.6	$1,386	Hi	Hi	Med	Med	Hi	Potential new option. Use existing Clover Outfall and proposed McLoughlin outfall or Macaulay outfall.
18	McLoughlin / Rock Bay Secondary	McLoughlin - 60 MLD Secondary, Rock Bay 48 MLD Secondary	$980	$22.2	$1,288	Hi	Hi	Med	Med	Med	Two plant option, conveyance impacts with Rock Bay.
THREE LIQUID PLANT OPTIONS											
19	Colwood / Langford, Esquimalt Nation and Rock Bay Secondary	80% to secondary, 20% tertiary sidestream at Esquimalt and Rock Bay.	$1,153	$23.6	$1,481	Med	Med	Med	Med	Med	CRD has an option on Rock Bay land. Could use permitted outfall but new outfall required for Colwood / Langford. EIS only required for Colwood / Langford option
20	Colwood / Langford (tertiary), Esquimalt Nation and Rock Bay (both secondary)	Up to 30% of Colwood Langford is tertiary and small scale sidestream reuse. Also included at Rock Bay and Esquimalt. The majority of flow is secondary.	$1,208	$24.7	$1,551	Med	Med	Med	Med	Med	Significant conveyance requirement to implement. Could use McLoughlin permitted outfall but new outfall required for Colwood / Langford.
21	Clover Point Primary, McLoughlin and Rock Bay Tertiary	2 tertiary plants and 1 primary plant	$1,116	$23.4	$1,441	Hi	Hi	Hi	Med	Hi	Satisfies technical screens but 3 plants required.
22	Option 1 A – 3 Plants located at East Saanich, McLoughlin, West Shore	East Saanich – 16.6 MLD MBR tertiary McLoughlin – 84.2 MLD BAF Secondary 24 MLD West Shore – MBR Thermophilic Anaerobic Digestion in Upper Harbour.	$1,147	$22.3	$1,457	Hi	Med	Med	Med	Med	Satisfies technical screens but 3 plants required, multiple outfalls required, McLoughlin has permitted outfall, East Saanich outfall extension, West Shore requires new outfall.

Number	Option Description	Facilities / Technologies	PHASE 3 – RANKING CONSIDERATIONS								
			Cost ($ Million)			Environmental Impact		Construction Impact	Community / First Nation Impacts	Flexibility	Comment
			Capital	O & M	Life Cycle	Carbon Footprint	Resource Recovery Potential				
23	Option 1A Refinement 3 Plants located at East Saanich, McLoughlin, West Shore	East Saanich – 16.6 MLD MBR tertiary McLoughlin – 84.2 MLD BAF Secondary 24 MLD West Shore – MBR tertiary Thermophilic Anaerobic Digestion at Hartland	$1,150	$22.7	$1,426	Hi	Hi	Med	Med	Med	Multiple outfalls and EISs required, option eliminated.
24	Option 1D - 3 Plants Upper Harbour Saanich East West Shore	East Saanich – 16.6 MLD MBR Upper Harbour Steel Pacific-91.2 MLD secondary BAF West Shore MBR- 7 MLD Thermophilic Anaerobic Digestion in Upper Harbour at combined site	$1,236	$21.3	$1,532	Med	Med	Med	Med	Hi	Upper Harbour site is privately owned. Steel Pacific requires environmental remediation, minimum 2 year clean-up. Option eliminated due to schedule.
25	Option 1 – 3 Plants Option Macaulay or McLoughlin, South Colwood, Saanich East, Clover Point Wet Weather	Macaulay/ McLoughlin MBR Tertiary-100.8 MLD South Colwood WWTP MBR Tertiary – 38 MLD Saanich East WWTP MBR Tertiary- 17 MLD Clover Point Wet Weather – 254 MLD Biosolids - Thermophilic Anaerobic Digestion	$1,438	$28.6	$1,835	Hi	Hi	Med	Med	Med	South Colwood site not available, purchased by developer, multiple outfalls required and EIS required. Option eliminated.
FOUR & GREATER LIQUID PLANT OPTIONS											
26	4 Plants Rock Bay, Colwood, East Saanich and Esquimalt Nation	Treats 75% of flow to secondary level and 25% to tertiary levels. Tertiary effluent is available for reuse in each of 4 areas.	$1,225	$25.9	$1,585	Hi	Hi	Hi	Med	Med	Need for new outfall on west shore, multiple outfalls required, option eliminated due to multiple sites, EIS requirements and schedule.
27	5 Plants Macaulay / McLoughlin, South Colwood, Saanich East, Ogden Point, Juan De Fuca	Macaulay McLoughlin – 23 MLD MBR Tertiary Saanich East- 17 MLD MBR Tertiary South Colwood – 1- MLD MBR Tertiary Ogden Point – 37.3 MLD MBR Tertiary Juan De Fuca – 56 MLD MBR Tertiary Biosolids – Thermophilic Anaerobic Digestion	$1,949	$35.3	$2,439	Hi	Hi	Hi	Hi	Med	Multiple sites, most not available, multiple outfalls required, option eliminated due to multiple sites, EIS requirements and schedule.
28	7 Plants: Rock Bay, Colwood, East Saanich, Esquimalt Township, View Royal, Langford and Core Saanich	Treats up to 45% of flow to tertiary quality with all flows on West Side treated to tertiary level.	$1,382	$27.3	$1,761	Hi	Hi	Hi	Hi	Med	Multiple sites, most not available, multiple outfalls required. Option eliminated due to multiple sites, EIS requirements and schedule.

			PHASE 3 – RANKING CONSIDERATIONS								
Number	Option Description	Facilities / Technologies	Cost ($ Million)			Environmental Impact		Construction Impact	Community / First Nation Impacts	Flexibility	Comment
			Capital	O & M	Life Cycle	Carbon Footprint	Resource Recovery Potential				
29	10 Plants Macaulay / McLoughlin, South Colwood, Saanich East, Ogden Point, Juan deFuca, Windsor Park, Westhills, Florence Lake, Lang Cove, Roderick	Macaulay/ McLoughlin 12 MLD MBR Tertiary South Colwood 8 MLD MBR Tertiary Saanich East 15 MLD MBR - Tertiary Ogden Point – 20 MLD MBR Tertiary Juan de Fuca –m 13.5 MLD MBR Tertiary Windsor Park- 12 MLD MBR Tertiary Westhills- 8 MLD MBR Tertiary Florence Lake -4 MLD MBR Tertiary Lang Cave – 8 MLD MBR Tertiary Roderick – 21 MLD MBR Tertiary Biosolids Thermophilic Anaerobic Digestion	**$2,254**	$40.2	$2,812	Hi	Hi	Hi	Hi	Med	Multiple sites, most not available, multiple outfalls required. Option eliminated due to multiple EIS requirements and schedule.

9.0 SCHEDULE

9.1 Schedule Assumptions

As a further means of evaluation, a preliminary schedule was developed for each of the shortlisted options that were outlined in Section 8. Project schedule factors into meeting the regulatory timelines and the potential costs associated with inflation and financing costs.

In developing the schedule for each of the options, the following assumptions have been made:

- The business case funding application will be submitted and approved by the CRD Board in September 2016.
- Funding for the project will be confirmed by December 31st, 2016.
- Commencement of the defined program will begin on January 2nd, 2017.
- A typical rezoning process will apply for new sites. Procurement (RFP and tendering) will not commence until the site(s) are secured and zoned appropriately. This is necessary to maintain bidder confidence in the overall program
- A full EIS or a screening level environmental assessment will be required for new sites. CEAA Screening will be required for new options.
- Options which require modification to our existing outfall to increase capacity at the same location will take at least 14 months to permit. New outfalls will require a minimum of 24 months and possibly longer (McLoughlin outfall took 30 months to permit).
- For single plant options it has been assumed the permitted McLoughlin outfall would be used.
- The preparation of the program EIS (new or amended) and the procurement documents will commence in October 2016.
- Biosolids treatment facility will be located at the Hartland Landfill for all options. The construction of the biosolids facilities would proceed concurrently with the liquid train treatment so it is completed and ready to receive solids upon commissioning of the liquid train.

9.2 Options Schedule

Table 9.1 outlines the schedule for each of the short listed options under consideration.

Table 9.1 – Options Schedule Summary

Option No.	Option	Property Acquired & Zoned	Liquid Treatment in Services Date	Biosolids In Service Date	Program Complete
4	Rock Bay Secondary	January 1, 2018	March 6, 2023	March 6, 2023	May 1, 2023
4a	Rock Bay Tertiary (Disc Filters)	January 1, 2018	March 6, 2023	March 6, 2023	May 1, 2023
8	McLoughlin Secondary	January 13, 2017	December 31, 2020	December 31, 2020	February 28, 2021
8a	McLoughlin Secondary (Disc Filters)	January 13, 2017	December 31, 2020	December 31, 2020	February 28, 2021
18	McLoughlin / Rock Bay Secondary	January 15, 2018	March 6, 2023	March 6, 2023	May 1, 2023
18a	McLoughlin / Rock Bay Tertiary Disc	January 15, 2018	March 6, 2023	March 6, 2023	May 1, 2023

Scheduling assessment indicates that there are two options, 8 and 8a, which have the potential to meet the Federal regulatory requirement of December 31, 2020. All other options would require a time extension of 2 – 1/2 years beyond the regulatory compliance date. Program complete data allows 2 months for contract wrap up items from overall program. Detailed schedules are included in **Appendix C**.

10.0 OPINION OF PROBABLE COSTS

10.1 Cost Estimate Basis

For the Capital Regional District wastewater treatment program, various consulting firms have been involved in preparing cost estimates. The cost estimates have ranged from Class D estimates for comparison of options at a conceptual level to Class C estimates where indicative schematic designs have been prepared to assist in preparing overall program budgets. Adjustment of estimates is necessary to account for inflation and commodity price changes and to bring them to present day dollars given that they were prepared at different times over the last 10 years. Another factor to consider is the Canadian dollar has dropped against the US dollar and some of the equipment that will be used in the treatment plants is sourced from US suppliers.

The industry accepted cost estimate classifications and their precision are summarized in **Table 10.2**.

Table 10.1 – Construction Cost Estimate Classifications, Use and Precision

Estimate Classification	Level of Project Definition	Intended Use	Level of Precision
A	100% Design - Pre-Tender	Project Approval Final Budget	-5% to+10%
B	66 % Design Development	Seeking effective project approval	-10% to +15%
C	Schematic or Indicative Design	Seeking project approval and funding	-15%to +20%
D	Concept Design	Screening of Options	-20% to+30%

10.1.1 Screening Level Estimates used for Ranking

The screening level estimates provided in Table 8.2 were compiled from previous cost estimating work and adjusted to 2016 dollars to provide appropriate comparison of options. For the CRD project cost estimates have previously been prepared using various base years ranging from 2008 to 2015. For comparison purposes in the initial screening assessment all costs were adjusted to 2016 dollars by reviewing the Statistics Canada Construction Price Index (CCPI) inflation factors from the base year of estimate preparation to current 2016 dollars. The CCPI was 100 for the year 2007 and increased to 123.2 for 2015. A review of the Engineering News Record (ENR) index was also completed, and it was noted to be similar to the CCPI but slightly higher. The ENR is primarily US based so a decision was made to use the CCPI with data available for the Victoria region. Based on these indices, an inflation factor of 2.5% was used to inflate capital costs to the 2016 base comparison year. Inflation adjustments were also applied to operations and maintenance costs to enable an equal base year comparison for calculation of life cycle costs.

Sensitivity analysis was completed by calculating life cycle costs using discount rates of 4% and 6% at the request of the Project Board to assess if impact on life cycle costs would impact the selection of one option over another option. The analysis indicated that there was no significant reason to select one option over another option due to discount rate differences. Following review by the Project Board a decision was made to proceed with estimates using a 4% discount rate. The 4% discount rate was also to be used in the preparation of Class C estimates.

For cost evaluation, options were compared using the estimate classification that was available from previous work. The Class D estimates carried a higher contingency recognizing that there is more uncertainty because of the level of project definition.

10.1.2 Cost Estimates for Short Listed Options

To enable completion of TBL assessments and to obtain an initial indication of capital costs for each of the six short listed options Class C estimates were prepared for each option. The basis of the estimates follow a similar format as previously completed with respect to direct and indirect costs for the Core Area Wastewater Treatment Program.

The cost estimates comprise the following:

Direct Costs

- Capital construction costs.
- Construction contingency costs at 15% of construction costs.

Indirect Costs

- Engineering at 15% of direct costs.
- Administration and project management at 6% of direct costs.
- Miscellaneous at 2% of direct costs.

Financing Costs

- Interim financing at 4% of direct and indirect costs.
- Inflation to mid-point of construction using information provided by PBC.

Whole Life Cycle Costs

- A discount rate of 4% was used for calculating whole life cycle costs. The term selected was 25 years because this is typically the life cycle of process and electrical equipment in a treatment plant. Structural components are expected to last at least 50 years before any rehabilitation would be required.

Capital costs could vary depending on market conditions at time of tender, the overall procurement strategy, and the risk profile of a particular project. All costs are presented in 2016 dollars.

10.2 Capital Costs and Whole Life Cycle Costs

To arrive at capital costs for the short listed options conceptual level layouts were prepared for facilities and sited on the potential sites under consideration. Class C estimates were prepared for each of the short listed options and included conveyance costs, liquid treatment, and assumed biosolids were located at Hartland. The same biosolids cost was carried for all options based on the previously base case at Hartland. The approach enabled comparison with the previous funded program although the biosolids program and costs could change pending the outcome of the biosolids assessment.

Representative technologies were selected for the purposes of preparing cost estimates at each site although the technologies could change during final procurement. Site drawings for each option are appended to this report.

All estimates assume the budget carried for funding application for biosolids treatment at Hartland. The capital costs (rounded) for each option are summarized in **Table 10.1.**

Table 10.2 – Capital and Life Cycle Costs ($ million)

Option	Liquid Treatment	Biosolids Treatment	Conveyance	Total Capital Costs	Operation & Maintenance Cost	Whole Life Cycle Cost
Option 4 Rock Bay Secondary	$367	$269	$335	$971	$15.4	$1,177
Option 4a Rock Bay Tertiary Disc Filters	$381	$269	$335	$985	$15.5	$1,192
Option 8 McLoughlin Secondary	$318	$269	$273	$860	$14.7	$998
Option 8a McLoughlin Tertiary Disc Filters	$331	$269	$273	$873	$14.9	$1,013
Option 18 McLoughlin - Rock Bay Secondary	$537	$269	$243	$1,049	$18.1	$1,291
Option 18 a McLoughlin – Rock Bay Tertiary Disc Filters	$552	$269	$243	$1,064	$18.3	$1,309

* *Life Cycle Cost based on 25 year period and 4% discount rate. Life cycle costs include liquid and biosolids treatment. Costs are engineer's estimate and do not include development costs of retained risk costs. These costs will be established for the business case control budget. Total costs will vary depending on selected biosolids treatment program. Costs shown assume full cost of previously funded biosolids facility at Hartland.*

The costs for tertiary options assume that disc filters are carried for the purposes of estimating capital costs and operating.

10.3 Discussion on Life Cycle Costs

Most wastewater treatment and other capital infrastructure projects place significant importance on life cycle costs. The cost of operations and maintenance is significant over the life of the project. A review of life cycle costs for the six options under consideration indicates that secondary treatment plants have a lower life cycle cost than tertiary plants. The use of disc filters for tertiary treatment provides a significant advantage in life cycle in comparison to membranes and results in only marginal additional capital and operating costs.

11.0 TRIPLE BOTTOM LINE ASSESSMENT

11.1 Approach

A total of 7 liquid train options which made it through the screening and ranking process described in Section 8.0 of this report were evaluated using a triple bottom line (TBL) assessment. The Project Board requested tertiary additions to each options, options 4, 8 and 18 to bring the total number of options to 10 for TBL consideration. These tertiary are described as option 4a, 8a and 18a. The TBL considers economic, environmental and social criteria to provide balanced decision making. Many organizations including Metro Vancouver and BC Hydro have adopted the TBL framework to evaluate their performance in a broader perspective to create greater business value in consideration of non-monetary social and environmental criteria.

Municipal officials across Canada increasingly recognize that sustainable projects benefit not only the environment, but also the economy and society at large. For this reason, FCM promotes and measures Green Municipal Fund (GMF) project impacts using a triple bottom line approach — one that considers criteria from all three areas. The combined and often complementary effects of project benefits lead to tangible improvements at the community level — cleaner water, better municipal services, and more efficient use of resources such as energy. By understanding the economic, environmental and social implications of the alternatives that consider community values, the best long term sustainable decisions can be made.

- **Economic Criteria** – This category includes the capital and whole life cycle costs for each option. The capital costs used for the TBL were screening level Class D estimates prepared previously and updated to 2016 dollars. The whole life cycle costs have been calculated using a 4% discount rate over a period of 25 years. The 25 year period is typically the life cycle of major mechanical and electrical components which will be programmed for replacement at the end of their life cycle. Other facilities such as concrete tankage have a longer life cycle. A 25 year life cycle term is typical industry practice when assessing options.
- **Environmental Criteria** – This category includes a number of criteria associated with the environmental performance of the specific option. Some factors include carbon footprint, flexibility for integrated resource management and other environmental criteria.
- **Social Criteria** – Social criteria include items which have a direct social impact on the public. This could include items such as operations traffic, noise and odour.

11.1 Evaluation of Qualitative Criteria

A qualitative assessment and scoring of criteria was completed in each of the environmental and social categories. Economic criteria were not scored but the information was provided to be included in the overall TBL assessment.

As an example of how a social criteria was assessed, low construction impacts are considered preferable to moderate or high impacts. For construction impacts the characteristics of a particular option may be ranked (e.g. very good, good, average, fair, poor) based on characteristics such as noise, proximity to residential areas, requirements for transporting materials through residential or urban areas, need for blasting, excavation, etc. In this case little or no impact may be considered 'very good', whereas significant impacts may be considered 'poor', and therefore the low impact option would be ranked higher.

Each option was assessed under a listing of considerations and evidence provided to support the conclusions reached. The evaluation team included the Project Board, senior wastewater technical specialists, CRD staff, operations specialists, construction specialists, financial and business case specialists and legal advisors. This range of discipline of expertise provided valuable input into the TBL assessment.

Rankings were also assigned a numerical result (e.g., from 1 – 5, corresponding to Poor to Very Good), to facilitate presenting the combined results. The description of each of the rankings is provided below.

Very Good (5)	Good (4)	Average (3)	Fair (2)	Poor (1)
Exceeds the requirements of the criterion.	Meets the requirements of the criterion.	Meets the basic requirements of the criterion.	Minimally meets basic requirements.	Option fails to meet basic requirements of the criterion.

The Project Board then applied one of the following weightings to each criterion:

- Very Important (3)
- Important (2)
- Somewhat Important (1)

The weighted evaluation was considered by the Project Board to evaluate each option.

The Project Board then assessed each option by examining the economic information (cost and schedule) and the assessment and ranking of each option along the environmental and social criterion.

11.2 Assessment Results

The results of the weighted triple bottom line assessment are shown in **Table 11.1**. **Table 11.2** provides the unweighted TBL ranking. Of the three options short listed by the Project Board (shown shaded in green), the McLoughlin tertiary option ranked the highest with the Rock Bay and Rock Bay / McLoughlin secondary options showing similar rankings. The two plant Rock Bay / McLoughlin was ranked lower because of conveyance impacts and carbon footprint. The Rock Bay also had lower rankings due to conveyance impact and carbon footprint.

Table 11.1 Triple Line Assessment Framework (Weighted)

		Evaluation	Quantitative										
		Weighted Evaluation	Weighted										
Criteria Gr	No.	Criteria Categories	Measure Description	Criteria Weight	2	4	4a	8	8a	10	13	17	18	18a
			Location of Treatment Plant(s)		Rock Bay Tertiary MBR Plant 108 MLD	Rock Bay Secondary Plant 108 MLD	Rock Bay Tertiary Disc Filters	McLoughlin Secondary Plant 108 MLD	McLoughlin Tertiary Disc Filter Plant 108 MLD	McLoughlin - 60 MLD Clover Point - 48 MLD Tertiary Plants	McLoughlin - 92 MLD (Secondary) East Saanich - 16 MLD (Tertiary)	McLoughlin - 60 MLD, Rock Bay - 48 MLD Tertiary Plants	McLoughlin - 60 MLD, Rock Bay - 48 MLD Secondary Plants	McLoughlin - 60 MLD, Rock Bay - 48 MLD Tertiary Disc Filter Plants
			Location of Biosolids Facility		Hartland	Hartland	Harland	Hartland	Hartland	Hartland	Hartland	Hartland	Hartland	Hartland
Economic	EC-01	Capital Costs	Construction costs including both direct and indirect costs in 2016 dollars		$1,159	$984	$1,004	$822	$842	$1,078	$995	$1,030	$980	$1,000
	EC-02	Whole Life Cycle Costs	Capital, operating and maintenance costs		$1,535	$1,248	$1,268	$1,058	$1,085	$1,434	$1,257	$1,386	$1,288	$1,308
	EC-03	CRD Capital Contribution	CRD Share of Capital Cost after Federal/Pprovincial funding contributions		$657	$482	$502	$320	$340	$576	$493	$528	$478	$498
	EC-04	Schedule of Completion	Options which extend over a longer period and cause schedule impact costs		1-May-2023	6-Mar-2023	6-Mar-2023	31-Dec-2020	31-Dec-2020	31-Dec-2023	31-Dec-2022	31-Mar-2023	6-Mar-2023	6-Mar-2023
				Economic Subtotal:										
Environmental	EN-01	Carbon Footprint	Tons of eCO2 created	3	3	9	9	12	12	6	9	6	9	6
	EN-02	Heat Recovery Potential	Potential utilization of heat recovered	1	4	4	4	3	3	2	3	3	3	3
	EN-03	Water Reuse Potential	Potential to meet future demand	1	4	1	4	1	3	3	2	4	1	3
	EN-04	Environmental Considerations for site	Compatability of site with the natural envirionment	3	6	6	6	9	9	9	9	9	9	9
	EN-05	Flexibility for Integrated Resource Management and Resource Recove	Suitability of the products produced from the liquid stream treatment for IRM	3	12	9	12	12	12	12	9	12	9	12
	EN-06	Wet weather treatment resiliency	Process robustness	2	8	8	8	8	8	8	8	8	8	8
	EN-07	Flexibility for more stringent treatment regulations in future	Ease of future modifications	3	15	9	9	9	12	15	9	15	9	9
	EN-08	Terrestrial vegetation and Inter-tidal impacts	Impact that a given site would have on existing terrestrial and inter-tidal habitat and mitigation	2	6	6	6	8	8	8	6	8	6	6
	EN-09	Environmental Performance	Comparison of options with respect to required performance to meet regulatory requirements	2	10	6	8	6	8	10	6	10	6	8
				Environmental Subtotal: 100 Points Maximum	**68**	**58**	**66**	**68**	**75**	**73**	**61**	**75**	**60**	**64**
Social	SO-01	Operations Traffic	Amount of traffic nuisance caused to neighbouring residentss post construction	1	4	4	4	3	3	3	3	3	3	3
	SO-02	Operations Impact on Local Community	Noise and vibration inconvenience	2	6	6	6	10	10	6	8	8	8	8
	SO-03	Odour Impact on Local Community	Potential odour impact on nearby residential/commercial properties	3	9	9	9	15	15	9	12	12	12	12
	SO-04	Visual Aesthetics	Impact of aethetics on views	3	9	9	9	9	9	9	9	9	9	9
	SO-05	Amenities Potential	Opportunity for amenities	2	8	8	8	8	8	6	6	6	6	6
	SO-06	Construction Impacts (Conveyance)	Disruption to community during construction phase	2	2	2	2	6	6	8	6	2	2	2
	SO-07	Construction Impacts (Plant)	Disruption to community during construction phase	2	6	6	6	8	8	4	6	6	6	6
	SO-08	Impacts to existing public amenities	Impact on the community's ability to enjoy existing public amenities such as park land	2	10	10	10	10	10	4	4	10	10	10
	SO-09	Compatibility with Official Community Plan	Degree of planning activity to amend OCP, zoning and Development Permitting	3	9	9	9	15	15	3	6	9	9	9
	SO-10	Archeological Findings	Risk of a cultural site find during construction	3	12	12	12	9	9	12	12	12	12	12
	SO-11	Impact to local First Nations	Have First Nations communities who aboriginal interests may be affected been consulted?	3	12	12	12	9	9	9	9	12	12	12
	SO-12	Leading Development	Opportunity to be a catalyst for future development or improvements in existing development	1	4	4	4	3	3	3	3	4	4	4
	SO-13	Cultural and Heritage impacts	Impacts to any physical and cultural heritage value	2	10	10	10	6	6	6	6	8	8	8
				Social Subtotal: 145 Points Maximum	**101**	**101**	**101**	**111**	**111**	**82**	**90**	**101**	**101**	**101**
				Environmental + Social Subtotal: 245 Points Maximum	**169**	**159**	**167**	**179**	**186**	**155**	**151**	**176**	**161**	**165**

Table 11.2 Triple Line Assessment Framework (Unweighted)

Criteria	No.	Criteria Categories	Measure Description	Criteria Weight	TBL Option Results									
					2	4	4a	8	8a	10	13	17	18	18a
			Location of Treatment Plant(s)		Rock Bay Tertiary MBR Plant 108 MLD	Rock Bay Secondary Plant 108 MLD	Rock Bay Tertiary Disc Filters	McLoughlin Secondary Plant 108 MLD	McLoughlin Tertiary Disc Fitter Plant 108 MLD	McLoughlin - 60 MLD Clover Point - 48 MLD Tertiary Plants	McLoughlin - 92 MLD (Secondary) East Saanich - 16 MLD (Tertiary)	McLoughlin - 60 MLD, Rock Bay - 48 MLD Tertiary Plants	McLoughlin - 60 MLD, Rock Bay - 48 MLD Secondary Plants	McLoughlin - 60 MLD, Rock Bay - 48 MLD Tertiary Disc Filter Plants
			Location of Biosolids Facility		Hartland	Hartland	Hartland	Hartland	Hartland	Hartland	Hartland	Hartland	Hartland	Hartland
Economic	**EC-01**	Capital Costs	Construction costs including both direct and indirect costs in 2016 dollars		$1,159	$984	$1,004	$822	$842	$1,078	$995	$1,030	$980	$1,000
	EC-02	Whole Life Cycle Costs	Capital, operating and maintenance costs		$1,535	$1,248	$1,268	$1,058	$1,085	$1,434	$1,257	$1,386	$1,288	$1,308
	EC-03	CRD Capital Contribution	CRD Share of Capital Cost after Federal/Pprovincial funding contributions		$657	$482	$502	$320	$340	$576	$493	$528	$478	$498
	EC-04	Schedule of Completion	Options which extend over a longer period and cause schedule impact costs		1-May-2023	6-Mar-2023	6-Mar-2023	31-Dec-2020	31-Dec-2020	31-Dec-2023	31-Dec-2022	31-Mar-2023	6-Mar-2023	6-Mar-2023
Environmental	**EN-01**	Carbon Footprint	Tons of eCO_2 created	Very Important	1	3	3	4	4	2	3	2	3	2
	EN-02	Heat Recovery Potential	Potential utilization of heat recovered	Somewhat Important	4	4	4	3	3	2	3	3	3	3
	EN-03	Water Reuse Potential	Potential to meet future demand	Somewhat Important	4	1	4	1	3	3	2	4	1	3
	EN-04	Environmental Considerations for site	Compatability of site with the natural envirionment	Very Important	2	2	2	3	3	3	3	3	3	3
	EN-05	Flexibility for Integrated Resource Management and Resource Recovery	Suitability of the products produced from the liquid stream treatment for IRM	Very Important	4	3	4	4	4	4	3	4	3	4
	EN-06	Wet weather treatment resiliency	Process robustness	Important	4	4	4	4	4	4	4	4	4	4
	EN-07	Flexibility for more stringent treatment regulations in future	Ease of future modifications	Very Important	5	3	3	3	4	5	3	5	3	3
	EN-08	Terrestrial vegetation and Inter-tidal impacts	Impact that a given site would have on existing terrestrial and inter-tidal habitat and mitigation	Important	3	3	3	4	4	4	3	4	3	3
	EN-09	Environmental Performance	Comparison of options with respect to required performance to meet regulatory requirements	Important	5	3	4	3	4	5	3	5	3	4
			Environmental Subtotal: 45 Points Maximum		**32**	**26**	**31**	**29**	**33**	**32**	**27**	**34**	**26**	**29**
Social	**SO-01**	Operations Traffic	Amount of traffic nuisance caused to neighbouring residentss post construction	Somewhat Important	4	4	4	3	3	3	3	3	3	3
	SO-02	Operations Impact on Local Community	Noise and vibration inconvenience	Important	3	3	3	5	5	3	4	4	4	4
	SO-03	Odour Impact on Local Community	Potential odour impact on nearby residential/commercial properties	Very Important	3	3	3	5	5	3	4	4	4	4
	SO-04	Visual Aesthetics	Impact of aethetics on views	Very Important	3	3	3	3	3	3	3	3	3	3
	SO-05	Amenities Potential	Opportunity for amenities	Important	4	4	4	4	4	3	3	3	3	3
	SO-06	Construction Impacts (Conveyance)	Disruption to community during construction phase	Important	1	1	1	3	3	4	3	1	1	1
	SO-07	Construction Impacts (Plant)	Disruption to community during construction phase	Important	3	3	3	4	4	2	3	3	3	3
	SO-08	Impacts to existing public amenities	Impact on the community's ability to enjoy existing public amenities such as park land	Important	5	5	5	5	5	2	2	5	5	5
	SO-09	Compatibility with Official Community Plan	Degree of planning activity to amend OCP, zoning and Development Permitting	Very Important	3	3	3	5	5	1	2	3	3	3
	SO-10	Archeological Findings	Risk of a cultural site find during construction	Very Important	4	4	4	3	3	4	4	4	4	4
	SO-11	Impact to local First Nations	Have First Nations communities who aboriginal interests may be affected been consulted?	Very Important	4	4	4	3	3	3	3	4	4	4
	SO-12	Leading Development	Opportunity to be a catalyst for future development or improvements in existing development	Somewhat Important	4	4	4	3	3	3	3	4	4	4
	SO-13	Cultural and Heritage impacts	Impacts to any physical and cultural heritage value	Important	5	5	5	3	3	3	3	4	4	4
			Social Subtotal: 65 Points Maximum		**46**	**46**	**46**	**49**	**49**	**37**	**40**	**45**	**45**	**45**
			Environmental + Social Subtotal: 110 Points Maximum		**78**	**72**	**77**	**78**	**82**	**69**	**67**	**79**	**71**	**74**

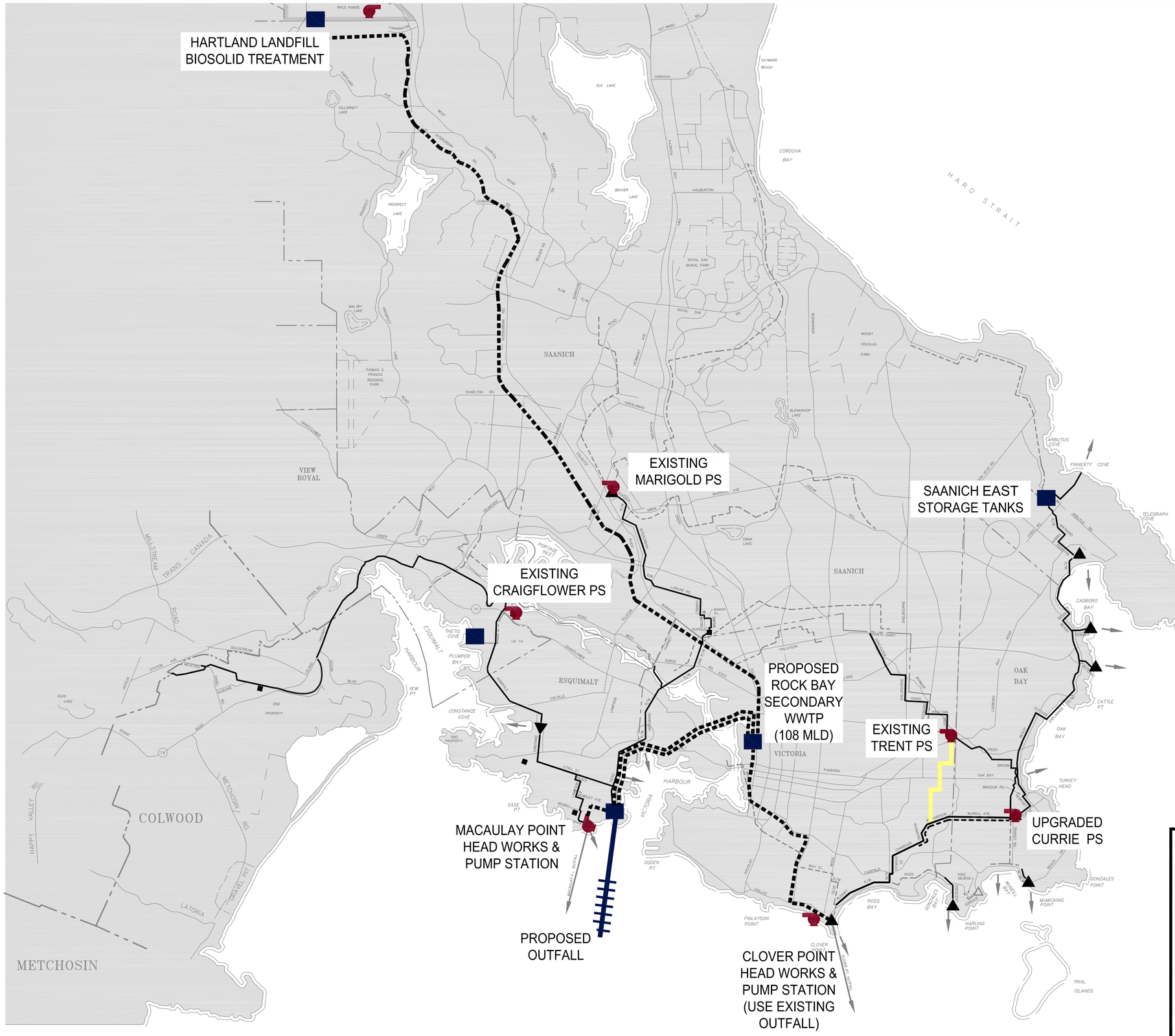
Appendix A

Cost Estimates

(Commercial Confidential – Under Separate Cover)

Appendix B

Drawings



LEGEND

- EXISTING TRUNK SEWER
- EXISTING FORCEMAIN
- PROPOSED FORCEMAIN
- PROPOSED OUTFALL

DISCLAIMER: THESE INDICATIVE DESIGN DRAWINGS ARE PRELIMINARY AND ARE NOT FOR CONSTRUCTION. STANTEC MAKES NO WARRANTY AS TO THEIR ACCURACY

CAD FILE : I:\1137\04\31\Drawings\Business Case\DISC FILTERS OPTIONS\Option 4\OPTION 4 KEY PLAN.dwg
PRINTED BY : CTITONG – SEPTEMBER/06/2016 – 4:10PM
UPDATED BY DGUITERREZ – JULY/28/2016 – 2:01PM

Stantec

SEAL	BY	DATE	No.	REVISION	ENG.	No.	DATE	ISSUE

Making a difference...together

Capital Regional District |	Core Area Wastewater Treatment Program		
DESIGNED	RAF	SURVEYED	–
DRAWN	PRC	DATE	06/07/16
SCALE HORIZONTAL	N.T.S	CHECKED	–
SCALE VERTICAL	–	APPROVED	RAF

CORE AREA WASTEWATER TREATMENT PROGRAM

OPTION 4
ROCK BAY SECONDARY PLANT – 108 MLD

CONTRACT NUMBER	DRAWING NUMBER	ISSUE	SHT. No.
		–	– OF –

PRIMARY CLARIFIERS

BIOLOGICAL AERATED FILTERS

EFFLUENT CHAMBER
EFFLUENT BACKWASH/
PUMP STATION & UV ROOM

BLOWER AND PUMP ROOM

ODOUR CONTROL ROOM

THICKENING FACILITY

ADMIN AND OPERATIONS BUILDING

CHEMICAL BUILDING

GREEN

PARKING

ACCESS ROAD

ELECTRICAL ROOM (ABOVE)

HEAT RECOVERY ROOM

ELECTRICAL & MECH'L BLDG.

HERITAGE BUILDING

ENTRY

PARKING

POWER DISTRIBUTION EQUIPMENT AND STANDBY POWER

ACCESS ROAD

EXIT

HERITAGE BUILDING

PROPERTY LINE

PROPERTY LINE

AREA = 37,903 SQ. M.

N

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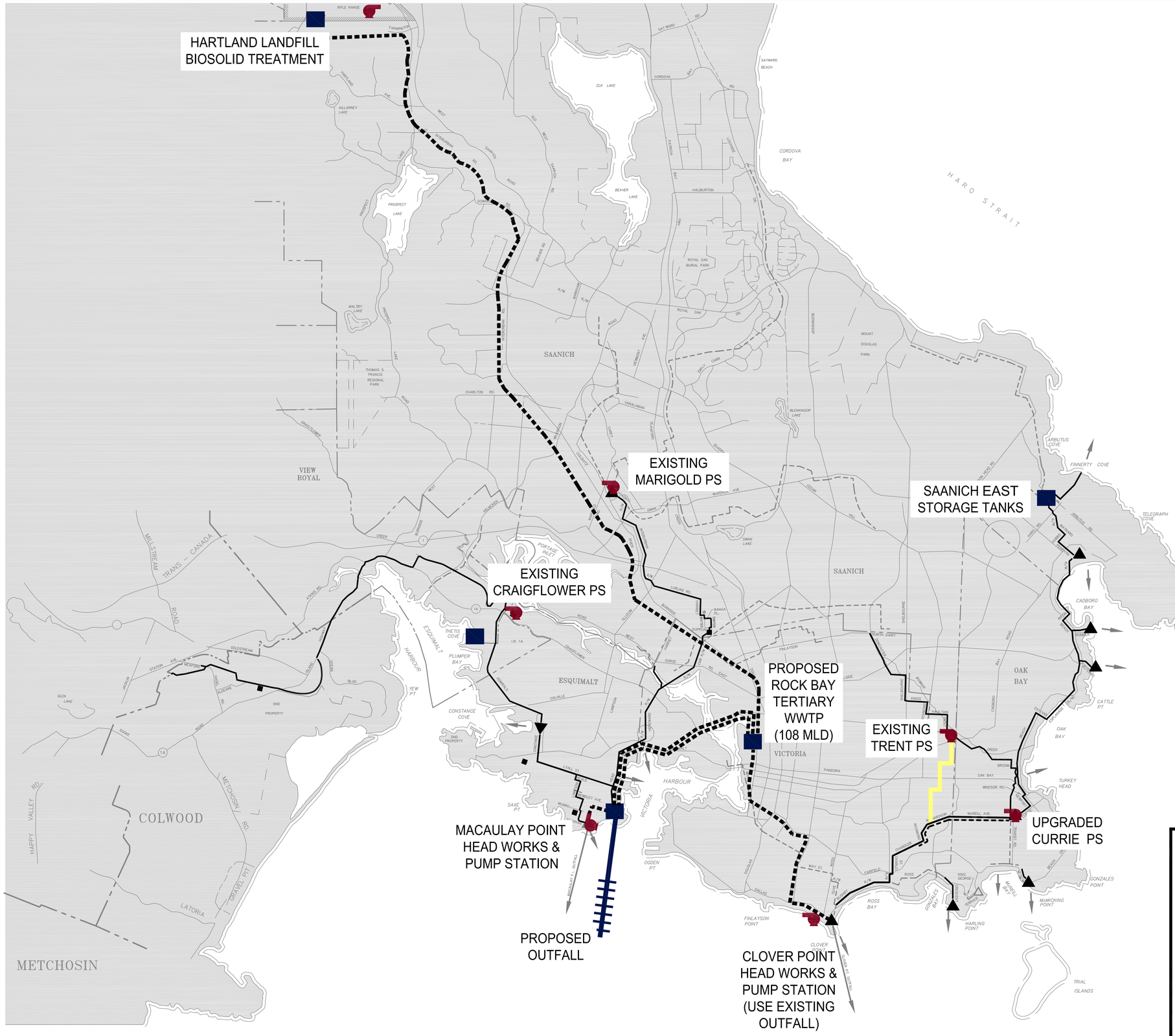
Friday, February 05, 2016 U:\111700431\DRAWINGS\BUSINESS CASE\DISC FILTERS OPTIONS\OPTION 4\RB-OPT4.DWG TITONG, CHRIS

Stantec

SEAL	BY	DATE	No.	REVISION	ENG.	No.	DATE	ISSUE

Making a difference...together

Capital Regional District | Core Area Wastewater Treatment Program		CORE AREA WASTEWATER TREATMENT PROGRAM	
DESIGNED	SURVEYED –	OPTION 4 ROCK BAY SECONDARY PLANT – 108 MLD	
DRAWN PRC	DATE 05/07/16		
SCALE HORIZONTAL 1:500	CHECKED SS		
SCALE VERTICAL –	APPROVED RAF		
CONTRACT NUMBER	DRAWING NUMBER –	ISSUE	SHT. No. OF



LEGEND

- EXISTING TRUNK SEWER
- EXISTING FORCEMAIN
- PROPOSED FORCEMAIN
- PROPOSED OUTFALL

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Making a difference...together

Capital Regional District |	Core Area Wastewater Treatment Program		
DESIGNED	RAF	SURVEYED	–
DRAWN	PRC	DATE	06/07/16
SCALE HORIZONTAL	N.T.S	CHECKED	–
SCALE VERTICAL	–	APPROVED	RAF

CORE AREA WASTEWATER TREATMENT PROGRAM

OPTION 4A
ROCK BAY TERTIARY PLANT (DISC FILTER) – 108 MLD

CONTRACT NUMBER	DRAWING NUMBER	ISSUE	SHT. No.
		–	– OF –

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Friday, February 05, 2016 U:\111700431\DRAWINGS\BUSINESS CASE\DISC FILTERS OPTIONS\OPTION 4A\RB-OPT4A.DWG TITONG, CHRIS

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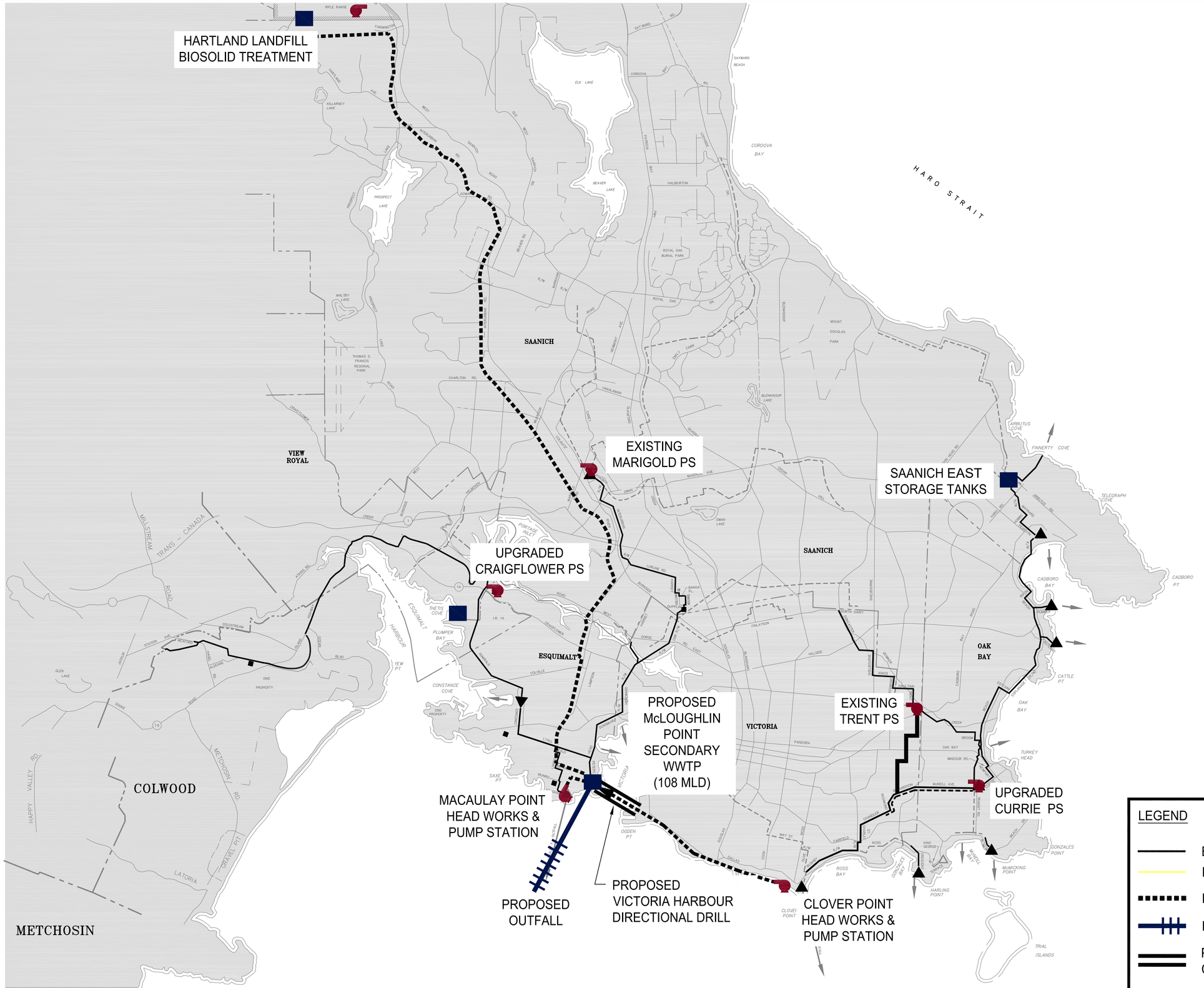
Capital Regional District | Core Area Wastewater Treatment Program			
DESIGNED		SURVEYED	–
DRAWN	PRC	DATE	05/07/16
SCALE HORIZONTAL	1:500	CHECKED	SS
SCALE VERTICAL	–	APPROVED	RAF

CORE AREA WASTEWATER TREATMENT PROGRAM

OPTION 4A
ROCK BAY TERTIARY PLANT (DISC FILTER) – 108 MLD

CONTRACT NUMBER	DRAWING NUMBER	ISSUE	SHT. No. OF
	–		



LEGEND

- EXISTING TRUNK SEWER
- EXISTING FORCEMAIN
- PROPOSED FORCEMAIN
- PROPOSED OUTFALL
- PROPOSED HARBOUR CROSSING

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CAD FILE : \\1117004431\Drawings\Business Case\DISC. FILES OPTIONS\Option 8\[OPTION 8 KEY PLAN.dwg
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DESIGNED	RAF	SURVEYED	–
DRAWN	PRC	DATE	06/07/16
SCALE HORIZONTAL	N.T.S	CHECKED	–
SCALE VERTICAL	–	APPROVED	RAF

CORE AREA WASTEWATER TREATMENT PROGRAM

OPTION 8
McLOUGHLIN SECONDARY PLANT – 108 MLD

CONTRACT NUMBER	DRAWING NUMBER	ISSUE	SHT. No. OF
			– –

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Capital Regional District |	Core Area Wastewater Treatment Program		
DESIGNED	MN/KC	SURVEYED	–
DRAWN	PRC	DATE	16/07/05
SCALE HORIZONTAL	1:250	CHECKED	PP
SCALE VERTICAL	–	APPROVED	RAF

CORE AREA WASTEWATER TREATMENT PROGRAM

OPTION 8
McLOUGHLIN SECONDARY PLANT – 108 MLD

CONTRACT NUMBER	DRAWING NUMBER	ISSUE	SHT, No.
			– OF –

HARTLAND LANDFILL
BIOSOLID TREATMENT

EXISTING
MARIGOLD PS

SAANICH EAST
STORAGE TANKS

UPGRADED
CRAIGFLOWER PS

EXISTING
TRENT PS

PROPOSED
McLOUGHLIN
POINT TERTIARY
WWTP (108 MLD)

UPGRADED
CURRIE PS

MACAULAY POINT
HEAD WORKS &
PUMP STATION

PROPOSED
OUTFALL

PROPOSED
VICTORIA HARBOUR
DIRECTIONAL DRILL

CLOVER POINT
HEAD WORKS &
PUMP STATION

N

0 500 1000 1500 2000 2500

SCALE IN METRES

LEGEND

- EXISTING TRUNK SEWER
- EXISTING FORCEMAIN
- PROPOSED FORCEMAIN
- PROPOSED OUTFALL
- PROPOSED HARBOUR CROSSING

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BY	DATE	No.	REVISION	ENG.

No.	DATE	ISSUE

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Capital Regional District |	Core Area Wastewater Treatment Program		
DESIGNED	RAF	SURVEYED	–
DRAWN	PRC	DATE	06/07/16
SCALE HORIZONTAL	N.T.S	CHECKED	–
SCALE VERTICAL	–	APPROVED	RAF

CORE AREA WASTEWATER TREATMENT PROGRAM

OPTION 8A
McLOUGHLIN TERTIARY PLANT (DISC FILTER) – 108 MLD

CONTRACT NUMBER	DRAWING NUMBER	ISSUE	SHT. No.
		–	– OF –

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BY	DATE	No.	REVISION	ENG.

No.	DATE	ISSUE

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Capital Regional District |	Core Area Wastewater Treatment Program		
DESIGNED	MN/KC	SURVEYED	–
DRAWN	PRC	DATE	16/07/05
SCALE HORIZONTAL	1:250	CHECKED	PP
SCALE VERTICAL	–	APPROVED	RAF

CORE AREA WASTEWATER TREATMENT PROGRAM

OPTION 8A
McLOUGHLIN TERTIARY PLANT (DISC FILTER) – 108 MLD

CONTRACT NUMBER	DRAWING NUMBER	ISSUE	SHT. No.
			– OF –

HARTLAND LANDFILL
BIOSOLID TREATMENT

EXISTING
MARIGOLD PS

SAANICH EAST
STORAGE TANKS

EXISTING
CRAIGFLOWER PS

PROPOSED
ROCK BAY
SECONDARY
WWTP (48 MLD)

EXISTING
TRENT PS

PROPOSED
McLOGHLIN
POINT
SECONDARY
WWTP (60 MLD)

UPGRADED
CURRIE PS

MACAULAY POINT
HEAD WORKS &
PUMP STATION

PROPOSED
OUTFALL

CLOVER POINT
HEAD WORKS &
PUMP STATION
(USE EXISTING
OUTFALL)

SAANICH

VICTORIA

ESQUIMALT

VIEW
ROYAL

COLWOOD

METCHOSIN

OAK
BAY

HARO STRAIT

CORDOVA
BAY

N

0 500 1000 1500 2000 2500

SCALE IN METRES

LEGEND

- EXISTING TRUNK SEWER
- EXISTING FORCEMAIN
- PROPOSED FORCEMAIN
- PROPOSED OUTFALL

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CAD FILE : I:\1117304\3\Drawings\Business Case\DISC_FILTERS OPTIONS\Option 18\OPTION 18 KEY PLAN.dwg
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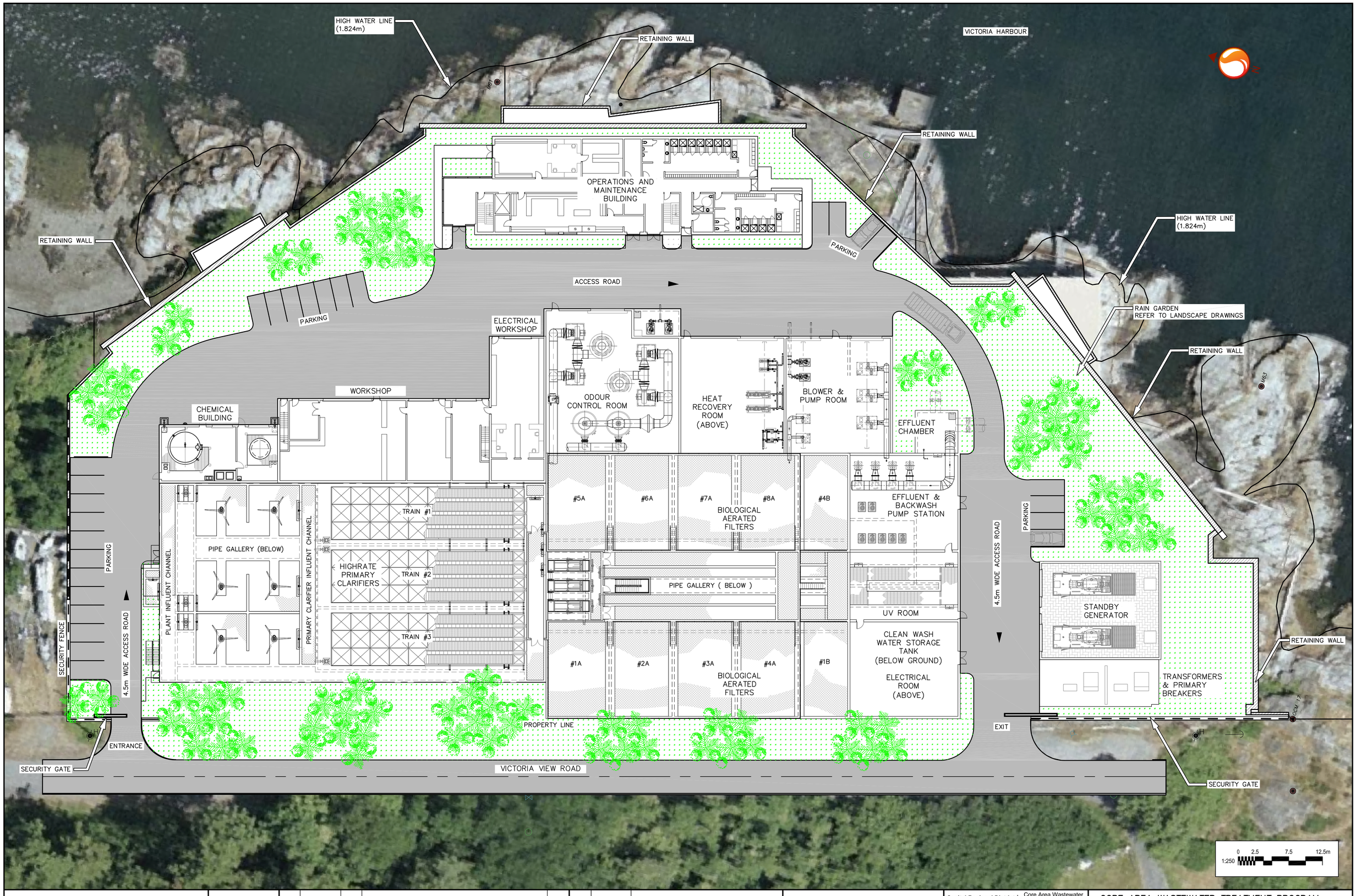
Capital Regional District |	Core Area Wastewater Treatment Program		
DESIGNED	RAF	SURVEYED	–
DRAWN	PRC	DATE	06/07/16
SCALE HORIZONTAL	N.T.S	CHECKED	–
SCALE VERTICAL	–	APPROVED	RAF

CORE AREA WASTEWATER TREATMENT PROGRAM

OPTION 18
McLOUGHLIN SECONDARY PLANT – 60 MLD
ROCK BAY SECONDARY PLANT – 48 MLD

CONTRACT NUMBER	DRAWING NUMBER	ISSUE	SHT. No.
		–	– OF –



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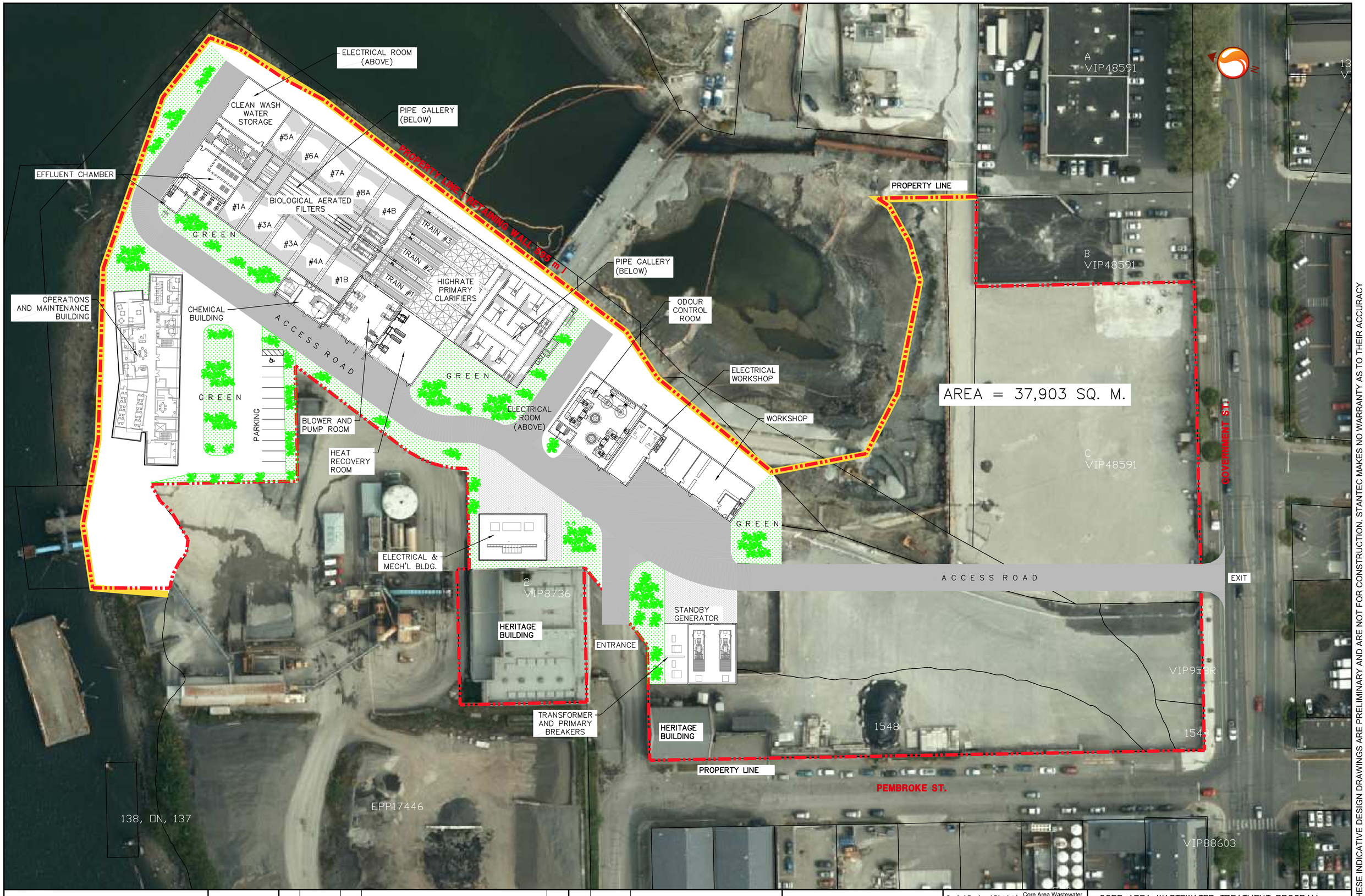
Capital Regional District | Core Area Wastewater Treatment Program		CORE AREA WASTEWATER TREATMENT PROGRAM			
DESIGNED MY	SURVEYED –	OPTION 18 McLOUGHLIN SECONDARY PLANT – 60 MLD			
DRAWN PRC	DATE 16/07/04				
SCALE HORIZONTAL 1:250	CHECKED RAF				
SCALE VERTICAL –	APPROVED RAF	CONTRACT NUMBER	DRAWING NUMBER	ISSUE	SHT. No. – OF –



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SEAL	BY	DATE	No.	REVISION	ENG.

No.	DATE	ISSUE

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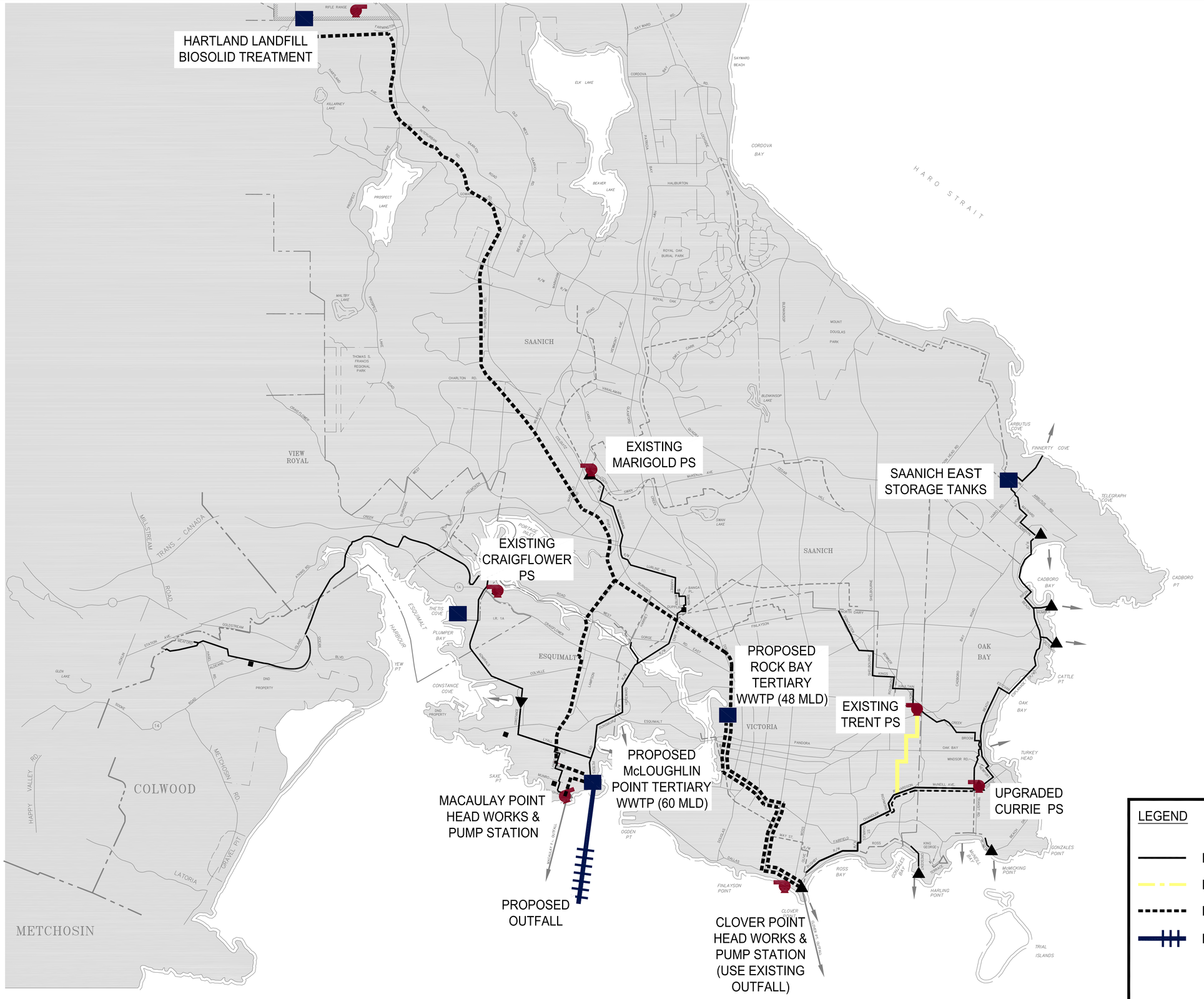
Capital Regional District |	Core Area Wastewater Treatment Program	CORE AREA WASTEWATER TREATMENT PROGRAM			
DESIGNED RAF	SURVEYED –	OPTION 18 ROCK BAY SECONDARY PLANT – 48 MLD			
DRAWN PRC	DATE 04/07/16				
SCALE HORIZONTAL 1: 500	CHECKED –				
SCALE VERTICAL –	APPROVED RAF	CONTRACT NUMBER	DRAWING NUMBER –	ISSUE	SHT. No. – OF –



LEGEND

- EXISTING TRUNK SEWER
- EXISTING FORCEMAIN
- PROPOSED FORCEMAIN
- PROPOSED OUTFALL

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Capital Regional District |	Core Area Wastewater Treatment Program		
DESIGNED	RAF	SURVEYED	–
DRAWN	PRC	DATE	06/07/16
SCALE HORIZONTAL	N.T.S	CHECKED	–
SCALE VERTICAL	–	APPROVED	RAF

CORE AREA WASTEWATER TREATMENT PROGRAM

OPTION 18A
McLOUGHLIN TERTIARY PLANT (DISC FILTER) – 60 MLD
ROCK BAY TERTIARY PLANT (DISC FILTER) – 48 MLD

CONTRACT NUMBER	DRAWING NUMBER	ISSUE	SHT. No.
		–	– OF –

HIGH WATER LINE (1.824m)
RETAINING WALL
VICTORIA HARBOUR
RETAINING WALL
HIGH WATER LINE (1.824m)
RETAINING WALL
OPERATIONS AND MAINTENANCE BUILDING
PARKING
ACCESS ROAD
PARKING
RAIN GARDEN REFER TO LANDSCAPE DRAWINGS
RETAINING WALL
ELECTRICAL WORKSHOP
WORKSHOP
CHEMICAL BUILDING
ODOUR CONTROL ROOM
HEAT RECOVERY ROOM (ABOVE)
BLOWER & PUMP ROOM
EFFLUENT CHAMBER
#5A
#6A
#7A
#8A
#4B
BIOLOGICAL AERATED FILTERS
EFFLUENT & BACKWASH PUMP STATION
PARKING
PIPE GALLERY (BELOW)
TRAIN #1
HIGHRATE PRIMARY CLARIFIERS
TRAIN #2
TRAIN #3
PRIMARY CLARIFIER INFLUENT CHANNEL
PLANT INFLUENT CHANNEL
PIPE GALLERY (BELOW)
UV ROOM
4.5m WIDE ACCESS ROAD
STANDBY GENERATOR
SECURITY FENCE
PARKING
4.5m WIDE ACCESS ROAD
#1A
#2A
#3A
#4A
#1B
BIOLOGICAL AERATED FILTERS
DISC FILTER TERTIARY TREATMENT
TRANSFORMERS & PRIMARY BREAKERS
RETAINING WALL
PROPERTY LINE
EXIT
ENTRANCE
SECURITY GATE
VICTORIA VIEW ROAD
SECURITY GATE
0 2.5 7.5 12.5m
1:250

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CAD FILE : \\1117004431\Drawings\Business Case\DISC FILTERS OPTIONS\Option 18A\ML-OPT18A.dwg
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SEAL	BY	DATE	No.	REVISION	ENG.	No.	DATE	ISSUE

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Capital Regional District | Core Area Wastewater Treatment Program		CORE AREA WASTEWATER TREATMENT PROGRAM			
DESIGNED MY	SURVEYED –	OPTION 18A McLOUGHLIN TERTIARY PLANT (DISC FILTER) – 60 MLD			
DRAWN PRC	DATE 16/07/04				
SCALE HORIZONTAL 1:250	CHECKED RAF				
SCALE VERTICAL –	APPROVED RAF	CONTRACT NUMBER	DRAWING NUMBER	ISSUE	SHT. No. – OF –

Stantec

SEAL

BY	DATE	No.	REVISION	ENG.	No.	DATE	ISSUE

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Capital Regional District | Core Area Wastewater Treatment Program

DESIGNED	RAF	SURVEYED	–
DRAWN	PRC	DATE	04/07/16
SCALE HORIZONTAL	1:500	CHECKED	–
SCALE VERTICAL	–	APPROVED	RAF

CORE AREA WASTEWATER TREATMENT PROGRAM

OPTION 18A
ROCK BAY TERTIARY PLANT (DISC FILTER) – 48 MLD

CONTRACT NUMBER | DRAWING NUMBER – | ISSUE – | SHT. No. OF –

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Appendix C

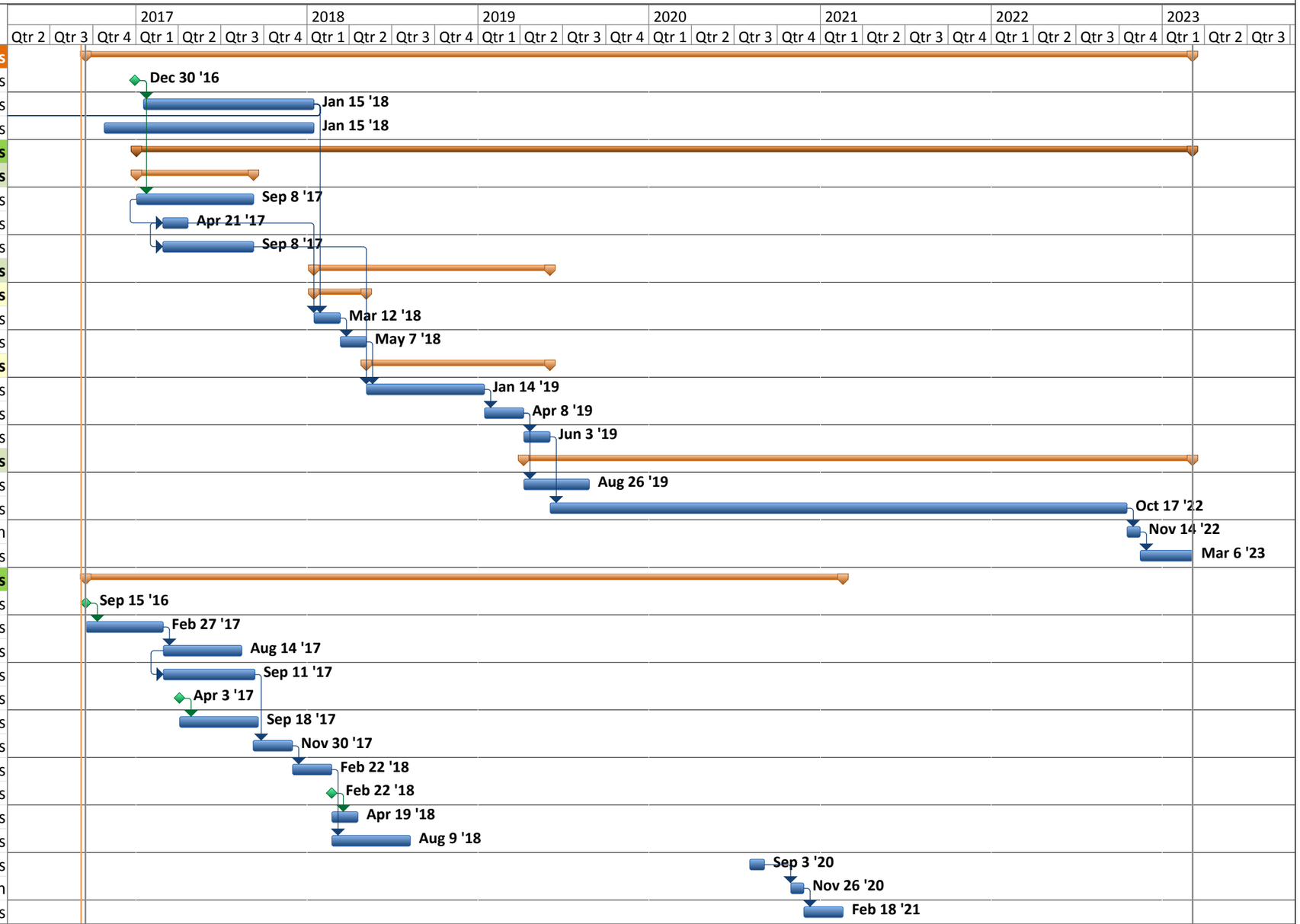
Schedule

CAPITAL REGIONAL DISTRICT - CORE AREA WASTEWATER TREATMENT PROGRAM

OPTION 4 - Rock Bay Secondary. Biosolids at Hartland

Stantec

ID	Task Name	Duration
1	**Core Area Wastewater Treatment Program - Option 5B'**	**84.35 mons**
2	**Funding in Place**	0 mons
3	**Secure Property/Zoning /Lease**	13 mons
4	**Environmental Impact Study (EIS)**	16 mons
5	**Rock Bay Liquid Plant**	**80.55 mons**
6	**Planning**	**9 mons**
7	Scope/Indicative Design/PA	9 mons
8	Prepare RFQ	2 mons
9	Prepare RFP	7 mons
10	**Procurement**	**18 mons**
11	**RFQ**	**4 mons**
12	RFQ Submission	2 mons
13	RFQ Evaluation/Shorlist	2 mons
14	**RFP**	**14 mons**
15	RFP Submission	9 mons
16	RFP Evaluation and Preferred Proponent	3 mons
17	Financial Close	2 mons
18	**Construction**	**51 mons**
19	Early Work/Design	5 mons
20	Construction & Commissioning	44 mons
21	Wet Testing	1 mon
22	Acceptance Testing	4 mons
23	**Biosolids Hartland**	**57.75 mons**
24	Approval of Business Case	0 mons
25	Procurement Planning	5.85 mons
26	Release RFQ to Market	6 mons
27	Approval of Shortlist	7 mons
28	Release RFP to Market	0 mons
29	Proposal Preparation	6 mons
30	Technical RFP Submission Due	3 mons
31	Financial Submission Due	3 mons
32	Preferred Proponent Announced	0 mons
33	Commercial / Financial Close	2 mons
34	Design / Construction of Facility	6 mons
35	Wet Testing	1.2 mons
36	Functional Testing	1 mon
37	Acceptance Testing	3 mons



Date: Tue 9/6/16

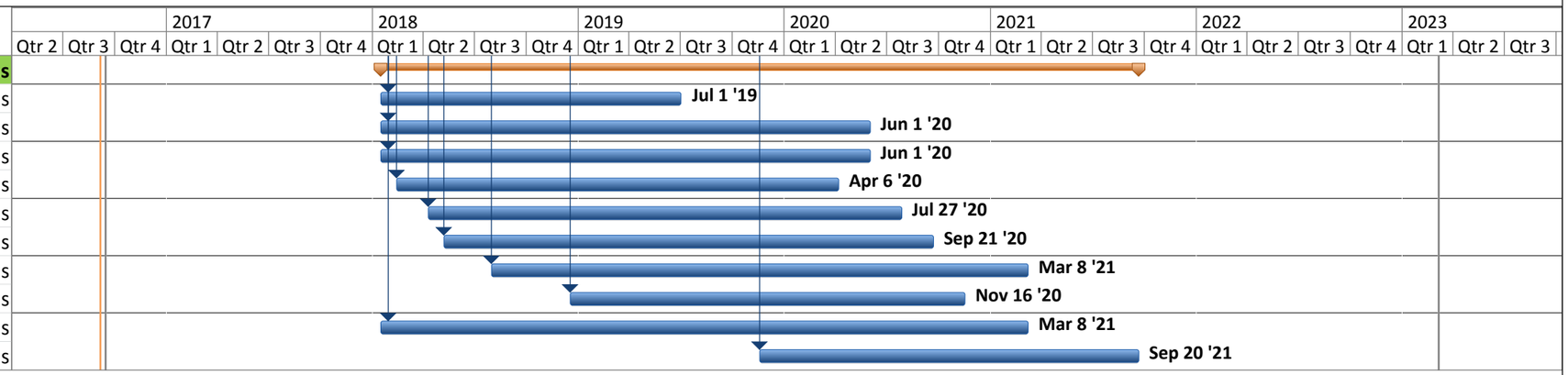
Task	Project Summary	Inactive Milestone	Manual Summary Rollup	Deadline	
Split	External Tasks	Inactive Summary	Manual Summary	Progress	
Milestone	External Milestone	Manual Task	Start-only		
Summary	Inactive Task	Duration-only	Finish-only		

CAPITAL REGIONAL DISTRICT - CORE AREA WASTEWATER TREATMENT PROGRAM

OPTION 4 - Rock Bay Secondary. Biosolids at Hartland

Stantec

ID	Task Name	Duration
38	**Conveyance (Scope TBD)**	**48 mons**
39	Arbutus Road Attenuation Tank (DBB)	19 mons
40	Clover Forcemain to Rock Bay	31 mons
41	Rock Bay to Clover Forcemain	31 mons
42	Clover Pump Station	28 mons
43	ECI/Trent Twining (DBB)	30 mons
44	Macaulay Forcemain to Rock Bay	31 mons
45	Currie Forcemain	34 mons
46	Currie Pump Station	25 mons
47	Macaulay Pump Station	41 mons
48	Clover Outfall Twin	24 mons



Date: Tue 9/6/16

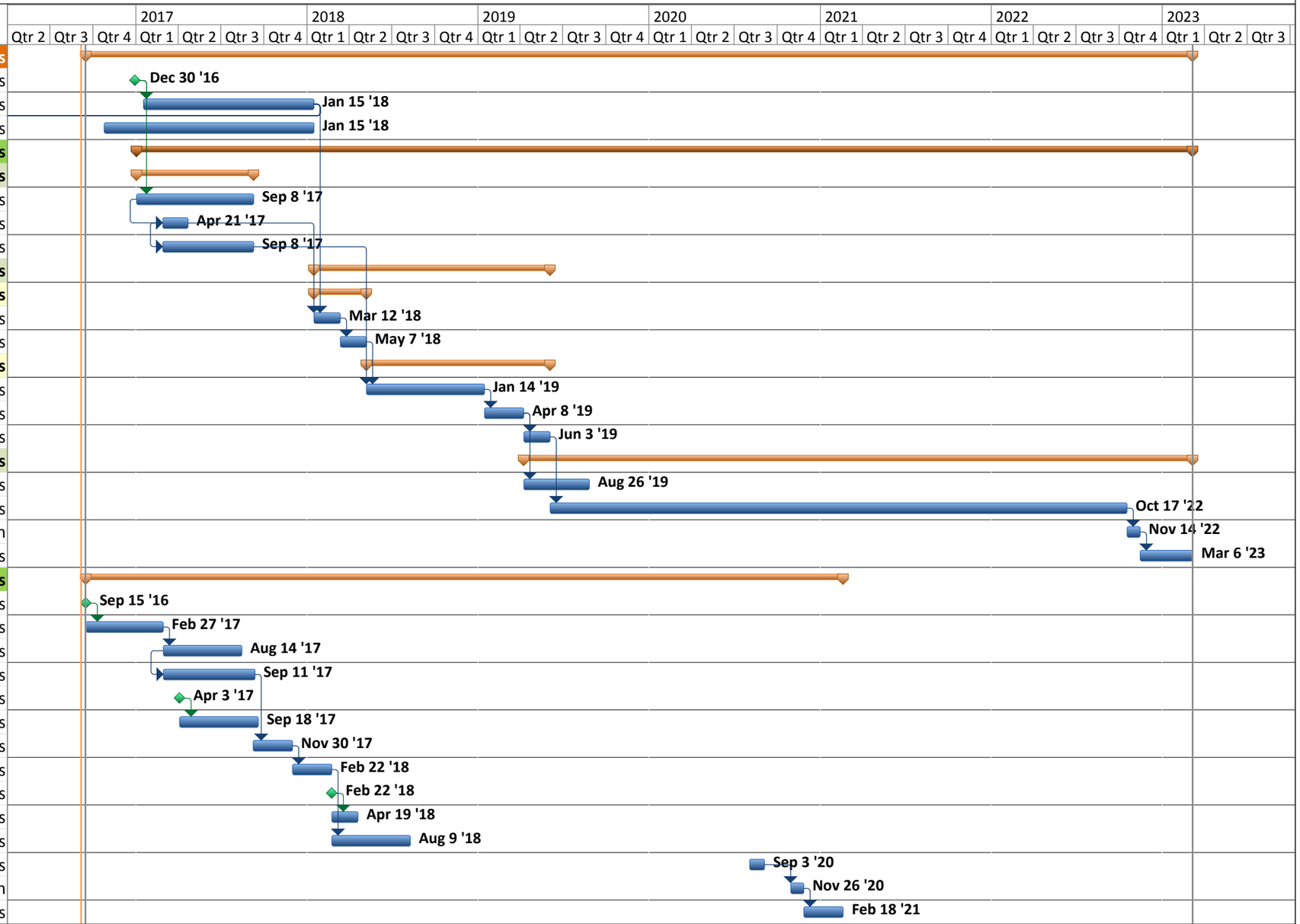
Task		Project Summary		Inactive Milestone		Manual Summary Rollup		Deadline	
Split		External Tasks		Inactive Summary		Manual Summary		Progress	
Milestone		External Milestone		Manual Task		Start-only			
Summary		Inactive Task		Duration-only		Finish-only			

CAPITAL REGIONAL DISTRICT - CORE AREA WASTEWATER TREATMENT PROGRAM

OPTION 4a - Rock Bay Tertiary. Biosolids at Hartland

Stantec

ID	Task Name	Duration
1	**Core Area Wastewater Treatment Program - Option 5B'**	**84.35 mons**
2	**Funding in Place**	0 mons
3	**Secure Property/Zoning /Lease**	13 mons
4	**Environmental Impact Study (EIS)**	16 mons
5	**Rock Bay Liquid Plant**	**80.55 mons**
6	**Planning**	**9 mons**
7	Scope/Indicative Design/PA	9 mons
8	Prepare RFQ	2 mons
9	Prepare RFP	7 mons
10	**Procurement**	**18 mons**
11	**RFQ**	**4 mons**
12	RFQ Submission	2 mons
13	RFQ Evaluation/Shorlist	2 mons
14	**RFP**	**14 mons**
15	RFP Submission	9 mons
16	RFP Evaluation and Preferred Proponent	3 mons
17	Financial Close	2 mons
18	**Construction**	**51 mons**
19	Early Work/Design	5 mons
20	Construction & Commissioning	44 mons
21	Wet Testing	1 mon
22	Acceptance Testing	4 mons
23	**Biosolids Hartland**	**57.75 mons**
24	Approval of Business Case	0 mons
25	Procurement Planning	5.85 mons
26	Release RFQ to Market	6 mons
27	Approval of Shortlist	7 mons
28	Release RFP to Market	0 mons
29	Proposal Preparation	6 mons
30	Technical RFP Submission Due	3 mons
31	Financial Submission Due	3 mons
32	Preferred Proponent Announced	0 mons
33	Commercial / Financial Close	2 mons
34	Design / Construction of Facility	6 mons
35	Wet Testing	1.2 mons
36	Functional Testing	1 mon
37	Acceptance Testing	3 mons



Date: Tue 9/6/16

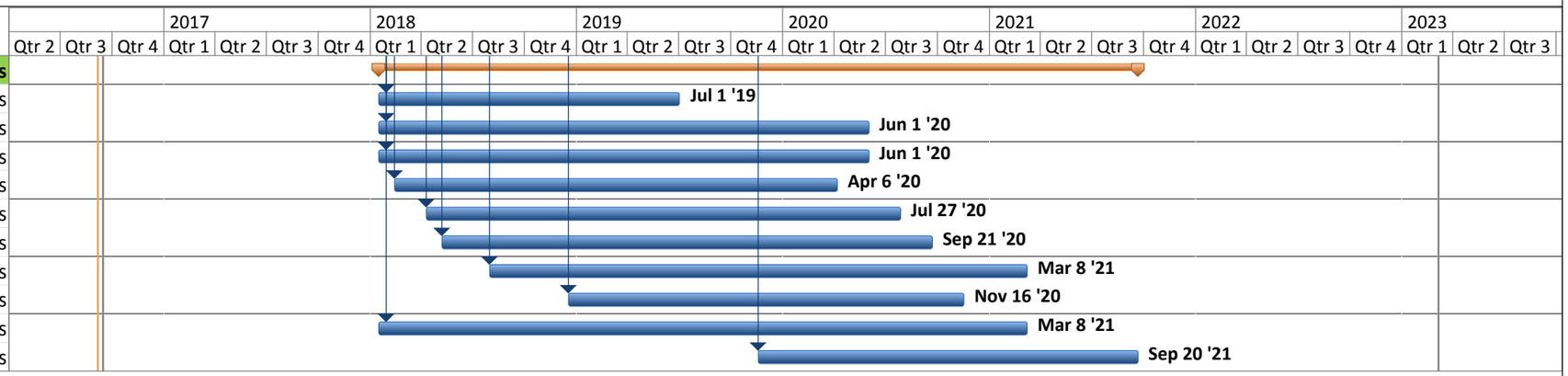
Task	Project Summary	Inactive Milestone	Manual Summary Rollup	Deadline			
Split	External Tasks	Inactive Summary	Manual Summary	Progress			
Milestone	External Milestone	Manual Task	Start-only				
Summary	Inactive Task	Duration-only	Finish-only				

CAPITAL REGIONAL DISTRICT - CORE AREA WASTEWATER TREATMENT PROGRAM

OPTION 4a - Rock Bay Tertiary. Biosolids at Hartland

Stantec

ID	Task Name	Duration
38	**Conveyance (Scope TBD)**	**48 mons**
39	Arbutus Road Attenuation Tank (DBB)	19 mons
40	Clover Forcemain to Rock Bay	31 mons
41	Rock Bay to Clover Forcemain	31 mons
42	Clover Pump Station	28 mons
43	ECI/Trent Twining (DBB)	30 mons
44	Macaulay Forcemain to Rock Bay	31 mons
45	Currie Forcemain	34 mons
46	Currie Pump Station	25 mons
47	Macaulay Pump Station	41 mons
48	Clover Outfall Twin	24 mons



Date: Tue 9/6/16

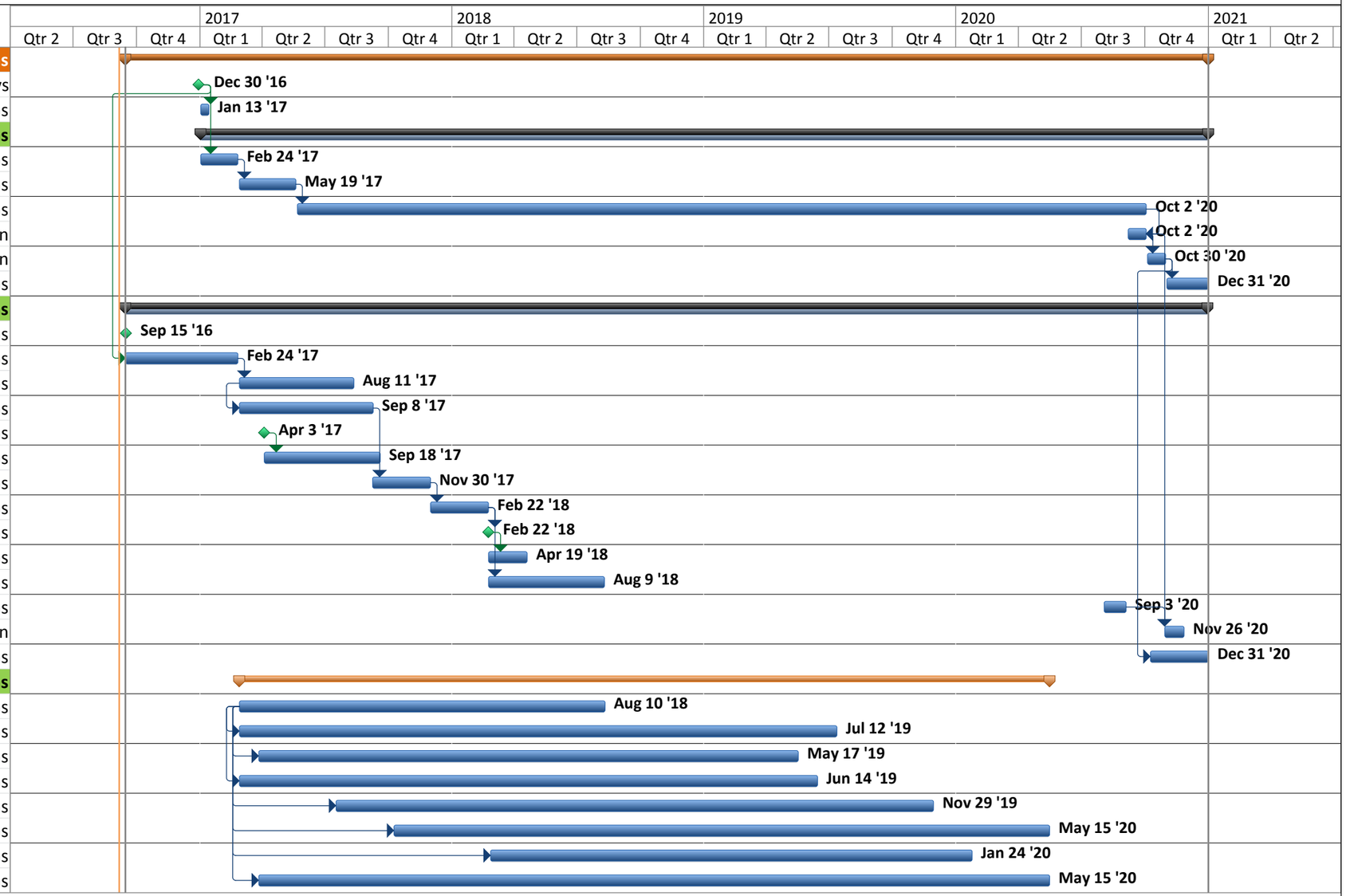
Task		Project Summary		Inactive Milestone		Manual Summary Rollup		Deadline	
Split		External Tasks		Inactive Summary		Manual Summary		Progress	
Milestone		External Milestone		Manual Task		Start-only			
Summary		Inactive Task		Duration-only		Finish-only			

CAPITAL REGIONAL DISTRICT - CORE AREA WASTEWATER TREATMENT PROGRAM

OPTION 8 - McLoughlin Point Secondary, Biosolids Treatment at Hartland

Stantec

ID	Task Name	Duration
1	**Core Area Wastewater Treatment Program - Option 8**	**56.05 mons**
2	**Funding in Place**	0 days
3	**McLoughlin Point Zoning/Property Finalized**	0.5 mons
4	**Liquid Plant McLoughlin Point**	**52.2 mons**
5	Negotiation financial submission	2 mons
6	Preparation for Financial Close (include Board approval)	3 mons
7	Construction & Commissioning	44 mons
8	Wet Testing	1 mon
9	Functional Testing	1 mon
10	Acceptance Testing Liquid Treatment	2.2 mons
11	**Biosolids Facility Hartland**	**56 mons**
12	Approval of Business Case	0 mons
13	Procurement Planning	5.85 mons
14	Release RFQ to Market	6 mons
15	Approval of Shortlist	7 mons
16	Release RFP to Market	0 mons
17	Proposal Preparation	6 mons
18	Technical RFP Submission Due	3 mons
19	Financial Submission Due	3 mons
20	Preferred Proponent Announced	0 mons
21	Commercial / Financial Close	2 mons
22	Design / Construction of Facility	6 mons
23	Wet Testing	1.2 mons
24	Functional Testing	1 mon
25	Acceptance Testing	3 mons
26	**Conveyance**	**42 mons**
27	Arbutus Road Attenuation Tank (DBB)	19 mons
28	Clover Forcemain	31 mons
29	Clover Pump Station	28 mons
30	ECI/Trent Twining (DBB)	30 mons
31	Macaulay Forcemain	31 mons
32	Currie Forcemain	34 mons
33	Currie Pump Station	25 mons
34	Macaulay Pump Station	41 mons



Date: Tue 9/6/16

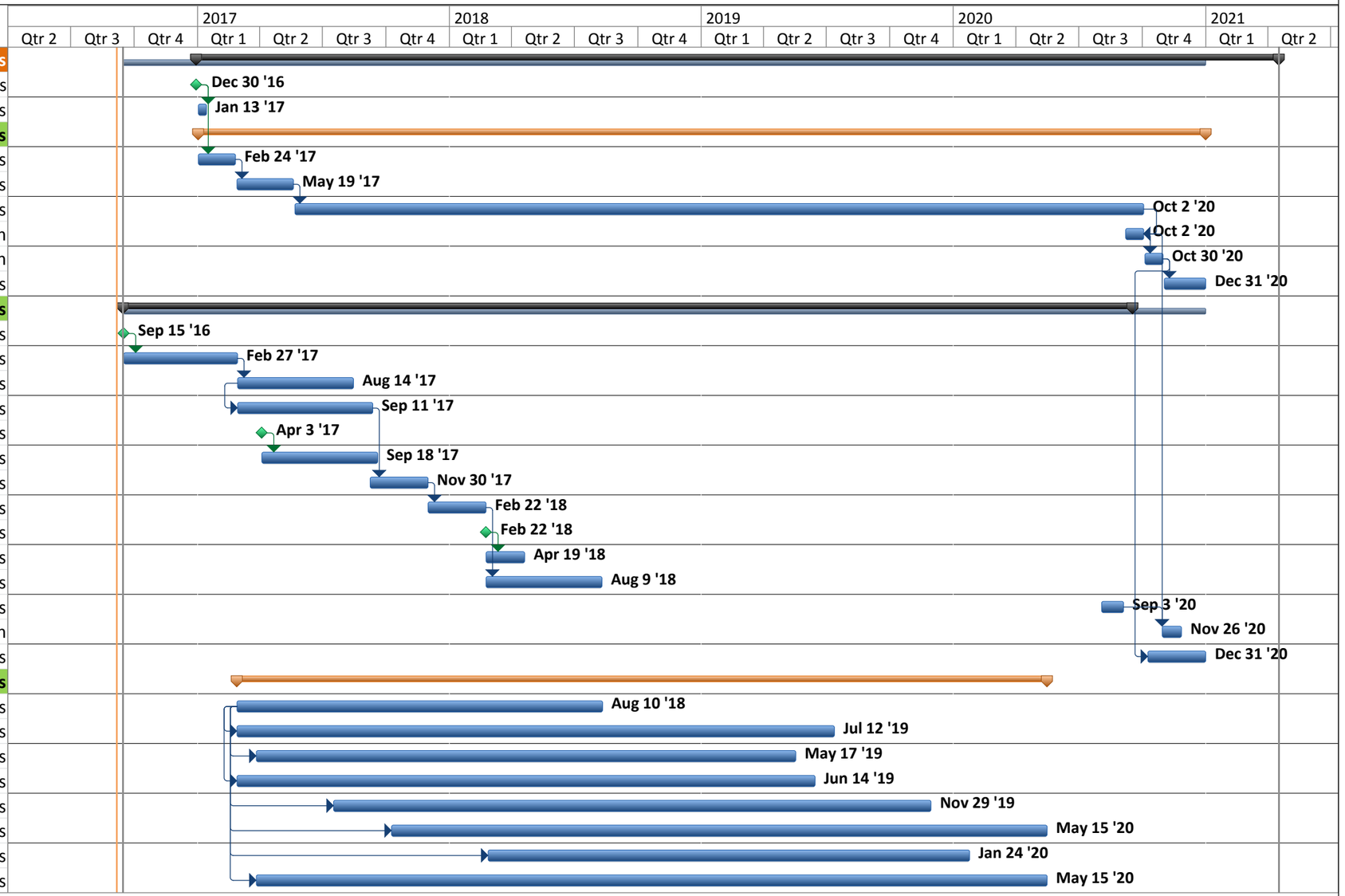
Task	Project Summary	Inactive Milestone	Manual Summary Rollup	Deadline
Split	External Tasks	Inactive Summary	Manual Summary	Progress
Milestone	External Milestone	Manual Task	Start-only	
Summary	Inactive Task	Duration-only	Finish-only	

CAPITAL REGIONAL DISTRICT - CORE AREA WASTEWATER TREATMENT PROGRAM

OPTION 8a - McLoughlin Point Tertiary, Biosolids Treatment at Hartland

Stantec

ID	Task Name	Duration
1	**Core Area Wastewater Treatment Program - Option 8**	**56.05 mons**
2	**Funding in Place**	0 days
3	**McLoughlin Point Zoning/Property Finalized**	0.5 mons
4	**Liquid Plant McLoughlin Point**	**52.2 mons**
5	Negotiation financial submission	2 mons
6	Preparation for Financial Close (include Board approval)	3 mons
7	Construction & Commissioning	44 mons
8	Wet Testing	1 mon
9	Functional Testing	1 mon
10	Acceptance Testing Liquid Treatment	2.2 mons
11	**Biosolids Facility Hartland**	**52.25 mons**
12	Approval of Business Case	0 mons
13	Procurement Planning	5.85 mons
14	Release RFQ to Market	6 mons
15	Approval of Shortlist	7 mons
16	Release RFP to Market	0 mons
17	Proposal Preparation	6 mons
18	Technical RFP Submission Due	3 mons
19	Financial Submission Due	3 mons
20	Preferred Proponent Announced	0 mons
21	Commercial / Financial Close	2 mons
22	Design / Construction of Facility	6 mons
23	Wet Testing	1.2 mons
24	Functional Testing	1 mon
25	Acceptance Testing	3 mons
26	**Conveyance**	**42 mons**
27	Arbutus Road Attenuation Tank (DBB)	19 mons
28	Clover Forcemain	31 mons
29	Clover Pump Station	28 mons
30	ECI/Trent Twining (DBB)	30 mons
31	Macaulay Forcemain	31 mons
32	Currie Forcemain	34 mons
33	Currie Pump Station	25 mons
34	Macaulay Pump Station	41 mons



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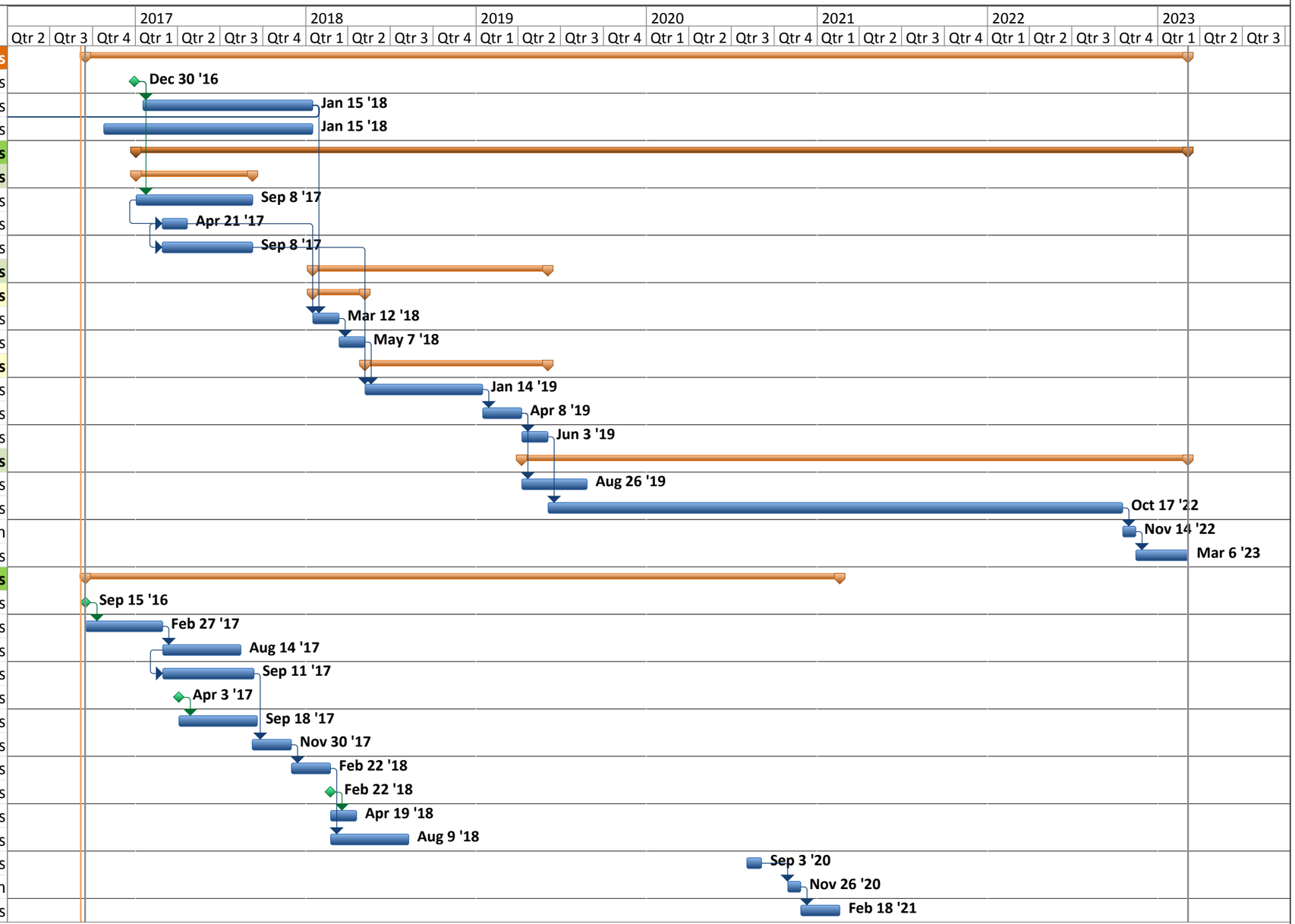
Split	External Tasks	Inactive Summary	Manual Summary	Progress
Milestone	External Milestone	Manual Task	Start-only	
Summary	Inactive Task	Duration-only	Finish-only	

CAPITAL REGIONAL DISTRICT - CORE AREA WASTEWATER TREATMENT PROGRAM

OPTION 18 - Rock Bay / McLoughlin Secondary. Biosolids at Hartland

Stantec

ID	Task Name	Duration
1	**Core Area Wastewater Treatment Program - Option 2B & 3B**	**84.35 mons**
2	**Funding in Place**	0 mons
3	**Secure Property/Zoning /Lease**	13 mons
4	**Environmental Impact Study (EIS)**	16 mons
5	**Liquid Plants**	**80.55 mons**
6	**Planning**	**9 mons**
7	Scope/Indicative Design/PA	9 mons
8	Prepare RFQ	2 mons
9	Prepare RFP	7 mons
10	**Procurement**	**18 mons**
11	**RFQ**	**4 mons**
12	RFQ Submission	2 mons
13	RFQ Evaluation/Shorlist	2 mons
14	**RFP**	**14 mons**
15	RFP Submission	9 mons
16	RFP Evaluation and Preferred Proponent	3 mons
17	Financial Close	2 mons
18	**Construction**	**51 mons**
19	Early Work/Design	5 mons
20	Construction & Commissioning	44 mons
21	Wet Testing	1 mon
22	Acceptance Testing	4 mons
23	**Biosolids Hartland**	**57.75 mons**
24	Approval of Business Case	0 mons
25	Procurement Planning	5.85 mons
26	Release RFQ to Market	6 mons
27	Approval of Shortlist	7 mons
28	Release RFP to Market	0 mons
29	Proposal Preparation	6 mons
30	Technical RFP Submission Due	3 mons
31	Financial Submission Due	3 mons
32	Preferred Proponent Announced	0 mons
33	Commercial / Financial Close	2 mons
34	Design / Construction of Facility	6 mons
35	Wet Testing	1.2 mons
36	Functional Testing	1 mon
37	Acceptance Testing	3 mons



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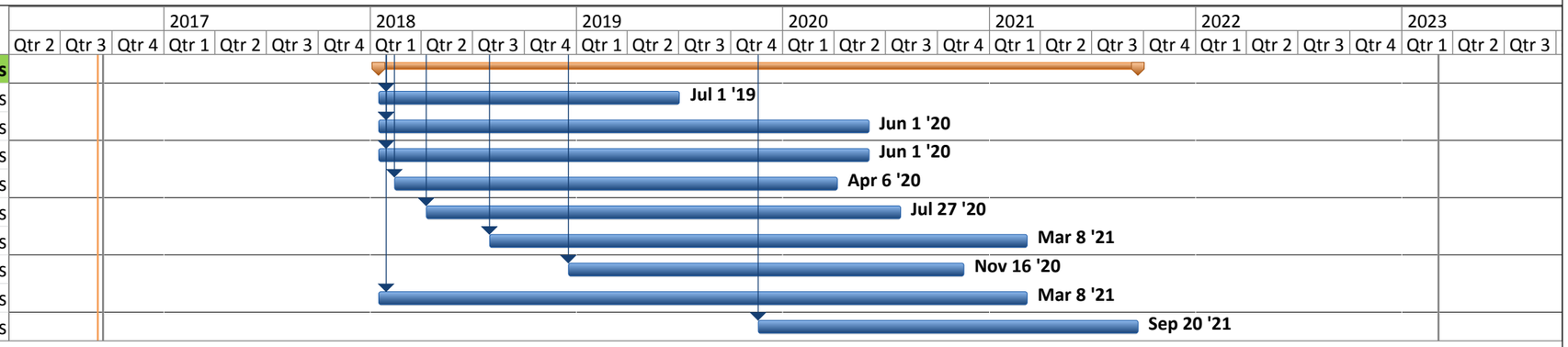
CAPITAL REGIONAL DISTRICT - CORE AREA WASTEWATER TREATMENT PROGRAM

OPTION 18 - Rock Bay / McLoughlin Secondary. Biosolids at Hartland

Stantec

ID	Task Name	Duration
38	**Conveyance (Scope TBD)**	**48 mons**
39	Arbutus Road Attenuation Tank (DBB)	19 mons
40	Clover Forcemain to Rock Bay	31 mons
41	Rock Bay to Clover Forcemain	31 mons
42	Clover Pump Station	28 mons
43	ECI/Trent Twining (DBB)	30 mons
44	Currie Forcemain	34 mons
45	Currie Pump Station	25 mons
46	Macaulay Pump Station	41 mons
47	Clover Outfall Twin (TBD)	24 mons



Date: Tue 9/6/16

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Split		External Tasks		Inactive Summary		Manual Summary		Progress	
Milestone		External Milestone		Manual Task		Start-only			
Summary		Inactive Task		Duration-only		Finish-only			

CAPITAL REGIONAL DISTRICT - CORE AREA WASTEWATER TREATMENT PROGRAM

OPTION 18a - Rock Bay / McLoughlin Tertiary. Biosolids at Hartland

Stantec

ID	Task Name	Duration
1	**Core Area Wastewater Treatment Program - Option 2B & 3B**	**84.35 mons**
2	**Funding in Place**	0 mons
3	**Secure Property/Zoning /Lease**	13 mons
4	**Environmental Impact Study (EIS)**	16 mons
5	**Liquid Plants**	**80.55 mons**
6	**Planning**	**9 mons**
7	Scope/Indicative Design/PA	9 mons
8	Prepare RFQ	2 mons
9	Prepare RFP	7 mons
10	**Procurement**	**18 mons**
11	**RFQ**	**4 mons**
12	RFQ Submission	2 mons
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23	**Biosolids Hartland**	**57.75 mons**
24	Approval of Business Case	0 mons
25	Procurement Planning	5.85 mons
26	Release RFQ to Market	6 mons
27	Approval of Shortlist	7 mons
28	Release RFP to Market	0 mons
29	Proposal Preparation	6 mons
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31	Financial Submission Due	3 mons
32	Preferred Proponent Announced	0 mons
33	Commercial / Financial Close	2 mons
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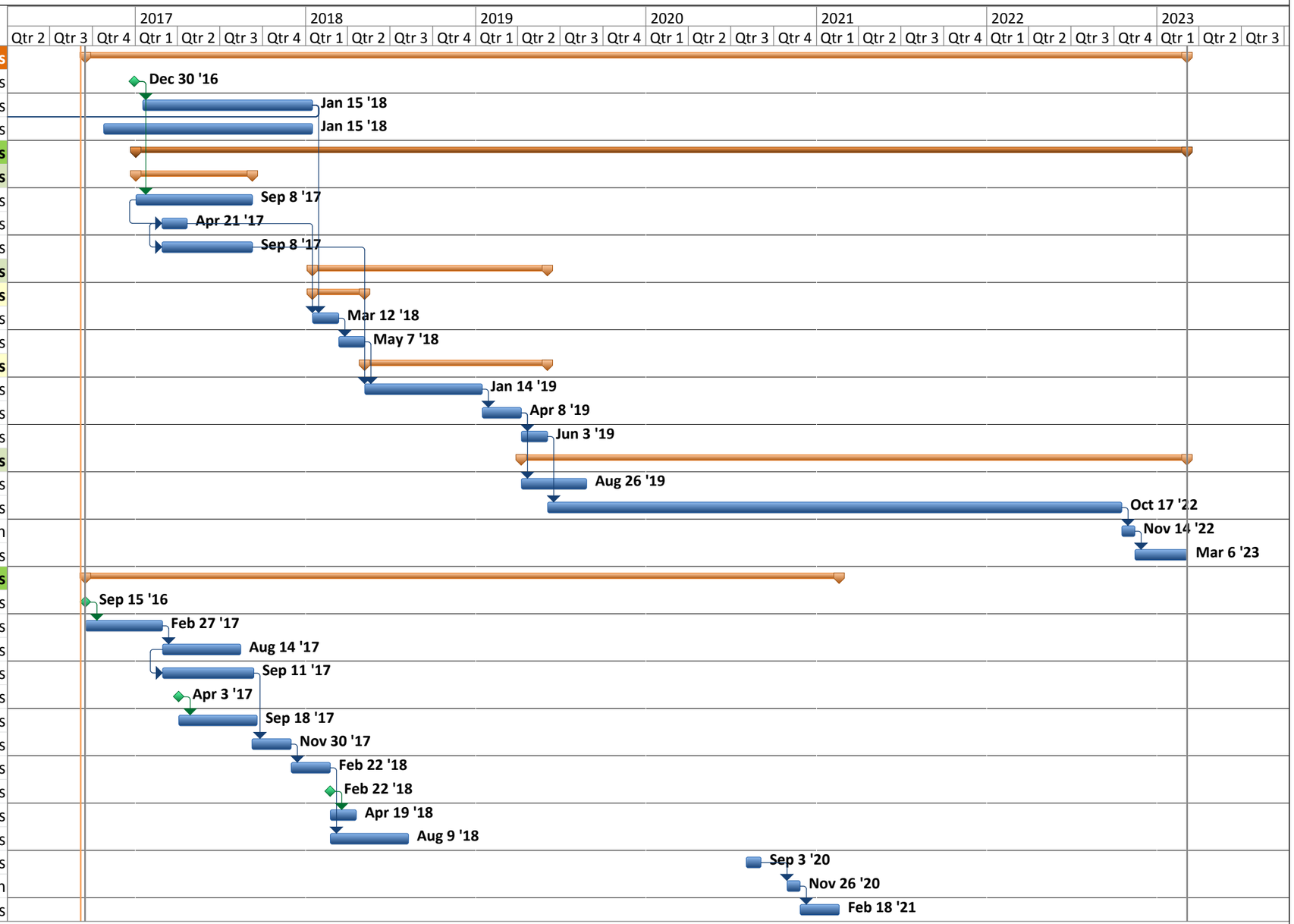
36	Functional Testing	1 mon
37	Acceptance Testing	3 mons



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CAPITAL REGIONAL DISTRICT - CORE AREA WASTEWATER TREATMENT PROGRAM

OPTION 18a - Rock Bay / McLoughlin Tertiary. Biosolids at Hartland

Stantec

ID	Task Name	Duration
38	**Conveyance (Scope TBD)**	**48 mons**
39	Arbutus Road Attenuation Tank (DBB)	19 mons
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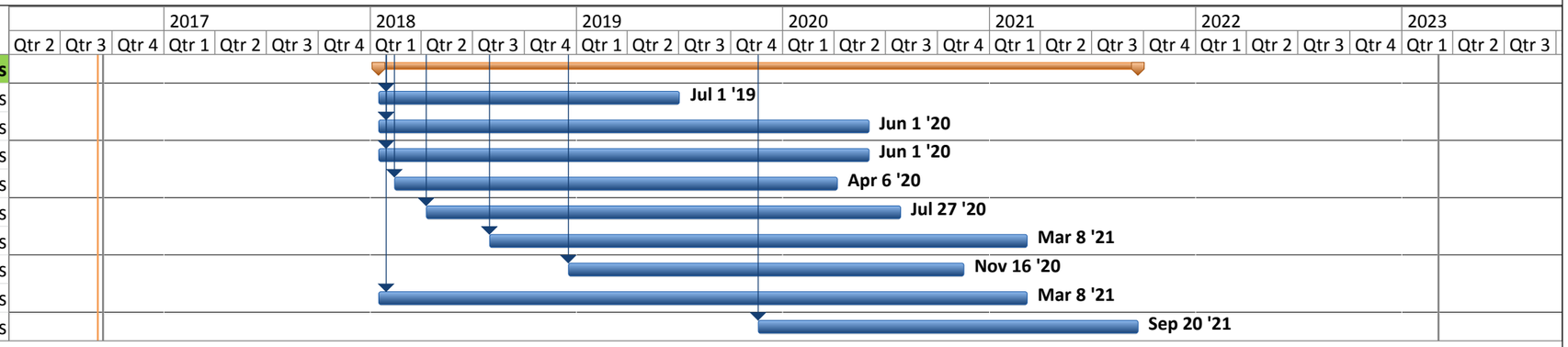

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Appendix D

Regulatory Memo by David Bursey of Bennett Jones LLP

Bennett Jones

MEMORANDUM

PRIVILEGED AND CONFIDENTIAL

TO: Don Fairbairn, Jane Bird and James Burke

FROM: David Bursey LOCAL: 604.891.5128

DATE: June 30, 2016

RE: CRD Wastewater Project – Summary of Environmental Regulatory Approvals and Requirements - Project Option Screening

---

1. INTRODUCTION

This memo outlines the environmental regulatory approvals and requirements applicable to the CRD Wastewater Project. This information is intended to assist the Project Board in screening the project options. Accordingly, the regulatory requirements are reviewed at a general level to compare projects concepts. More detailed analysis would be necessary to identify the specific requirements associated with a more detailed project design.

The information is organized as follows:

- Section 2 suggests how the regulatory risk may be quantified to screen the project options.

- Section 3 summarizes the environmental regulatory requirements in table form.

- Section 4 outlines the environmental assessment schemes under the *Canadian Environmental Assessment Act* and the BC *Environmental Assessment Act*.

- Section 5 reviews the provincial approvals that may be required.

- Section 6 reviews the federal and provincial environmental compliance requirements relevant to the treatment and discharge of municipal wastewater, including the prohibitions and standards under

    - the *Fisheries Act* and the related *Wastewater Systems Effluent Regulations*, and *Species at Risk Act*, and

    - the *Environmental Management Act*, and the related *Municipal Wastewater Regulation* and *Organic Matter Recycling Regulation.*

2. SCREENING CRITERIA

The following approach could be used to quantify the environmental regulatory compliance risk associated with the different project options.

Basic assumptions:

- If CRD is out of compliance with the federal *Fisheries Act* and its *Wastewater Systems Effluent Regulations* after 31 December 2020, CRD is exposed to the risk of prosecution under the *Fisheries Act*. CRD would also be exposed to the risk of prosecution under the federal *Species at Risk Act* (for harm to endangered aquatic species and their habitat in the local area from the outfall) and under the provincial *Environmental Management Act.*

- The risk of enforcement action is substantial. The public reputation implications would also be substantial given the high profile of this wastewater issue. CRD may not rely on DFO or the Province exercising administrative discretion to avoid prosecution. DFO, in particular, would face considerable public pressure to enforce the WSER standards.

- A due diligence defence would be difficult to establish in the circumstances since CRD has known about the regulatory requirements for years.

- The potential fines under the *Fisheries Act* would be up to $6,000,000 for the first offence. The fines under other federal and provincial legislation would be up to $1,000,000. Imprisonment for officers and directors is possible.
    - The offence under each applicable statute would be independent, so the fines would be cumulative.
    - Each day the contravention occurs is a separate offence.

- The range of recent fines suggests that a discharge of the magnitude associated with CRD daily would warrant a substantial fine. The fines we have noted were assessed before the *Fisheries Act* was amended to include a minimum fine. We should assume a federal fine of $500,000 as a minimum.

- CRD will also incur professional fees (for engineers, environmental consultants and lawyers) to assess the risk, respond to regulators and possibly defend prosecutions. CRD will undoubtedly incur some cost and effort on this issue, even if no prosecution is initiated.

- The longer the contravention occurs, the greater the risk of prosecution, and the higher the potential fine and the higher the cost of dealing with the issue. So, options that take longer to bring into service have a higher relative risk.

- Any project requiring a federal or provincial environmental assessment, will need at least 2 years to prepare application and have it reviewed.

- To reduce these assumption to a mathematical expression, I suggest

    - assuming $1,000,000 in total – i.e. $500,000 in potential fines and $500,000 in associated professional fees to deal with the issue.

    - assuming a 0.75 probability of that outcome in 2021.

    - escalating the probability of that outcome 0.25 each year to reflect the increasing pressure to bring CRD into compliance.

Year in Service	Potential Cost	Probability
2021	$1,000,000	x 0.75
2022	$1,000,000	x 1.00
2023	$1,000,000	x 1.25
2024	$1,000,000	x 1.50

3. SUMMARY OF ENVIRONMENTAL REGULATORY REQUIREMENTS

Projects Subject to Environmental Assessments

Legislation	Project
Environmental Assessment Act* (BC) *(Reviewable Projects Regulation)	• Gasification facility: o Facility for generating electricity from the combustion of municipal solid waste ("thermal electric power plant"); o Facility that is part of a Solid Waste Management Plan that destroys waste using high temperatures and has a design capacity of > 225 tonnes/day; o Facility for treatment or disposal of municipal liquid waste that services > 10,000 people (unless it is part of a Municipal Liquid Waste

	Management Plan).
Canadian Environmental Assessment Act (Regulations Designating Physical Activities)	• Waste management facility constructed in a wildlife area or a migratory bird sanctuary; • Facility used exclusively for the treatment, incineration, disposal or recycling of hazardous waste.

Treatment Requirements

Wastewater Discharge		
Parameter	**Legislations**	**Requirements**
Effluent Quality	Municipal Wastewater Regulation (*Environmental Management Act*)	$\leq$ 45mg/L BOD_5, TSS for < 2 x ADWF $\leq$ 130mg/ L BOD_5, TSS for $\geq$ 2 x ADWF
	Wastewater Systems Effluent Regulations (*Fisheries Act*)	$\leq$ 25 mg/L (CBOD and TSS) [monthly avg., including flows $\geq$ 2 x ADWF] $\leq$ 0.02mg/L total residual chlorine [monthly avg]
Disinfection (fecal coliform)	Municipal Wastewater Regulation (*Environmental Management Act*)	< 14/100 mL MPN (median or geometric mean) with $\leq$ 10% of samples > 43/100 mL $\leq$ 200/100 mL MPN (geometric mean) at edge of initial dilution zone
Ammonia	Municipal Wastewater Regulation (*Environmental Management Act*)	6-9 pH depending on receiving environment
	Wastewater Systems Effluent Regulations (*Fisheries Act*)	< 1.25 mg/L (at 15C) unionized ammonia [monthly avg]

Monitoring	Municipal Wastewater Regulation (*Environmental Management Act*)	Flow frequency: daily BOD_5, TSS: 5 times/week (composite sample) NH4-N, PO4-P, total P: twice/month (composite sample) Fecal coliform: once/week (grab sample)
	Wastewater Systems Effluent Regulations (*Fisheries Act*)	Acute lethality testing on a monthly basis (grab sample) Effluent composition testing on a monthly basis (composite samples, 3 times/week)
Reclaimed Water		
Parameter	**Statutory Source**	**Requirements**
Effluent Quality (moderate exposure potential)	Municipal Wastewater Regulation (*Environmental Management Act*)	6.5-9 pH $\leq$ 25mg/L BOD_5, TSS < CFU/100 ml [median]; < 400 CFU [max] fecal coliform (/100 ml)
Effluent Quality (greater exposure potential)	Municipal Wastewater Regulation (*Environmental Management Act*)	6.5-9 pH $\leq$ 10 mg/L BOD_5, TSS < 2 NTU [avg]; < 5 NTU [max] turbidity < 1 CFU or < 2.2 MPN [median]; < 14 CFU [max] fecal coliform (/100ml)
Monitoring (moderate exposure potential)	Municipal Wastewater Regulation (*Environmental Management Act*)	Flow frequency: weekly BOD_5, TSS: weekly NH4-N, PO4-P, total P: N/A

		Fecal coliform: weekly (moderate) pH: 6.5-9 Turbidity: N/A
Monitoring (greater exposure potential)	Municipal Wastewater Regulation (*Environmental Management Act*)	Flow frequency: weekly BOD_5, TSS: weekly NH4-N, PO4-P, total P: N/A Fecal coliform: daily pH: 6.5-9 Turbidity: continuous

Biosolids			
Parameter	**Statutory Source**	**Class A**	**Class B**
Pathogen Reduction Requirements	Organic Matter Recycling Regulations (*Environmental Management Act*)	< 1000 MPN/g (dry solids basis)	< 2,000,000 MPN/g (dry solids basis)
Acceptable Process for Pathogen Reduction	Organic Matter Recycling Regulations (*Environmental Management Act*)	• Thermophilic aerobic digestion > 55C for at least 30 min; • Thermophilic anaerobic digestion at > 50C for at least 10 days; • Exposure to time-temperature processing requirements according to arithmetical formulation given in the regulation depending on total solids	• Aerobic digestion with mean cell retention time between 40 days at 20C and 60 days at 15C; • Anaerobic digestion with mean cell retention time between 15 days at 35C and 60 days at 20C; • Air drying for >3 months, during which the ambient temperature must be >0C for at

		concentration of biosolids; or • Alkaline stabilization by maintaining the pH of the biosolids >12 for 72 hours during which T > 52C for 12 hours followed by air drying to >50% total solids concentration	least 2 months; or • Lime stabilization such that the pH of the biosolids is raised to > 12 after 2 hours of contact
Vector Attraction Reduction Requirements	Organic Matter Recycling Regulations (*Environmental Management Act*)	Aerobic or anaerobic digestion resulting in > 38% destruction of volatile solids mass or another acceptable criterion specified in the Regulation	Aerobic or anaerobic digestion resulting in > 38% destruction of volatile solids mass or another acceptable criterion specified in the Regulation
Quality Criteria	Organic Matter Recycling Regulations (*Environmental Management Act*)	See Section 3 of Schedule 4	See Table A (below)
Sampling and Analysis	Organic Matter Recycling Regulations (*Environmental Management Act*)	At least every 1000 tonnes dry weight of organic matter or once/year, whichever occurs first	At least every 1000 tonnes dry weight of organic matter or once/year, whichever occurs first

Table A – Quality Criteria: Class B Biosolids (from Organic Matter Recycling Regulations

Arsenic	75	**Cadmium**	20
Chromium	1060	**Cobalt**	150
Copper	2200	**Lead**	500
Mercury	15	**Molybdenum**	20
Nickel	180	**Selenium**	14
Zinc	1850	Expressed in µg/g dry weight	

Reliability Requirements (Municipal Wastewater Regulation under *Environmental Management Act*)

Unit Treatment Process	Category I	
	Treatment System	**Back-up Power**
Grit Removal	N/A	Optional
Primary Sedimentation	Multiple Units[a]	Yes
Primary Sedimentation	Multiple Units[b]	Yes
Blows	Multiple Units	Yes
Secondary Clarification	Multiple Units[b]	Yes
Effluent Filters	2 Minimum[a]	Yes
Disinfection Units	Multiple Units[b]	Yes
Anaerobic Digesters	2 Minimum[a]	Yes
Remaining capacity with the largest unit out of service must be at least: [a] 50% of the design maximum flow; or [b] 75% of design maximum flow		

Fines and Penalties

Statutory Source	Fine/Penalty
Canadian Environmental Assessment Act	**Corporation/Individual** • Up to $200,000 (first offence) • Up to $400,000 (subsequent offences) **Each day constitutes a separate offence**
Environmental Assessment Act	**Corporation** • Up to $100,000 (first offence) • Up to $200,000 (subsequent offences) **Individual** • Up to $100,000 and 6 months imprisonment (first offence) • Up to $200,000 and 12 months imprisonment (subsequent offences)
Fisheries Act	**Individual/Corporation** • $500,000 to $6,000,000 (first offence) • $1,000,000 to $12,000,000 (subsequent offences) **Each day constitutes a separate offence**

Species at Risk Act	**Individual/Corporation** • Up to $1,000,000 and 5 years imprisonment (first offence) • Up to $2,000,000 (subsequent offences) **Each day constitutes a separate offence** **Where an offence involves more than one animal, the offence against each animal constitutes a separate offence**
Environmental Management Act	**Individual/Corporation** • Up to $1,000,000 and 6 months imprisonment **Director/Officer/Employee/Agent of Corporation** • Commits an offence whether or not corporation is convicted **Each day constitutes a separate offence**

4. ENVIRONMENTAL ASSESSMENT

4.1 Summary of the Statutory Scheme

(a) *Canadian Environmental Assessment Act* (Federal)

Section 6 of the Act prohibits a proponent of a designated project from doing any act in connection with carrying out the project unless the Agency makes a decision under s. 10(b) that no environmental assessment is required, or the proponent complies with the conditions attached to the decision statement made under s. 31(1).

A "designated project" is defined under s. 2(1) as one or more physical activities that are (a) carried out in Canada, (b) designated by regulations made under s. 84(a), and (c) linked to the same federal authority as specified in those regulations.

The Regulations Designating Physical Activities has been enacted under s. 84(a) for the purpose of defining of "designated project."

Section 8(1) requires that a proponent of a designated project provide the Agency with a description of the project in accordance with specifications in the regulations. Under s. 10, the Agency will then conduct screening of the project and decide whether an environmental assessment is required. After an environmental assessment is conducted, the Governor in Council will issue a decision.

Pursuant to s. 99(1), any proponent who contravenes s. 6 is guilty of an offence punishable on summary conviction, for a first offence, to a fine of not more than $200,000 and, for any subsequent offence, to a fine of not more than $400,000. If such an offence is committed or continued on more than one day, it constitutes a separate offence for each day on which it is committed or continued.

(b) Regulations Designating Physical Activities (Federal)

The Regulations Designating Physical Activities identifies physical activities that constitute "designated projects" and may require an environmental assessment by the Agency.

- A gasification facility is not listed as a designated project under the Regulations and is unlikely to require an environmental assessment, subject to the following considerations.

- A waste management facility constructed in a wildlife area or a migratory bird sanctuary is a designated project under s. 1(j). Part VIII of Schedule I of the *Wildlife Area Regulations* sets out the areas in BC that are wildlife areas. Part IX of the *Migratory Bird Sanctuary Regulations* sets out the areas in BC that are migratory bird sanctuaries.

    - There are no designated wildlife areas near the proposed construction sites.

    - The Esquimalt Lagoon Migratory Bird Sanctuary and the Victoria Harbour Bird Sanctuary are listed and their areas should be properly considered to determine whether the project is constructed in a migratory bird sanctuary.

- A facility used exclusively for the treatment, incineration, disposal or recycling of hazardous waste is also a designated project under s. 29. Hazardous waste is defined under ss. 1(1) and 2(1) of the *Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations*. These definitions are highly technical and refer to various other enactments. We have not analyzed these definitions for this memo.

Under the previous version of the *Canadian Environmental Assessment Act* (pre-2012), financial assistance to a proponent of a project by a federal authority would trigger an environmental assessment. There is no equivalent provision in the current Act.

(c) Timelines under *Canadian Environmental Assessment Act* (Federal)

The Act establishes timelines for each step of the process, and the overall timeline to complete an assessment:

- 1 year, if the Canadian Environmental Assessment Agency conducts the assessment

- 2 years, if a review panel conducts the assessment

These time lines do not include the time when an applicant is requested to provide further information. The "review clock is stopped" while the applicant gathers the information to respond.

It is common for most application to have some information deficiencies that must be remedied before the application is accepted for review. It is also common for the Agency (or Review Panel) to ask for more information during the course of a review. Most applications will take also about a year to prepare in advance of being filed for review.

Thus, we should assume the time to prepare an application and have it reviewed would be at least 2 years under the CEA Act. This time estimate is a best case scenario.

(d) British Columbia *Environmental Assessment Act*

Section 8(1) of the Act prohibits undertaking or carrying on any activity that is a "reviewable project" unless an environmental assessment certificate is obtained, or the executive director, under s. 10(1)(b), has determined that an environmental assessment certificate is not required for the project.

A "reviewable project" is defined under s. 1 as "a project that is within a category of projects prescribed under section 5." Under s. 5(1), the Lieutenant Governor in Council may make regulations prescribing what constitutes a reviewable project. The Reviewable Projects Regulation has been enacted for this purpose.

In addition, s. 8.1 prohibits a reviewable project on treaty lands from proceeding without the consent from the treaty first nation if the final agreement requires consent.

Under s. 10(1)(b), the executive director may determine that an environmental assessment certificate is not required for the project and that the proponent may proceed without an assessment. Alternatively, under s. 10(1)(c), the executive director may determine that an environmental assessment certificate is required and that the proponent may not proceed without an assessment.

A proponent of a reviewable project for which an environmental assessment certificate is required under s. 10(1)(c) may apply for an environmental assessment certificate under s. 16(1). Upon completion of an environmental assessment of a reviewable project, the Minister under s. 17(3)(c) must either (i) issue an environmental assessment certificate with attached conditions, (ii) refuse to issue a certificate, or (iii) order that further assessment be carried out before a final decision is made.

Pursuant to s. 41(2), contravention of ss. 8(1) or 8(2) constitutes an offence. For a corporation, an offence is punishable by a fine of up to $100,000 for a first offence and $200,000 for each subsequent offence. For an individual, an offence is punishable by a fine of up to $100,000 and 6 months imprisonment for a first offence, and $200,000 and 12 months imprisonment for each subsequent offence.

(e) British Columbia Reviewable Projects Regulation (Provincial)

The Reviewable Projects Regulation identifies categories of projects are reviewable projects.

- A gasification facility may be a reviewable project if it is classified as an Energy Project or Waste Disposal Project, described below.

- A thermal electric power plant with a rated nameplate capacity of ≥ 50 MW is a reviewable project. Section 9 defines "thermal electric power plant" as "a facility for generating electricity from the combustion of…municipal solid waste." "Municipal solid waste" is defined in the *Environmental Management Act* under s. 23 as "refuse that originates from residential [or] commercial…sources, or refuse specified by a director to be included in a waste management plan."

- A facility that is part of a Solid Waste Management Plan for the treatment or disposal of municipal solid waste by operation of a device, with or without energy recovery, destroys the waste using high temperatures and that has a design capacity of ≥ 225 tonnes/day. "Municipal solid waste" is defined as above.

- A facility that is for the treatment or disposal of municipal liquid waste and designed to service ≥ 10,000 people is a reviewable project unless it is a component of a Municipal Liquid Waste Management Plan approved under the *Environmental Management Act*. "Municipal liquid waste" is defined in the *Environmental Management Act* under s. 23 as "effluent that originates from any source and is discharged into a municipal sewer system" and "effluent specified by a director to be included in a waste management plan."

(f) Timelines under the British Columbia *Environmental Assessment Act*

The *Prescribed Time Limits Regulation* establish timelines for a review under the BC EA Act. Overall, a review is to be completed within 180 days after an application is accepted for review. This timeline is suspended when the EA Office requests more information.

The EA Office website explains that the pre-application stages usually takes about 12 months to gather the necessary information. Once an application is accepted for review, it is also common for the EA Office to request It is common for most application to have some information deficiencies that must be remedied before the application is accepted for review. It is also common for the Agency (or Review Panel) to ask for more information during the course of a review, which entails suspending the 180-day review timeline.

Thus, we should assume the time to prepare an application and have it reviewed would be at least 2 years under the BC EA Act. This time estimate is a best case scenario.

5. OTHER PROVINCIAL REGULATORY APPROVALS

5.1 Operational Discharge Permits (Provincial)

Section 6 of the *Environmental Management Act* prohibits the introduction of waste into the environmental without a permit or approval under s. 14 of the Act. These permits will be required for operations falling outside of a waste management plan. Generally, the permits must be granted before operation commences. However, a director may grant approval for up to 15 months without issuing a permit under s. 15.

The following permits may be required for a gasification facility:

- Air Emissions Permit
- Liquid Effluent Discharge Permit
- Ash Disposal Permit

5.2 Contaminated Sites Regulation (Provincial)

If the construction site for the facility is contaminated, remediation may necessary pursuant to the *Environmental Management Act* to bring it into compliance with the standards outlined in the Contaminated Sites Regulation.

Section 45(1)(a) allocates responsibility for remediation to the current owner and operator of the site. A person who is responsible for remediation is liable for the reasonably incurred costs of remediation.

6. ENVIRONMENTAL REGULATORY REQUIREMENTS

6.1 Summary of the Statutory Scheme

(a) *Fisheries Act* (Federal)

Section 36(3) of the Act prohibits the deposit of, a deleterious substance of any type in water frequented by fish. An exception to this prohibition is found in s. 36(4)(b), which allows the deposit of a deleterious substance in such water where authorized by regulations made by the Governor in Council under s. 36(5).

Pursuant to s. 40(2), contravention of s. 36(3) constitutes an offence. For persons other than individuals or small revenue corporations, neither of which the CRD fall within, an offence is punishable on conviction on indictment by a fine between:

- $500,000 and $6,000,000 for a first offence, and
- $1,000,000 to $12,000,000 for each subsequent offence.

On summary conviction, an offence is punishable by a fine between

- $100,000 and $4,000,000 for a first offence, and
- $200,000 to $8,000,000 for each subsequent offence.

The *Act* also establishes penalties for officers, directors, or agents of a corporation who direct, authorize, assent to, acquiesce in, or participation in the commission of the offence. Upon conviction on indictment, the fines would be between:

- $15,000 and $1,000,000, for a first offence, and
- $30,000 and $2,000,000, for a second or subsequent offence, or

- imprisonment for a term not exceeding three years, or both.

Upon summary conviction, the fines would be between::

- $5,000 and $300,000, for a first offence, and
- $10,000 and $600,000, for a second or subsequent offence or
- imprisonment for a term not exceeding six months, or both.

Under s. 78.1, each day on which a contravention is committed constitutes a separate offence.

The enforcement of s. 36(3) has been delegated to the Minister of the Environment. The following enforcement steps may be taken for contravention of ss. 36(3):

- Warnings and directions from Fishery Inspectors,
- Orders by the Minister,
- Injunctions, and
- Prosecutions.

In addition to fines, the financial cost associated with Court orders can be large, especially when the Court orders remediation, compensation, or other corrective action. The specific application of the enforcement regime would depend on the circumstance at the time of the contravention. The federal Crown has a range of enforcement options and administrative discretion in how it uses those options.

Due diligence is a defense under s. 78.6 if it can be established that the person:

- Exercised all due diligence to prevent the commission of the offence; or
- Reasonably and honestly believed in the existence of facts that, if true, would render the person's conduct innocent.

Recent penalties imposed on municipalities for contravention of s. 36(3) include:

- $190,000 penalty imposed on the City of Calgary
- $110,000 penalty imposed on Metro Vancouver for release of 650,000 liters of untreated sewage due to a blockage at a pump station
- $50,000 penalty imposed on the City of Prince Rupert for a spill of weak black liquor from a pulp mill
- $55,000 penalty imposed on the City of Moosejaw
- $15,000 penalty imposed on the City of Ottawa
  $5,000 penalty imposed on Dawson Creek, with a $5,000 fine per month it failed to meet its timeline

In the past 10 years, fines as large as $450,000 have been imposed on industrial entities for contravention of s. 36(3). All of these fines were imposed before the minimum fine was established in the *Fisheries Act*. The level of fines is also trending upward.

If CRD is out of compliance with WSER and the *Fisheries Act* by 31 December 2020, the risk of enforcement action is substantial. DFO would be under considerable public pressure to take some enforcement action, so CRD cannot rely on DFO to exercise its administrative discretion to forbear from prosecution.

Further, the public reputation implications would also be substantial given the high profile of the wastewater issue.

(b) *Species at Risk Act* (Federal)

The *Specifies of Risk Act* prohibits harming a wildlife species listed as "at risk" through s. 32. Section 33 prohibits damage or destruction of the residence of any listed species. Similarly, s. 58(1) prohibits the destruction of any part of a critical habitat of any listed species. "Critical habitat" is defined as "the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species."

Juan de Fuca Strait has been identified as a critical habitat for southern resident killer whales. The McLoughlin Point outfall would extend 700 m into the critical habitat, while the current Macaulay Point outfall extends 400 m into the critical habitat, and Clover Point outfall is located entirely within the critical habitat.

The Committee on the Status of Endangered Wildlife in Canada ("COSEWIC") is established by s. 14 for the purpose of listing wildlife species at risk. These species are listed in Schedule 1 of the Act. While BC does not have legislation directly protecting species at risk, the *Wildlife Act* grants the Lieutenant Governor in Council the power to designate threatened species as endangered or threatened species.

The Worley Parsons Stage 1 Environmental Impact Study found that the following species are at risk in the vicinity of McLoughlin Point discharge area:

Common Name	Scientific Name	BC/COSEWIC
Marbled Murrelet	*Brachyramphus marmoratus*	Blue/T (2012)
Surf Scoter	*Melanitta perspicillata*	Blue/No ranking
Purple Martin	*Progne subis*	Blue/No ranking
Peregrine Falcon	*Falco peregrinus pealei*	Blue/SC (2007)
Cutthroat Trout	*Oncorhynchus clarkii clarkii*	Blue/No ranking
Gray Whale	*Eschrichtius robustus*	Blue/SC (2004)
Steller Sea Lion	*Eumetopias jubatus*	Blue/SC (2003)
Northern Abalone	*Haliotis kamtschatkana*	Red/T (2000)
Killer Whale (Southern)	*Orcinus orca*	Red/E (2008)
Killer Whale (Northern)	*Orcinus orca*	Red/T (2008)
Killer Whale (Offshore)	*Orcinus orca*	Red/T (2008)
Killer Whale (West Coast)	*Orcinus orca*	Red/T (2008)

Olympia Oyster	*Ostrea conchaphila*	Blue/SC (2011)
Humpback Whale	*Megaptera novaeangliae*	Blue/SC (2011)
Harbour Porpoise	*Phocoena phocoena*	Blue/SC (2003)

Pursuant to s. 97(1), contravention of ss. 32, 33, or 36(1) is an offence.

Upon conviction on indictment, a corporation may be fined up to $1,000,000, and an individual up to $250,000 or imprisonment for up to 5 years, or both. On summary conviction, a corporation may be fined up to $300,000, and an individual up to $50,000 or imprisonment for up to one year, or both.

Each subsequent offence allows for a fine double the amount of the first offence, and each day on which a contravention is committed constitutes a separate offence. A fine may be assessed for each animal, plant, or organism involved in the offence.

(c) *Environment Management Act* (Provincial)

Sections 6(2) and 6(3) of the Act prohibit the introduction of waste into the environment for *prescribed* industries, activities or operations. "Municipal sewage management" is prescribed under the *Waste Discharge Regulation*.

An exemption to this prohibition is found in s. 6(5)(a)(iv), which allows the disposition of waste in compliance with a regulation. Section 138(1) grants the Lieutenant Governor in Council general authority to make regulations in relation to the Act. The *Municipal Wastewater Regulation* (MWR) has been enacted for the purposes of s. 6(5)(a)(iv). Section 5(1) of the MWR provides that a person may discharge municipal effluent or provide reclaimed water if the person does so in accordance with the regulation or to a wastewater facility that is authorized to discharge to the receiving environment.

Pursuant to s. 120(3), contravention of ss. 6(2) or 6(3) constitutes an offence punishable on conviction to a fine up to $1,000,000 or imprisonment for not more than 6 months, or both. Under s. 121, if a corporation commits an offence, the employee, officer, director, or agent of the corporation who authorized, permitted or acquiesced in the offence commits the offence whether or not the corporation is convicted. Separate fines of up to $1,000,000 may be imposed for each day that the offence continues.

Recent penalties imposed on industrial entities contravening s. 6 include:

- $250,000 imposed on a pipeline company for a synthetic crude oil spill into Burrard Inlet
- $150,000 imposed on the operator of a mill for discharge of effluent into the Columbia River
- $110,000 imposed on a mining company for discharge of lead, suspended particulate, and acid into the Columbia River

The exercise of "due diligence" is a defense under the Act.

6.2 Wastewater Systems Effluent Regulations (WSER) (Federal)

WSER establishes mandatory minimum effluent quality standards, monitoring requirements and a timeline to comply with its standards. Section 5 prescribes four deleterious substances and s. 6(1) sets the maximum amount of each of these deleterious substances that the owner or operator of a wastewater system is permitted to discharge:

> (a) average CBOD of the effluent does not exceed 25 mg/L;
> (b) average concentration of TSS in the effluent does not exceed 25 mg/L;
> (c) average concentration of total residual chlorine in the effluent does not exceed 0.02 mg/L; and
> (d) maximum concentration of un-ionized ammonia in the effluent is less than 1.25 mg/L, expressed as nitrogen (N), at 15°C ± 1°C.

Unlike the *Municipal Wastewater Regulation*, the maximums are calculated based on a *monthly average* if the average daily volume of effluent is greater than 17,500 m^3. Thus, secondary treatment may be required by WSER for flows in excess of 2 x ADWF in order to meet the monthly averages. There are no circumstances that prescribe a requirement for tertiary treatment.

Under s. 9(1)(a), a facility with an average daily volume in excess of 2,500 m^3 must continuously monitor the volume of influent. For continuous wastewater systems with average daily volumes in excess of 50,000 m^3, the composition of the effluent must be monitored by taking composite samples 3 times/week with at least one day between every sample. Under s. 11(1), acute lethality testing must be conducted via grab sample on a monthly basis with at least 21 days in between samples for average daily flows in excess of 50,000 m^3. Based on Stantec's calculations, it is unlikely that ammonia-nitrogen concentrations will be an issue. In addition, based on preliminary discussions with Environment Canada, it is unlikely that nitrification would be required for discharge into marine waters.

Entities subject to WSER were required to meet the minimum effluent quality standards set out in s. 6(1) by January 1, 2015. Entities unable to meet these standards were required to apply for a transitional authorization by June 30, 2014 under s. 24(1).

The CRD obtained a transitional authorization that allows it to deposit deleterious substances in amounts exceeding the prescribed limits until December 31, 2020.

6.3 Municipal Wastewater Regulation (MWR) (Provincial)

MWR establishes mandatory minimum effluent quality standards, monitoring requirements and facility reliability requirements. Section 5 provides an exemption to ss. 6(2) and 6(3) of the Act if municipal effluent is discharged in accordance with the MWR. Pursuant to s. 6(2), a person must not discharge municipal effluent in a manner that would conflict with a liquid waste management plan approved by the minister.

(a) Effluent Quality Requirements: Discharge

Section 94 sets out the effluent quality requirements for discharge to water. Facilities with maximum daily flows greater than 50 m^3/day must not exceed 45 mg/L BOD_5 and TSS for daily flows < 2 x ADWF discharged to marine waters. For daily flows $\geq$ 2 x ADWF, 130 mg/L BOD_5 and TSS cannot be exceeded.

If effluent is discharged to lakes, rivers or streams, tertiary treatment is required and an environmental impact study may be required. If flows are more than 2 x ADWF during a storm or equivalent snow melt more than once every 5 years, a liquid waste management plan or specific study must be undertaken and implemented.

In its review, Stantec notes flows in excess of 2 x ADWF occur more than once every 5 years at Clover Point outfall.

(b) Disinfection and Ammonia Reduction Requirements: Discharge

Section 95(6) requires a discharger to determine the maximum allowable ammonia concentration at the "end of pipe" by a back calculation, from the edge of the initial dilution zone, that considers

(a) the ambient temperature and pH characteristics of the receiving water, and
(b) water quality guidelines for chronic ammonia.

Consequently, the municipal effluent quality requirements under s. 94 – Table 11 specify a variable pH level between 6 and 9.

Section 96(1) requires a discharger ensure that fecal coliform organisms meet the following requirements as applicable:

(a) if discharging to shellfish bearing waters at the edge of the initial dilution zone, the median or geometric mean MPN of fecal coliform organisms must be less than 14/100 mL, with not more than 10% of the samples exceeding 43/100 mL;
(b) if discharging to recreational use waters, the geometric mean number of fecal coliform organisms at the edge of the initial dilution zone must be less than or equal to 200/100 mL.

Stantec notes specific end of pipe ammonia and fecal coliform targets will be established based on projected dispersion of the effluent within the dilution zone. This is normally established with use of a dispersion model and the effluent quality guidelines.

(c) Effluent Quality Requirements: Reclaimed Water

Section 108 sets out the effluent quality requirements for providing reclaimed water. Section 104(1) categorizes reclaimed water as either:

(a) *indirect potable reuse* (used to replenish a potential potable water source);

(b) *greater exposure potential* (public contact is likely or presents a risk to the receiving environment);
(c) *moderate exposure potential* (public contact is likely minimal, public access is restricted and users are educated as to the risks, or presents a moderate risk to the receiving environment);
(d) *lower exposure potential* (public access is restricted and users are unlikely to have contact, uses are commercial or industrial in nature and users are educated as to the risks, or presents a low risk to the receiving environment).

The municipal effluent quality requirements for moderate and greater exposure potential are as follows:

Parameters	**Moderate Exposure Potential**	**Greater Exposure Potential**
pH	6.5-9	6.5-9
BOD_5, TSS	25 mg/L	10 mg/L
Turbidity	N/A	2 NTU (average); 5 NTU (maximum)
Fecal Coliform (/100 mL)	100 CFU (median); 400 CFU (maximum)	1 CFU or 2.2 MPN (median); 14 CFU (maximum)

Section 109 specifies additional guidelines for all exposure categories. Sections 110 to 112 specify further additional requirements for each individual exposure category. Section 113 requires that reclaimed water be disinfected with a minimum total chlorine residual of 0.5 mg/L at the point of use.

(d) Monitoring Requirements:

(i) Final Effluent

Section 103(1) sets out the monitoring requirements for discharge to water as follows:

Parameter	**Maximum Daily Flow Range (m^3/day)**	
Flow Frequency	$\geq$ 50,000 to < 200,000	> 200,000
BOD5, TSS Frequency and Type	Daily	Daily
NH4-N, PO4-P, Total Phosphorus Frequency and Type (marine)	Monthly (composite sample)	Twice/month (composite samples)
Fecal Coliform Frequency and Type	Twice/month (grab sample)	Weekly (grab sample)

(ii) Reclaimed Water

Section 118(1) sets out of monitoring requirements for reclaimed water as follows:

Parameters	Moderate Exposure Potential	Greater Exposure Potential
pH	Weekly	Weekly
BOD_5, TSS	Weekly	Weekly
Turbidity	N/A	Continuous Monitoring
Fecal Coliform (/100 mL)	Weekly	Daily

(e) Reliability Requirements:

Under s. 35(1), a qualified professional must determine, based on an environmental impact study, which reliability category applies to a proposed wastewater facility and ensure the design meets the requirements. The facility would likely fall under Category I as a wastewater facility that (i) discharges to ground or water, and (ii) in respect of which short term effluent degradation could cause permanent or unacceptable damage to the receiving environment, including discharges near drinking water sources, shellfish waters or recreational waters in which direct human contact occurs.

The reliability requirements for a Category I facility are as follows:

Unit Treatment Process	Category I	
	Treatment System	Back-up Power
Grit Removal	N/A	Optional
Primary Sedimentation	Multiple Units[a]	Yes
Primary Sedimentation	Multiple Units[b]	Yes
Blows	Multiple Units	Yes
Secondary Clarification	Multiple Units[b]	Yes
Effluent Filters	2 Minimum[a]	Yes
Disinfection Units	Multiple Units[b]	Yes
Anaerobic Digesters	2 Minimum[a]	Yes

The remaining capacity with the largest unit out of service must be at least 50% (annotation [a]) or 75% (annotation [b]) of the design maximum flow (depending on the notation in Table 1).

(f) Dilution Zone Requirements

Under s. 99(1), a qualified professional must design an outfall such that initial dilution zone requirements are met for discharge to water. "Initial dilution zone" is defined in s. 91(1) as "the 3-dimensional zone around the point of discharge where mixing of the municipal effluent and the receiving water occurs." The edge of the initial dilution zone must be located at least 300 m

away from (a) recreational areas and (b) aboriginal, commercial or recreational shellfish harvesting areas.

6.4 Organic Matter Recycling Regulation (OMRR) (Provincial)

The OMRR establishes mandatory standards for pathogen reduction, vector attraction, quality, and sampling and analysis of Class A and Class B biosolids.

(a) Pathogen Reduction Limits

Schedule 3 sets out the pathogen reduction limits for Class A and Class B biosolids. For Class A biosolids, fecal coliform levels must be less than 1,000 MPN/g of solids on a dry weight basis. For Class B biosolids, fecal coliform levels must be less than 2,000,000 MPN/g of total solids on a dry weight basis.

(b) Pathogen Reduction Processes

Schedule 1 lists the acceptable pathogen reduction processes for Class A and Class B biosolids. Section 2 sets out the acceptable processes for Class A biosolids and s. 7 sets out the acceptable processes for Class B biosolids. These processes are listed in the Summary at the beginning of the memo.

(c) Vector Attraction Reduction

Schedule 2 sets out the vector attraction reduction processes for Class A and Class B biosolids. Stantec suggests aerobic or anaerobic digestion resulting in >38% destruction of volatile solids mass or another acceptable criterion specified in the Regulation.

(d) Quality Criteria

Schedule 4 establishes the maximum allowable substance concentrations for Class A and Class B biosolids. Pursuant to s. 3, Class A biosolids must not contain elements at concentrations above those specified in the Trade Memorandum T-4-93, Standards for Metals in Fertilizers and Supplements. Class B biosolids cannot contain substance concentrations exceeding the values set out in s. 1.

(e) Sampling and Analysis

Schedule 5 sets out the sampling and analysis protocols and frequency. Section 1 states that all required analyses for Class A and Class B biosolids must be carried out at intervals of once every 1,000 tonnes of dry weight of organic matter, or once per year, whichever occurs first.

Appendix E

Summary Memo of Previous Options

Stantec

Memo

To:	CRD Wastewater Program Board	From:	Reno Fiorante Bob Dawson Stantec
File:	111700431	Date:	June 8, 2016

Reference: CRD Wastewater Program – Review of Past Planning Work

Introduction

The Capital Regional District has been planning for wastewater treatment for many years. In the last 10 years a significant amount of work has been done to review treatment solution sets, assess siting alternatives, and review available and emerging technologies along with their respective life cycle costs. The options reviewed have included decentralized and centralized treatment options for liquid and biosolids treatment. The availability of sites large enough for the liquid and / or biosolids treatment facilities has been the most critical issue facing the CRD.

A myriad of proven and emerging technologies have been assessed by various consulting engineering firms. The engineering firms involved in the most recent and previous works are summarized as follows:

- Urban Systems / Carollo Engineers - (2015 – 2016)
- Stantec Consulting - (2009 – 2015)
- CH2M / Associated / KWL – (2006-2009)

This memorandum provides a summary of the work that has been completed by various firms, the options reviewed, the technologies considered, and the estimated capital and operating costs. Where available, potential revenues from recovery of resources such as heat, reclaimed water and biogas are summarized. The actual revenues that would be realized would be subject to market condition and business case considerations.

Where available, plans illustrating the various configurations assessed are appended to this memorandum.

Urban Systems / Carollo Engineers Work Summary (2015-2016)

The most recent work on conceptual treatment options has been completed by an engineering team consisting of Urban Systems and Carollo Engineers. The following options were reviewed for the 2030 average dry weather (ADWF) design flow of 108 ML/d. Cost estimates are based on 2015 dollars and are high level Class D estimates.

Reference: CRD Wastewater Program – Review of Past Planning Work

Option Description	Facilities/Technologies	Capital Cost	Annual Operating Cost	Potential Revenue
Rock Bay Central Secondary Facility	Activated Sludge with 10 MLD MBR tertiary	$1.03 Billion	$21.8 Million	$0.9 Million
Rock Bay Central Tertiary	MBR Tertiary Treatment for full flow	$1.131 Billion	$26.4 Million	$0.9 Million
2 Plants ; Rock Bay and Colwood	80% of flow to secondary (AS) treatment and 20% to tertiary (MBR)	$1.088 Billion	$22.8 Million	$2.4 Milllion
3 Plant Secondary: Colwood / Langford, Esquimalt Nation and Rock Bay	80% to secondary, 20% tertiary sidestream at Esquimalt and Rock Bay.	$ 1.125 Billion	$ 23.0 Million	$ 1.6 Million
3 Plant Tertiary / Secondary Colwood / Langford (tertiary), Esquimalt Nation and Rock Bay (both secondary) :	Up to 30% of Colwood Langford is tertiary and small scale sidestream reuse. Also included at Rock Bay and Esquimalt. The majority of flow is secondary.	$ 1.178 Billion	$ 24.1 Million	$ 2.8 Million
4 Plants Rock Bay, Colwood, East Saanich and Esquimalt Nation	Treats 75% of flow to secondary level and 25% to tertiary levels. Tertiary effluent is available for reuse in each of 4 areas.	$ 1.195 Billion	$ 25.3 Million	$ 3.8 Million
7 Plants: Rock Bay, Colwood, East Saanich, Esquimalt Township, View Royal, Langford and Core Saanich	Treats up to 45% of flow to tertiary quality with all flows on West Side treated to tertiary level.	$ 1.348 Billion	$ 26.6 Million	$ 4.0 Million
1 Plant Rock Bay Tertiary	Tertiary Plant for full flow, outfall upsize deferred	$ 1.077 Billion	Not available	Not available

Reference: CRD Wastewater Program – Review of Past Planning Work

Option Description	Facilities/Technologies	Capital Cost	Annual Operating Cost	Potential Revenue
3 Plant Clover Point, McLoughlin and Rock Bay Tertiary	2 tertiary plants and 1 primary plant	$ 1.089 Billion	Not available	Not available
2 Plant Clover Point and McLoughlin Tertiary	1 tertiary plant at Clover Point and 1 tertiary plant at McLoughlin Point	$ 1.052 Billion	Not available	Not available

The last three options in the above tables were extracted from a March 4, 2016 letter report so it is unknown if the cost estimates received the same level of diligence as the previous estimates.

The representative liquid treatment technologies reviewed by Urban Systems / Carollo included tertiary treatment using membrane bioreactor (MBR) technology, and secondary treatment options using conventional activated sludge or moving bed bioreactor (MBBR) technology. The MBBR technology provides a smaller footprint than conventional activated sludge.

The biosolids processing technology reviewed by Urban / Carollo assumed that mesophilic anaerobic digestion would be used. The site for the biosolids facility was Hartland landfill.

The representative technology used for biosolids processing included aerobic digestion for smaller decentralized treatment plants and mesophilic anaerobic digestion for larger centralized treatment plants. These options are capable of producing a Class B biosolid.

Urban / Carollo also reviewed gasification on a conceptual level as a potential opportunity for biosolids disposal and also commented that additional feedstock such as woodwaste or pre processed solid waste would be required for this technology. Costs for gasification were not carried in the base line cost estimates.

Reference: CRD Wastewater Program – Review of Past Planning Work

Stantec Consulting Work Summary (2009-2015)

In 2009 Stantec were retained to provide Program Management and Technical Planning services for the Core Area Wastewater Treatment Program. One of the primary focuses of Stantec's work was to provide a sustainable cost effective treatment system while at the same time satisfying the triple bottom line objectives set by the CRD. Stantec reviewed a variety of configurations, technologies and prepared Class C cost estimates for each option. The estimates presented below are in 2009 dollars with escalation to midpoint of construction which was assumed to be 2014. Additional escalation will be required once the program schedule is defined.

Option Description	Facilities / Technologies	Capital Cost	Annual Operating Cost	Potential Revenue
Option 1 A – 3 Plants located at East Saanich, McLoughlin, West Shore	East Saanich – 16.6 MLD MBR tertiary McLoughlin – 84.2 MLD BAF Secondary 24 MLD West Shore – MBR Thermophilic Anaerobic Digestion in Upper Harbour.	$ 965 Million	$ 18.8 Million	Not Assessed
Option 1 B – 2 regional plants and 2 wet weather plants, one at Clover Point and one at Macaulay Point	16.6 MLD MBR Tertiary Plant at Saanich East 108 MLD secondary Plant (CAS) on West Shore 75 MLD Wet Weather Plant at Clover Point 92. MLD Wet weather plant at Macaulay Point Biosolids on combined West Shore Site – Thermophilic Anaerobic Digestion	$ 875 Million	$ 19.6 Million	Not Assessed
Option 1C - - West Shore Regional Plant and small plant in East Saanich	16.6 MLD Saanich East MBR Plant 108 MLD secondary Conventional Activated Sludge on West Shore Biosolids on combined West Shore Site – Thermophilic Anaerobic Digestion	$ 885 Million	$ 19.5 million	Not Assessed

Reference: CRD Wastewater Program – Review of Past Planning Work

Option Description	Facilities / Technologies	Capital Cost	Annual Operating Cost	Potential Revenue
Option 1A Refinement 3 Plants located at East Saanich, McLoughlin, West Shore	East Saanich – 16.6 MLD MBR tertiary McLoughlin – 84.2 MLD BAF Secondary 24 MLD West Shore – MBR tertiary Thermophilic Anaerobic Digestion at Hartland	$ 967 million	$ 19.08 Million	$3.47 million
Option 1A prime	East Saanich – 16.6 MLD MBR McLoughlin – 92 MLD secondary BAF Thermophilic Anaerobic Digestion at Hartland with IRM	$ 837 Million	$ 15.9 Million	Not Assessed
Option 1B rev Single West Shore Plant	East Saanich Plant eliminated 108 MLD Regional West Shore Plant – secondary CAS Thermophilic Anaerobic Digestion	$ 813 million	$ 15.5 million	Not Assessed
Option 1D 3 Plants Upper Harbour Saanich East West Shore	East Saanich – 16.6 MLD MBR Upper Harbor Steel Pacific-91.2 MLD secondary BAF West Shore MBR- 7 MLD Thermophilic Anaerobic Digestion in Upper Harbour at combined site	$ 1.04 Billion	$ 17.9 Million	Not Assessed

Reference: CRD Wastewater Program – Review of Past Planning Work

Option Description	Facilities / Technologies	Capital Cost	Annual Operating Cost	Potential Revenue
Option 1F – 2 Plants Saanich East Ulpper Harbour	Saanich East 16.6 MLD MBR Plant Upper Harbour – 98 MLD BAF Secondary with heat recovery and water reuse Thermophilic Anaerobic Digestion in Upper Harbour at combined site	$ $939 Million	$16.4 Million	Not Assessed
Option 1G 1 Plant Single Regional Plant at Upper Harbour	Saanich East Plant Eliminated and replaced with wet weather storage tank 108 MLD Upper Harbour BAF Secondary Plant with small MBR sidestream for water reuse. Thermophilic Anaerobic Digestion in Upper Harbour at combined site	$ 828 Million	$ 14.3 Million	Not Assessed
Option 1A Prime 2 1 Plant Regional Secondary Plant at McLoughlin (Option carried in business case and funding applications)	108 MLD BAF Secondary Plant at McLoughlin Wet weather treatment facilities with capacity of 412 MLD at McLoughlin Storage attenuation tank at East Saanich Pump Upgrades for Clover and Macaulay Conveyance to deliver flows to McLoughlin Thermophilic Anaerobic Digestion at Hartland Landfill Site which includes : Dewatering Drying	$ 783 Million	$ 14.3 Million	$ 3.02 Million

Reference: CRD Wastewater Program – Review of Past Planning Work

Option Description	Facilities / Technologies	Capital Cost	Annual Operating Cost	Potential Revenue
	Biogas Recovery and scrubbing P recovery Space provision for future WTE or gasifier			
Rock Bay Single Plant	Single 108 MLD plant at Rock Bay using activated sludge or BAF technology. Layout completed for space planning only.	Not costed	Not costed	Not costed
Clover Point Underground	54 MLD underground MBR plant at Clover Point completed for space planning only	Not costed	Not costed	Not costed

Option 1A Prime 2 above is the option carried forth in the federal/ provincial funding application. This option meets the necessary regulatory requirements for implementation of secondary treatment in the CRD and it also provides for a reasonable amount of resource recovery which can be phased in a logical manner to accommodate emerging technologies and integration with solid waste streams.

CH2M / Associated / KWL Work Summary (2006-2009)

A comprehensive review of decentralized treatment options was undertaken by the CH2M/ Associated/ KWL team from 2006 -2009. The options reviewed, capital and operating costs are as follows:

Option Description	Facilities / Technologies	Capital Cost	Annual Operating Cost	Potential Revenue
Option 1 – 3 plants option Macaulay or McLoughlin, South Colwood, Saanich East, Clover Point Wet Weather	Macaulay/ McLoughlin MBR Tertiary-100.8 MLD South Colwood WWTP MBR Tertiary – 38 MLD Saanich East WWTP MBR Tertiary- 17 MLD	$1.18 Billion	$23.5 Million	$3.6 Million

Reference: CRD Wastewater Program – Review of Past Planning Work

Option Description	Facilities / Technologies	Capital Cost	Annual Operating Cost	Potential Revenue
	Clover Point Wet Weather – 254 MLD Biosolids - Thermophilic Anaerobic Digestion			
Option 2 – 5 Plant Option Macaulay/ McLoughlin, South Colwood, Saanich East, Ogden Point, Juan De Fuca	Macaulay McLoughlin – 23 MLD MBR Tertiary Saanich East- 17 MLD MBR Tertiary South Colwood – 1-MLD MBR Tertiary Ogden Point – 37.3 MLD MBR Tertiary Juan De Fuca – 56 MLD MBR Tertiary Biosolids – Thermophilic Anaerobic Digestion	$1.6 Billion	$29 Million	$ 7.3 Million
Option 3 – 10 Plant Option Macaulay / McLoughlin, South Colwoood, Saanich East, Ogden Point, Juan deFuca, Windsor Park, Westhills, Florence Lake, Lang Cove, Roderick	Macaulay/ McLoughlin 12 MLD MBR Tertiary South Colwood 8 MLD MBR Tertiary Saanich East 15 MLD MBR - Tertiary Ogden Point – 20 MLD MBR Tertiary Juan de Fuca –m 13.5 MLD MBR Tertiary	$ 1.85 Billion	$ 33 Million	$ 8.3 Million

Reference: CRD Wastewater Program – Review of Past Planning Work

Option Description	Facilities / Technologies	Capital Cost	Annual Operating Cost	Potential Revenue
	Windsor Park- 12 MLD MBR Tertiary Westhills- 8 MLD MBR Tertiary Florence Lake -4 MLD MBR Tertiary Lang Cave – 8 MLD MBR Tertiary Roderick – 21 MLD MBR Tertiary Biosolids Thermophilic Anaerobic Digestion			

The CH2 M work focused on using membrane bioreactors to provide distributed treatment and water reuse throughout the Core Area. The costs for this approach were quite substantial and resulted in significant operating and maintenance costs. Membrane replacement is required every 8 to 10 years.

Appendix A

Urban Systems / Carollo Engineers Option Configuration

Table 1.1 – Summary of Engineering Aspects for Each Option

Option Set Map	Summary Characterization
Rock Bay (Option 1a and 1b) 	***Engineering Description*** • Rock Bay treats 100% of the base and wet weather flows. • Flows > 3 x ADWF at Clover Point and > 4 x ADWF at Macaulay Point are screened at those locations before discharge. • Solids recovery is based on either anaerobic digestion or gasification of mixed waste at Rock Bay or at Hartland Landfill. • Extent of new infrastructure is lowest of all option sets; municipal trunk sewers optimization (e.g. Victoria, Oak Bay) will be considered to minimize pumping and piping from Clover outfall back to Rock Bay • Clover Point may include an innovative, compact technology to maximize treatment including direct discharge to the outfall, thereby reducing the scope/cost of pumping to Rock Bay. • The treated effluent line from Rock Bay to Clover Point could be accessed for reuse/heat recovery projects. ***Levels of Service Differentiators*** • Focus on meeting regulations and disinfection plus tertiary quality water for local reuse (up to 10 MLD). • Heat recovery is contemplated at/around the plant. • Focus on minimizing operational complexity • Focus treatment and recovery in one location which has high public acceptability and is aligned with local land uses. Note that Option 1b would convert all secondary + disinfection flow treatment to an enhanced tertiary level to increase service levels and the feasibility of a harbor discharge.

Option Set Map	Summary Characterization
Rock Bay and Colwood (Option 2) 	***Engineering Description*** • Rock Bay treats 100% of the base and wet weather flows. • Flows > 3 x ADWF at Clover Point and > 4 x ADWF are screened at those locations before discharge. • Rock Bay is designed to handle 100% of the flow in order to provide the alternative method of disposal for reuse plants. Colwood sized to match the feasibility of irrigation and aquifer recharge in the area at an estimated 10 MLD. • Solids recovery is based on either anaerobic digestion or gasification of solid waste at Rock Bay or at Hartland Landfill; solids at Colwood will be discharged into the CRD trunk line for full treatment at Rock Bay. • Extent of new conveyance infrastructure is second lowest of all option sets; municipal trunk sewers optimization (e.g. Victoria, Oak Bay) will be considered to minimize pumping and piping from Clover outfall back to Rock Bay; no additional outfall at Colwood is required. • Clover Point may include an innovative, compact technology to maximize treatment and discharge to the outfall, thereby reducing the scope/cost of pumping to Rock Bay. • The treated effluent line from Rock Bay to Clover Point could be accessed for reuse/heat recovery projects. ***Levels of Service Differentiators*** • Focus on increasing the quantity of tertiary effluent to meet potential opportunities for water reuse in Colwood (10 MLD); treatment at Rock Bay will focus on meeting regulations and disinfection plus tertiary quality water for local reuse (up to 10 MLD). • Heat recovery is contemplated at/around the plants. • Focus for most of the treatment and recovery at Rock Bay where there is high public acceptability and alignment with local land uses. • Increases level of service for reuse without extensive new infrastructure. • Provides for opportunities to phase in greater reuse as flows increase with growth in Colwood-Langford area.

Option Set Map	Summary Characterization
4-Plant: Rock Bay, Colwood, Esquimalt Nation and East Saanich (Option 3) 	***Engineering Description*** • Rock Bay would serve as a sub-regional facility for all Eastside flows (69%). Esquimalt Nation plant would treat the remainder of flows (31%). Wet weather flows greater than 3 x ADWF at Clover and > 4 x ADWF at Macaulay would be screened before discharge out their respective outfalls. • Colwood reuse facility (10 MLD) would operate year-round and could increase over time to provide for potable substitution of toilet flushing and irrigation; East Saanich plant (3 MLD) would be commissioned initially for irrigation use only (summer). • Extent of new conveyance infrastructure is second highest of all option sets. • Includes either anaerobic digestion or gasification of mixed waste at Rock Bay or at Hartland Landfill; residual sludge from Colwood and East Saanich would discharge into the CRD main for full treatment at the main facilities • Life-cycle costing results for the four plant option could be quickly converted to a two plant option by removing the Colwood and East Saanich facilities (as needed). ***Levels of Service Differentiators*** • Further increase (beyond the 2-plant) of the quantity of tertiary effluent to meet probable opportunities for reuse in Colwood and East Saanich; treatment at Rock Bay and Esquimalt Nation will focus on meeting regulations and disinfection plus tertiary quality water for local reuse. • Heat recovery is contemplated at/around each plant, except East Saanich (seasonal initially). • Treatment and recovery is centered in two locations with high public acceptability at Rock Bay and Esquimalt Nation; other distributed facilities are smaller footprint in Colwood and East Saanich are located in growth centers with moderate acceptability.

Option Set Map	Summary Characterization
7-Plant: Rock Bay, Colwood, Esquimalt (Town), East Saanich, Langford, View Royal and Saanich Core (Option 4) 	***Engineering Description*** • Rock Bay would handle all of the Eastside flows or 69% of the 2030 flows. All the other six plants would provide tertiary treatment – maximizing resource recovery in the Core Area. The Rock Bay Plant will provide all primary treatment requirements for the Eastside. The Esquimalt (Town) plant would provide the primary treatment requirements of the 2 to 4 x ADWF for Westside, as well as tertiary treatment for the 0 to 2 x ADWF from the two First Nations and the Town of Esquimalt. • Wet weather flows greater than 3 x ADWF at Clover and > 4 x ADWF at Macaulay would be screened before discharge out their respective outfalls. • The Colwood plant would provide tertiary effluent for reuse (10 MLD) whereas View Royal and Langford plants would initially provide tertiary water quality without significant reuse (lack of potential demands); a new outfall is anticipated for the Westside distributed facilities. • Extent of new conveyance infrastructure is highest of all option sets. • East and Core Saanich facilities (3 MLD and 5 MLD respectively) would be commissioned initially for irrigation use only (summer) until sufficient demand occurs for toilet flushing. When not in use, flows would leverage existing infrastructure for treatment at Rock Bay • Solids recovery includes either anaerobic digestion or gasification of mixed waste at Rock Bay or at Hartland Landfill; solids would be dewatered at each plant for trucking to Rock Bay or Hartland. ***Levels of Service Differentiators*** • Greatest extent of tertiary effluent quality however provides only marginal increase of potential water reuse. Treatment at Rock Bay and Esquimalt (Town) will focus on meeting regulations and disinfection plus tertiary quality water for local reuse. • Heat recovery at 5 of 7 plants (not East or Core Saanich). • All sites are located in growth centers; public acceptability is greatest for Rock Bay; all six distributed facilities cover a relatively small footprint

March 4, 2016

File: 1692.0037.01

Capital Regional District (CRD)
625 Fisgard Street, PO Box 1000
Victoria, BC V8W 2S6

Attention: **Larisa Hutcheson; GM Parks and Environmental Services**

RE: **Core Area Wastewater - Analysis Summary for Motions of February 26 and March 2, 2016: Cost and Option Set Alternatives**

The *Core Area Liquid Waste Management Committee* (the Committee) is considering multiple option sets for wastewater treatment and resource recovery. Phase 2 comprises technical and financial analysis as well as public consultation to provide foundational information to the Committee to set levels of service, identify facility locations and define amendments to the Liquid Waste Management Plan.

Phase 2 analysis and findings encompass seven option sets ranging from centralized to distributed, secondary to tertiary, and solids recovery technologies and locations. While continuing to consider these seven option sets, the Committee would like to explore options to reduce conveyance costs at already proposed and new locations. This technical letter summarizes analysis stemming from motions of the February 26 and March 2 meetings which is to study elements of preliminary *value engineering*, including contracting levels of service for key elements and to study costing at alternative treatment locations: the information provided in this memo supports Committee is making a decision on a new plan for Core Area liquid waste management.

Motions and Staff direction arising from the February 26 and March 2 meetings include the following cost and option set alternatives:

1. **Costing and feasibility information to reduce the overall costs for a central, tertiary plant at Rock Bay** (i.e. cost saving potential for Option 1b Rock Bay tertiary, at the conceptual planning stage).

2. **3 Plant Tertiary Option:** *two tertiary plants and 1 primary plant to serve two catchments to reduce conveyance costs.*

    a) Costing and feasibility information for two tertiary plants at McLoughlin/Macaulay and Rock Bay with consideration to a primary plant at Clover Point to reduce the scope of conveyance infrastructure through urban areas of Victoria.
        - Flows from the East Coast Interceptor undergo primary treatment at Clover Point (maximizing known available land of <0.5ha at Clover Point) with 0x to 2x dry weather flows conveyed to Rock Bay for tertiary treatment
        - Flows from the Macaulay catchment treated to a tertiary level at McLoughlin (where suitable land space exists)

- Provision for a future plant in Colwood/Langford to accommodate flows for the Westshore beyond 2030
- All solids conveyed to Hartland Landfill for processing and potential integrated resource recovery

3. **2 Plant Configuration at Sites Adjacent the Outfalls:** *two plants to serve two existing catchments with new facilities located at sites adjacent the outfalls to largely eliminate conveyance costs.*

   b) Costing and feasibility information for two tertiary treatment plants for flows from the two existing sewer catchments (Clover Point and Macaulay Point) at McLoughlin/Macaulay and Clover Point sites.
      - Flows from the East Coast Interceptor would be treated to tertiary level at Clover Point, by means of an ultra-compact facility, with site feasibility confirmed by CRD Staff
      - Flows from the Macaulay catchment treated to a tertiary level at McLoughlin (where suitable land exists)
      - Provision for a future plant in Colwood/Langford to accommodate flows for the Westshore beyond 2030
      - All solids conveyed to Hartland Landfill for processing and potential integrated resource recovery

Analysis Summary

Overall Cost Alternative Considerations

The Committee's interest in cost reductions and cost alternatives at the planning-comparison stage is best met by contracting, eliminating or deferring select infrastructure. Future value-engineering exercises will uncover more detailed information which will inform contingencies and likely reduce overall costs, however those decisions are based on the results of subsequent design phases. Cost-alternatives and reductions for select infrastructure based on the motions arising from February 26 and March 2, include:

a) **Defer the installation of water reuse systems** to save initial capital costs and allow for gradual installation of reuse systems as warranted. There are no water reuse systems in any of the three option set alternatives.

b) **Defer upgrades to the existing long outfalls** (>1,500m) because their condition is likely adequate to carry beyond the 2030 design scenario.

c) **Install moderate-length outfalls (250m) for tertiary quality water** at Clover and/or Macaulay Points to avoid upsizing the long outfalls for future flows.

d) **Eliminate the Barnhard Pump Station** in option sets with 2 or more plants to eliminate the cost of conveying flows from the Macaulay catchment (flows from West Saanich and Vic West) back to eastside plants (previously included to respect municipal service governance)

e) Include the costs to convey solids to Hartland Landfill however these costs are separated from the base total to allow for a straight-line comparison to the costs of the option sets previously presented to the Committed (which accounted for a solids recovery plant in Rock Bay)

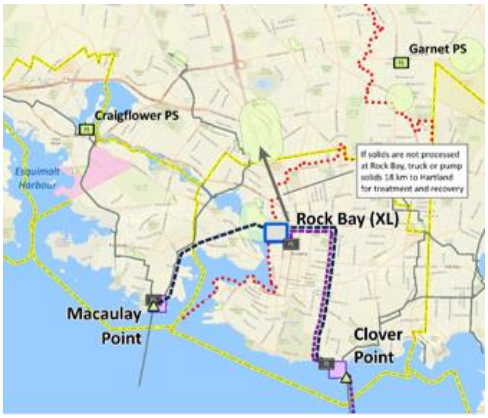
Considerations for a Westshore Plant (e.g. Colwood, Langford) for 2030

Each of the two new option set alternatives that include the McLoughlin site also include the provision for a Westshore plant serving Colwood and or Langford. Multiple option sets prepared for both the *Westside Select Committe*e and the *Core Area Committee* during Phase 2 provide key insights into the cost feasibility of a plant there.

A Westshore plant is considered suitable and more cost-effective for the future, toward 2045, so as to locate additional treatment capacity for growth, near the actual location of growth. Including a plant in the option set alternatives for the 2030 scenario would increase overall costs because of the loss in economies of scale for smaller plants and more significantly, due to the need for additional infrastructure to convey treated effluent to either Macaulay Point or a new outfall.

Cost and Technical Feasibility Results for Three Option Set Alternatives

Results summaries per option set outline the considerations and cost reductions with each of the three option set alternatives. Overall considerations follow the technical results table, to support upcoming Committee dialogue.

Map	Description + Cost Alternatives
	**1 Plant Rock Bay Tertiary** Central, tertiary plant at Rock Bay. ***Cost Management*** • Defer water reuse until there are sufficient connections for a system • Defer upsize to existing outfalls; instead install 250m outfalls for higher quality effluent • Although not reflected in costs in this letter, further optimization could reduce costs through conveyance • Cost reduced by $54M Capital 2030 Cost: **$1,077M**

Map	Description + Cost Alternatives
	**3 Plant: Clover Pt., McLoughlin and Rock Bay Tertiary** 2 tertiary plants and 1 primary plant to serve both catchments and to reduce conveyance costs. ***Cost Management*** • Reduce size of pipes and pumps from Clover to Rock Bay by up to 45%; • Eliminate Barnhard PS and provide adequate capacity for each existing catchment • Defer water reuse until there are sufficient connections for a system • Defer upsize to existing outfalls; instead install 250m outfalls for higher quality effluent • Suitable land exists at all locations; primary treatment at Clover has a projected footprint of 0.4ha Capital 2030 Cost: **$1,089M**
	**2 Plant: Clover Pt. and McLoughlin Tertiary** Two plants to serve the existing catchments with new facilities located at sites adjacent the outfalls to largely eliminate conveyance costs. ***Cost Management*** • Eliminate conveyance infrastructure from Clover or Macaulay points through urban areas • Defer water reuse until there are sufficient connections for a system • Defer upsize to existing outfalls; instead install 250m outfalls for higher quality effluent • A tertiary plant Clover point requires 1.25ha of land, yet further site analysis and design work is needed to potentially reduce this footprint further. Capital 2030 Cost: **$1,052M**

Overall Cost Considerations for Committee

The results of recent analysis suggest that key cost elements can be eliminated or deferred to manage overall costs. And further, that locating two plants at each outfall is a key strategy to reduce the cost of conveyance and this approach enables greater levels of treatment at similar or less cost to a centralized

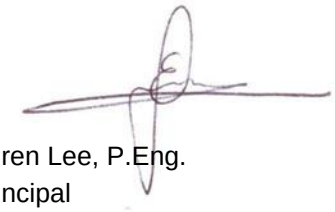
option. However, land availability at Clover Point must be determined if a tertiary plant is to be considered at this location.

Further consideration to the three plant configuration with primary treatment at Clover maximizes the land and sites available as part of the Committee's motion, and reduces the size of conveyance infrastructure, and offers treatment plants at sites with confirmed land areas. Further route optimization through urban areas (a standard but important optimization exercise) is a fundamental need for subsequent design phases, to both lower costs and to minimize impacts to neighborhoods.

Thank you for the opportunity to provide ongoing services to the Committee.

Sincerely,

URBAN SYSTEMS LTD.



Ehren Lee, P.Eng.
Principal

/el

Cc: Dan Telford, Senior Manager Environmental Services, CRD

Encl: Cost Breakdowns for Three Alternatives

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Cost Components for Option 1b - One Tertiary Plant (x 1000)

Cost Component	Capital Cost Incurred [1]	
	2015	2030
1. Conveyance		
(a) Clover Pt PS and Forcemain to Rock Bay	$ 51,400	N/A
(b) Macaulay Pt PS and Forcemain to Rock Bay	$ 65,400	N/A
(c) Effluent PS and Forcemain to Clover Point	$ 83,900	N/A
(d) Tertiary Outfall Clover	$ 6,500	N/A
Conveyance Subtotal:	$ 207,200	$ -
2. Liquid Treatment (Tertiary)	$ 500,000	$ 220,000
3. Solids Treatment - AD	$ 258,000	$ 90,600
4. Existing System Capacity Upgrades		
(a) Craigflower PS - Constructed	$ 12,100	N/A
(b) Arbutus Attenuation Tank- incl land	$ 20,000	N/A
(c) Siphon Extension (1600 m)	$ 7,500	N/A
(d) Upgrade Currie St PS	$ 2,300	N/A
(e) Upgrade East Coast Interceptor (1400 m)	$ 3,100	N/A
Existing System Subtotal:	$ 45,000	$ -
5. Land Costs*	$ 67,200	N/A
Total:	**$ 1,077,400**	**$ 310,600**
6. Solids Conveyance - All to Hartland	$ 36,400	

[1] Includes all contingencies, engineering, etc. outlined in TM #1

* Land costs include raw land, site development, contingencies and pro-rated mitigation sum; all data sourced by CRD Real Estate.

Cost Components for 3 Plants: Clover-Rock Bay - McLoughlin (x 1000)

Cost Component			Capital Cost Incurred [1] 2015	Capital Cost Incurred [1] 2030
1.	Conveyance - Rock Bay & Clover			
	(a)	Clover Pt PS and Forcemain to Rock Bay	$ 29,600	*TBD*
	(b)	Effluent PS and Forcemain to Clover Point	$ 29,600	*TBD*
	(c)	Clover Pt Primary + Outfall Pumpstations	$ 41,100	*TBD*
	(d)	New Tertiary Only Outfall	$ 4,200	*TBD*
		Conveyance - Rock Bay Subtotal:	$ 104,500	$ -
2.	Liquid Treatment - Rock Bay (Tertiary)		$ 180,700	*TBD*
3.	Liquid Treatment - Clover Point (Primary)		$ 38,700	*TBD*
4.	Conveyance - McLoughlin			
	(a)	Macaulay Pt PS and Forcemain to McLoughlin	$ 54,700	*TBD*
	(b)	Effluent PS to Outfall	$ 44,900	*TBD*
	(c)	New Tertiary Only Outfall	$ 5,700	*TBD*
		Conveyance - McLoughlin Subtotal:	$ 105,300	$ -
5.	Liquid Treatment - McLoughlin (Tertiary)		$ 293,100	*TBD*
6.	Solids Treatment - AD at Hartland		$ 258,000	*TBD*
7.	Existing System Capacity Upgrades			
	(a)	Craigflower PS - Constructed	$ 12,100	N/A
	(b)	Arbutus Attenuation Tank- incl land	$ 20,000	N/A
	(c)	Siphon Extension (1600 m)	$ 7,500	N/A
	(d)	Upgrade Currie St PS	$ 2,300	N/A
	(e)	Upgrade East Coast Interceptor (1400 m)	$ 3,100	N/A
		Existing System Subtotal:	$ 45,000	$ -
8.	Land Costs*		$ 63,500	N/A
		SubTotal	**$ 1,088,800**	*TBD*
9.	Solids Conveyance - All to Hartland		$ 47,800	*TBD*

[1] Includes all contingencies, engineering, etc. outlined in TM #1

* Land costs include raw land, site development, contingencies and pro-rated mitigation sum; all data sourced by CRD Real Estate.

Cost Components for 2 Plants: Clover - McLoughlin (x 1000)

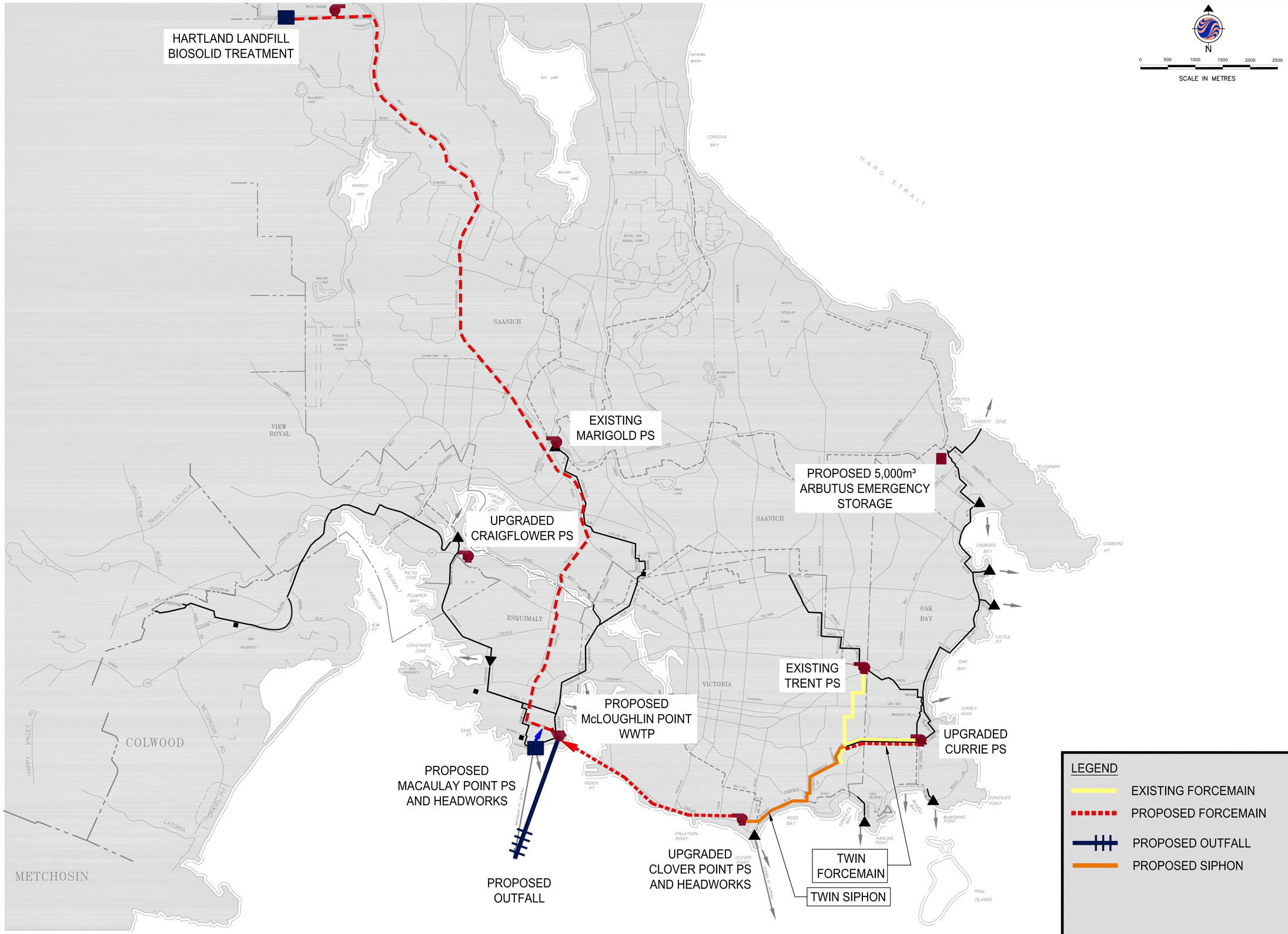
Cost Component			Capital Cost Incurred [1]	
			2015	2030
1.	Conveyance - Clover			
	(a)	Clover Pt RS + TE Pumpstations	$ 54,500	*TBD*
	(b)	New Tertiary Only Outfall	$ 4,200	*TBD*
		Conveyance - Clover Subtotal:	$ 58,700	$ -
2.	Liquid Treatment - Clover Point (Tertiary)		$ 219,400	*TBD*
3.	Conveyance - McLoughlin			
	(a)	Macaulay Pt PS and Forcemain to McLoughlin	$ 54,700	*TBD*
	(b)	Effluent PS to Outfall	$ 44,900	*TBD*
	(c)	New Tertiary Only Outfall	$ 5,700	*TBD*
		Conveyance - McLoughlin Subtotal:	$ 105,300	$ -
4.	Liquid Treatment - McLoughlin (Tertiary)		$ 293,100	*TBD*
5.	Solids Treatment - AD at Hartland		$ 258,000	*TBD*
6.	Existing System Capacity Upgrades			
	(a)	Craigflower PS - Constructed	$ 12,100	N/A
	(b)	Arbutus Attenuation Tank- incl land	$ 20,000	N/A
	(c)	Siphon Extension (1600 m)	$ 7,500	N/A
	(d)	Upgrade Currie St PS	$ 2,300	N/A
	(e)	Upgrade East Coast Interceptor (1400 m)	$ 3,100	N/A
		Existing System Subtotal:	$ 45,000	$ -
7.	Land Costs*		$ 72,000	N/A
		SubTotal	**$ 1,051,500**	*TBD*
8.	*Solids Conveyance - All to Hartland*		*$ 48,300*	

[1] Includes all contingencies, engineering, etc. outlined in TM #1

* Land costs include raw land, site development, contingencies and pro-rated mitigation sum; all data sourced by CRD Real Estate.

Appendix B

Stantec Consulting Options Configuration



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Stantec

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DRAWN	PRC	DATE	06/08/11
SCALE HORIZONTAL	N.T.S	CHECKED	
SCALE VERTICAL	–	APPROVED	RAF

CORE AREA WASTEWATER TREATMENT PROGRAM

McLOUGHLIN OPTION 1A PRIME 2
KEY PLAN

CONTRACT NUMBER	DRAWING NUMBER	ISSUE	SHT. No. OF
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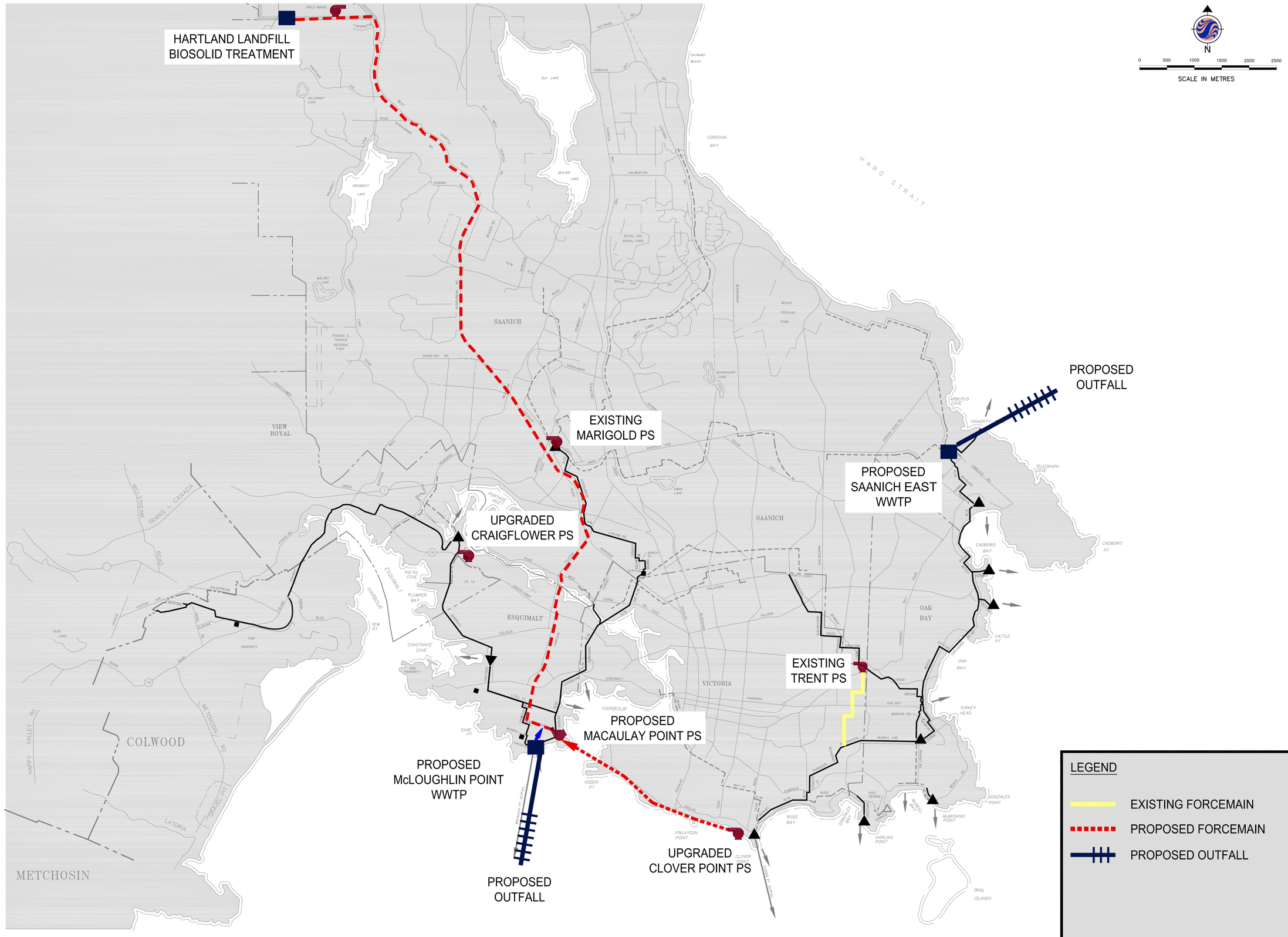

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April 15, 2010 11:54 am

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SCALE HORIZONTAL	N.T.S	CHECKED	
SCALE VERTICAL	–	APPROVED	RAF

CORE AREA WASTEWATER TREATMENT PROGRAM

OPTION 1A PRIME (REVISED)
KEY PLAN

CONTRACT NUMBER	DRAWING NUMBER	ISSUE	SHT. No. OF
–	FIGURE 2.2	–	– –

N

0 500 1000 1500 2000 2500

SCALE IN METRES

EXISTING MARIGOLD PS

EXISTING CRAIGFLOWER PS

PROPOSED 12,000m³ ARBUTUS EMERGENCY STORAGE

EXISTING TRENT PS

PROPOSED MACAULAY PT. PS

TWIN FORCEMAINS

UPGRADED CURRIE PS

UPGRADED CLOVER POINT PS

PROPOSED WEST SHORE WWTP

CONTROLLED ACCESS ZONE

PROPOSED OUTFALL

LEGEND

EXISTING FORCEMAIN

PROPOSED FORCEMAIN

PROPOSED OUTFALL

PROPOSED SIPHON

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April 15, 2010 2:51 p.m.

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DRAWN	PRC	DATE	04/12/10
SCALE HORIZONTAL	N.T.S	CHECKED	
SCALE VERTICAL	–	APPROVED	RAF

CORE AREA WASTEWATER TREATMENT PROGRAM

OPTION 1B (REVISED)
KEY PLAN

CONTRACT NUMBER	DRAWING NUMBER	ISSUE	SHT. No. OF
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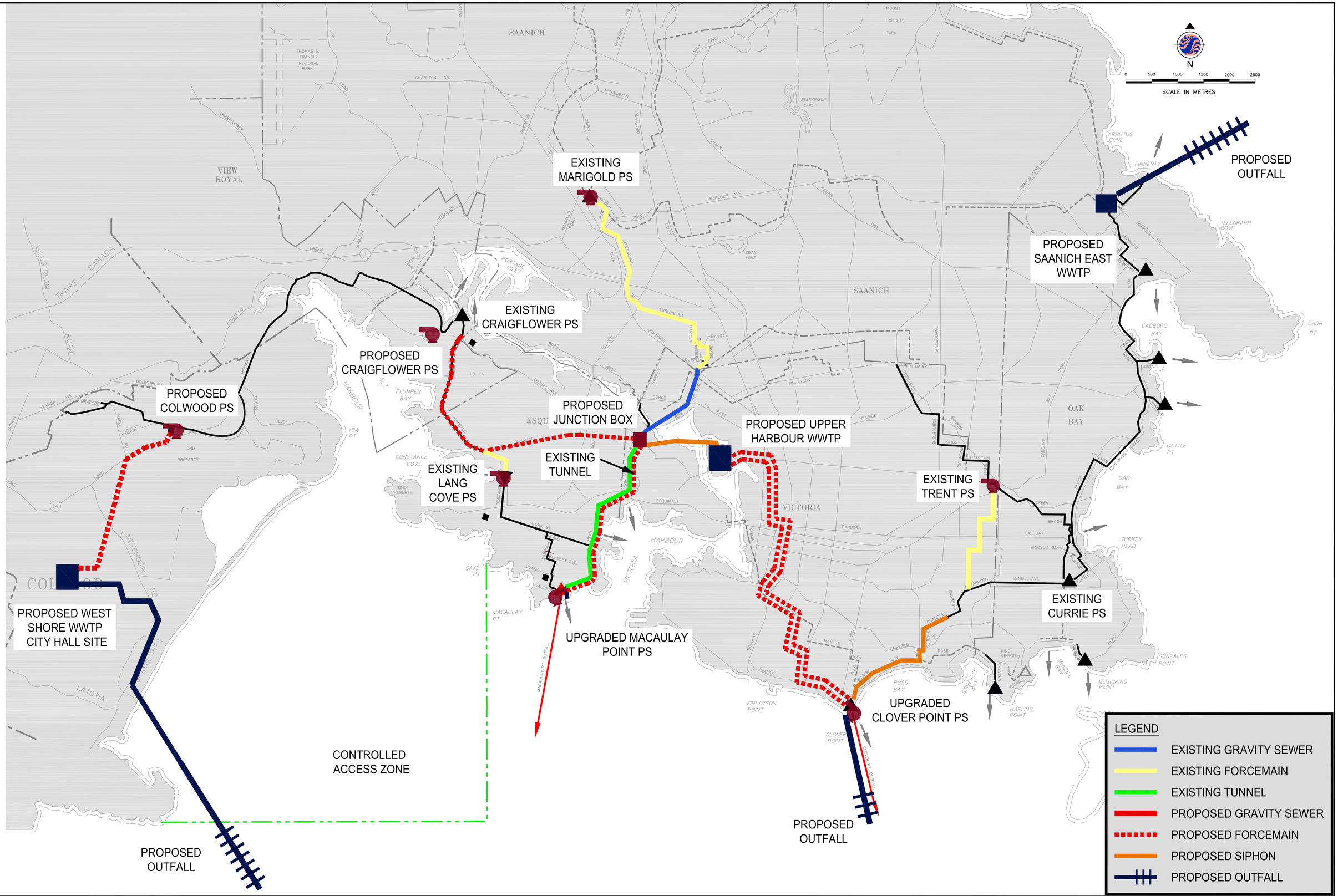

SEAL	BY	DATE	No.	REVISION	ENG.	No.	DATE	ISSUE

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Capital Regional District | Environmental Services			
DESIGNED	PP	SURVEYED	–
DRAWN	SN	DATE	03/15/10
SCALE HORIZONTAL	N.T.S	CHECKED	
SCALE VERTICAL	–	APPROVED	RAF

CORE AREA WASTEWATER TREATMENT PROGRAM

OPTION 1D
KEY PLAN

CONTRACT NUMBER	DRAWING NUMBER	ISSUE	SHT. No. OF
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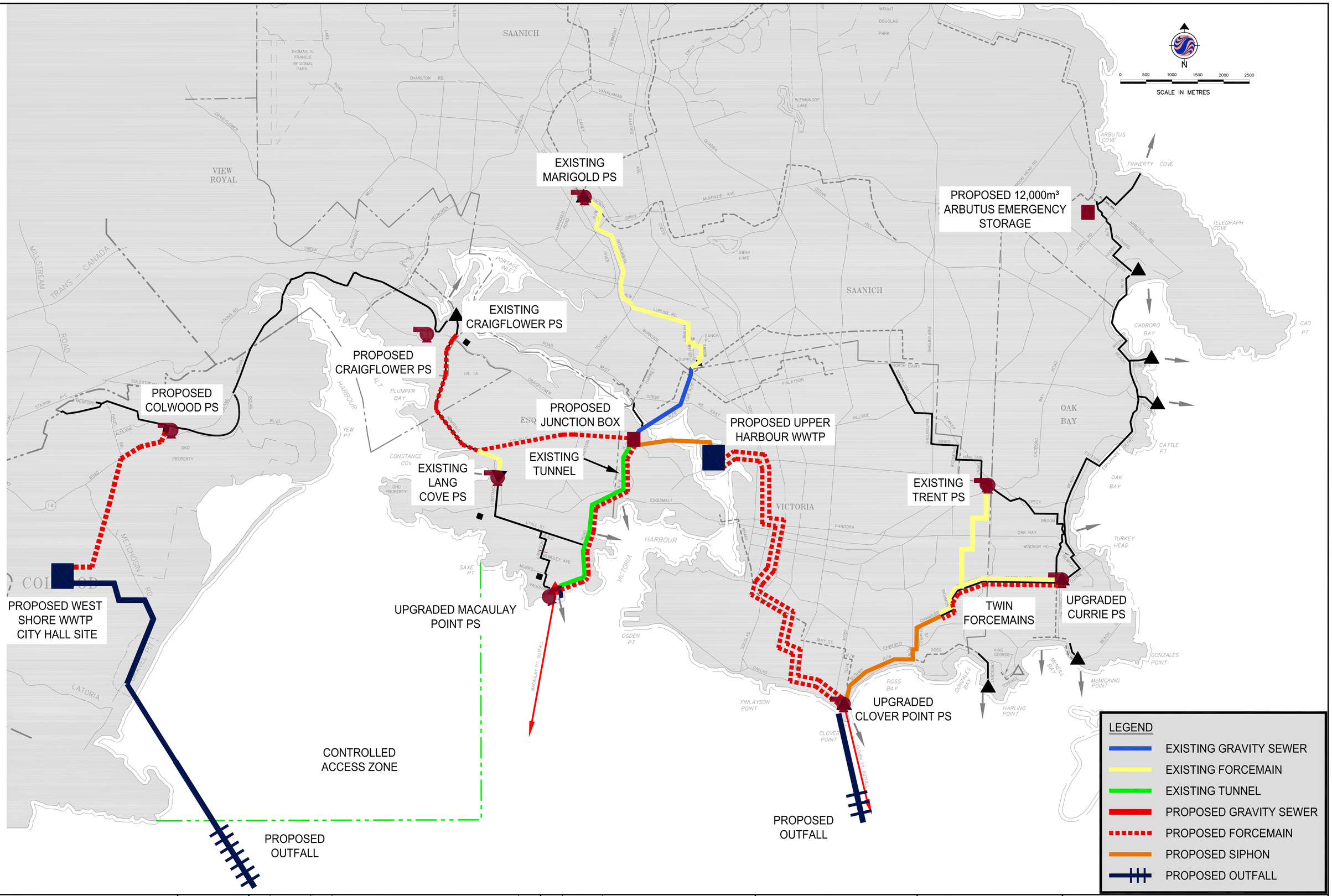

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April 23, 2010 8:40 a.m.

Brown AND Caldwell
Stantec

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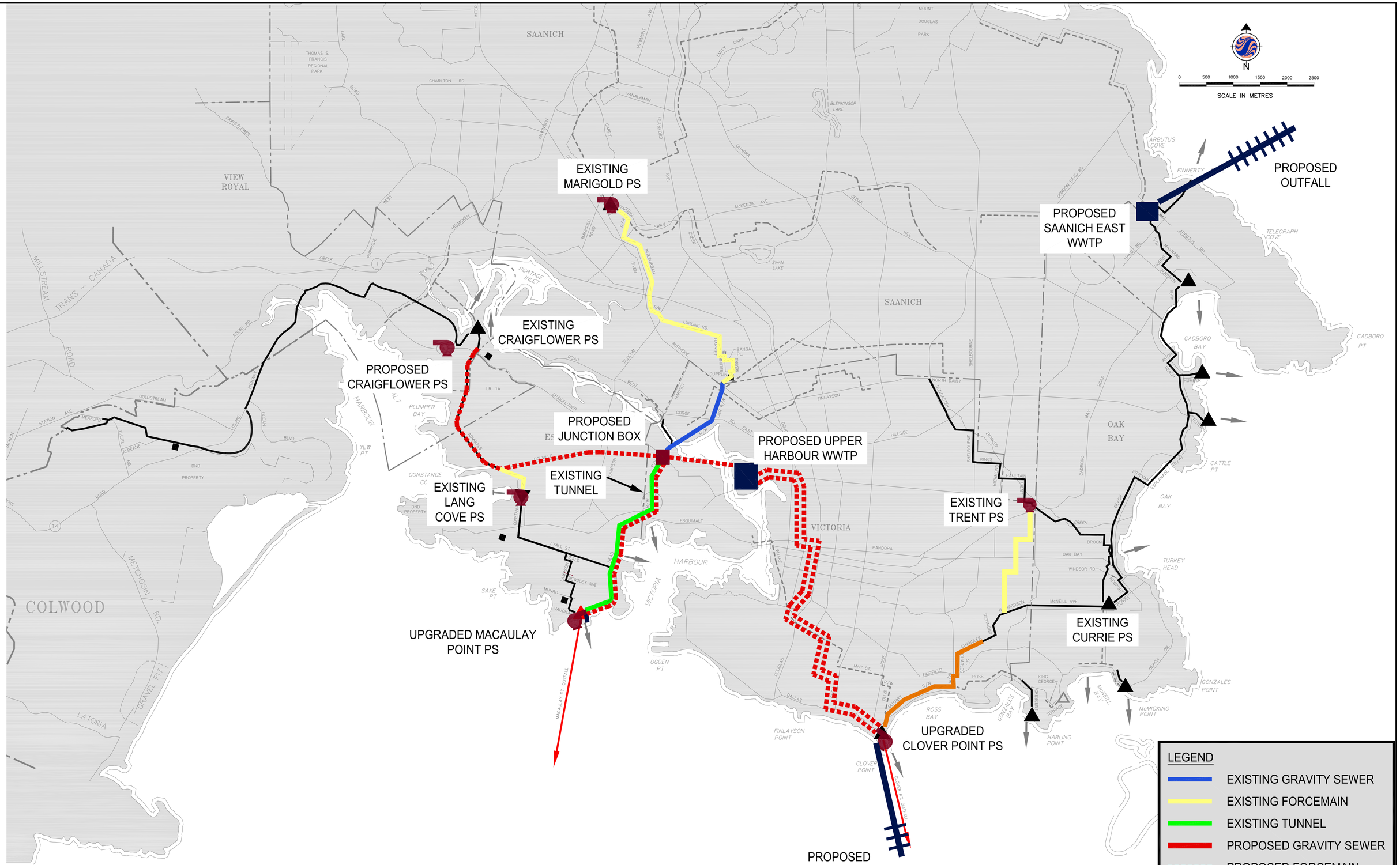
Capital Regional District | Environmental Services

DESIGNED	PP	SURVEYED	–
DRAWN	SN	DATE	03/15/10
SCALE HORIZONTAL	N.T.S	CHECKED	
SCALE VERTICAL	–	APPROVED	RAF

CORE AREA WASTEWATER TREATMENT PROGRAM

OPTION 1E
KEY PLAN

CONTRACT NUMBER	DRAWING NUMBER	ISSUE	SHT. No.
–	FIGURE 2.5	–	– OF –



Xrefs: overall map.DWG; A1-CRD-TITLE.DWG;
Drawing: \\Vic1490\1490096002\DRAWINGS\FIGURES\10.04.15\FIG 2-6.DWG
April 23, 2010 8:28 a.m.

Stantec

SEAL	BY	DATE	No.	REVISION	ENG.	No.	DATE	ISSUE

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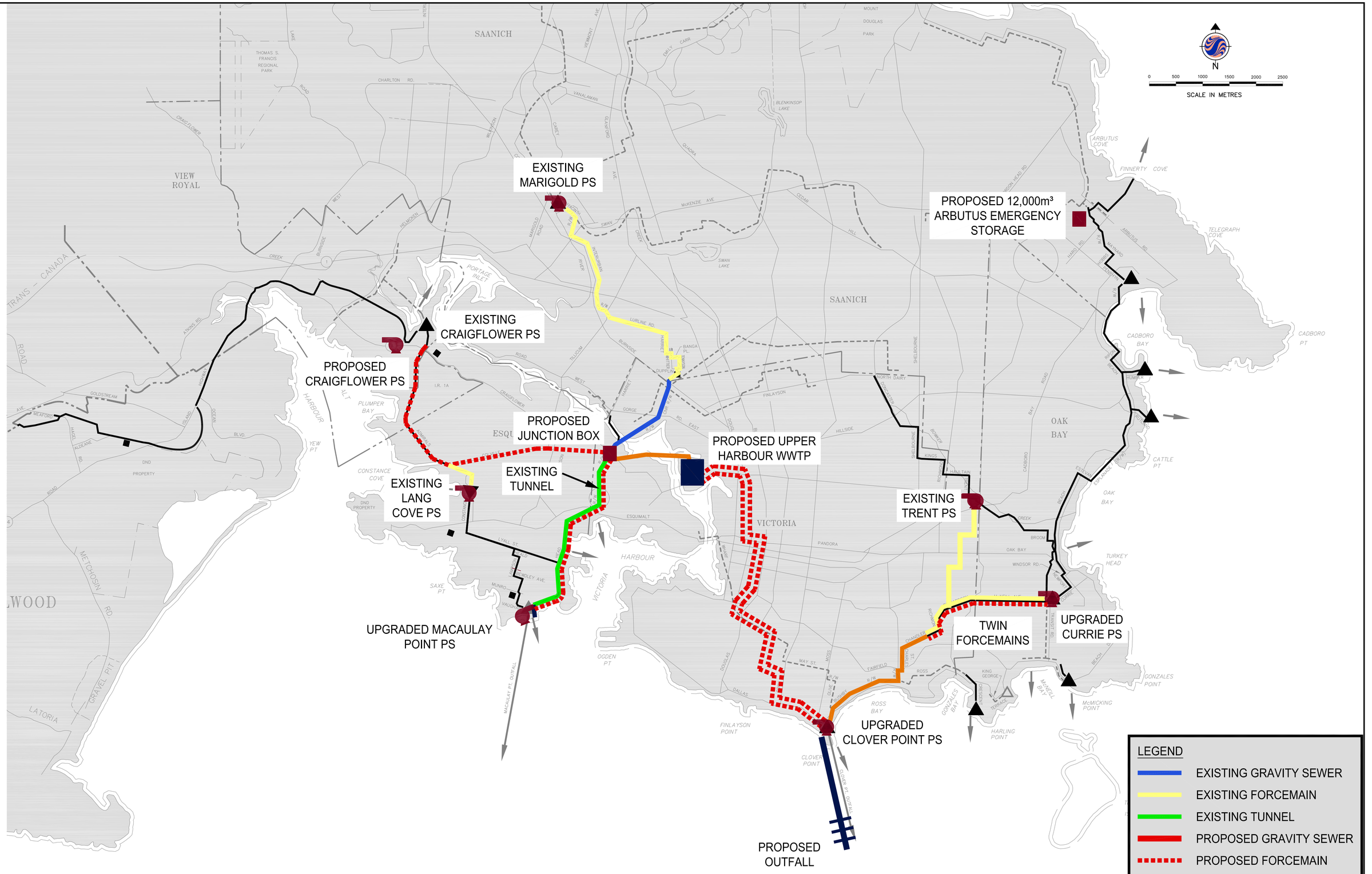
Capital Regional District | Environmental Services

DESIGNED	PP	SURVEYED	–
DRAWN	SN	DATE	03/15/10
SCALE HORIZONTAL	N.T.S	CHECKED	
SCALE VERTICAL	–	APPROVED	RAF

CORE AREA WASTEWATER TREATMENT PROGRAM

OPTION 1F
KEY PLAN

CONTRACT NUMBER	DRAWING NUMBER	ISSUE	SHT. No.
–	FIGURE 2.6	–	– OF –



Xrefs: overall map.DWG; A1-CRD-TITLE.DWG;
Drawing: V:\1490\1490098002\DRAWINGS\FIGURES\10.04.15\FIG 2-7.DWG
April 23, 2010 8:32 a.m.

Stantec

SEAL	BY	DATE	No.	REVISION	ENG.	No.	DATE	ISSUE

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DESIGNED	PP	SURVEYED	–
DRAWN	SN	DATE	04/12/10
SCALE HORIZONTAL	N.T.S	CHECKED	
SCALE VERTICAL	–	APPROVED	RAF

CORE AREA WASTEWATER TREATMENT PROGRAM

OPTION 1G
KEY PLAN

CONTRACT NUMBER	DRAWING NUMBER	ISSUE	SHT. No.
–	FIGURE 2.7	–	– OF –

Appendix F

Technical Oversight Panel Summary Report

Status Report #1 from the Technical Oversight Panel to the CALWMC

September 4, 2015

Summary statement

Planning: The Core Area liquid Waste management program has been reset so that it is now at the **pre-design options stage**. *The pre-design options stage will include the development of options, the review of those options, and the technical, political and funding approval of preferred options for wastewater and bio-solid processing. These options may be centralized, sub-regional or distributed.* The pre-design option stage will be followed by the **indicative pre-design and costing stage** for the approved options.

Implementation: The **design, contract documents and permit approval stage** will be followed by the **bidding and construction stage**, and finally by the **operations and occupancy phase.**

The Technical Oversight Panel has been engaged to review and advise on the work being undertaken in the planning pre-design stages by Urban Systems and Carollo, who started work this week. The pre-design stage quality assurance protocols (policy and procedures, schedules for meetings, deliverables and milestones, communications plan, org chart, finance info) and ToP contracts are not in place, and there is no dedicated skilled project manager for the planning/pre-design stage process identified at this time.

Recommended action for this period

1. **Contracts for consultants and ToP**

Brent Reems of CRD has prepared the contract paperwork regarding general policy. Letters specific to this assignment have been prepared. Contracts need to be executed and minor queries addressed. CRD business cards and email addresses also need to be set up.

2. **Project specific policy and procedures plan**

This plan should identify all of the policy and procedures that will apply to this project. The project charter that is being developed may form part of this plan. In the meantime, CRD corporate officer Sonia Santarossa spoke to ToP September 2, 2015 to ensure that the policies of the CRD are understood and complied with by the new teams.

3. **Planning/Pre-design stage project manager and full time scheduler**

ToP recommends that these two individuals be hired by the owner, CRD, as full time resources dedicated to the CALWMP with skills in project management, process innovation, project planning, project scheduling using MS Project, all for large construction projects. These individuals could eventually report to the leadership hired for the implementation phase of the project. This week, CRD appointed Dan Telford of CRD as PM and assigned a CRD scheduler to the project.

4. **Integrated planning/pre-design stage meeting, deliverables and milestones schedule**

This integrated planning/pre-design stage schedule is being initially established by the chair of Top in the absence of a planning/pre-design stage project PM and scheduler, but should be formally underway

mid-September with the whole team. The integrated pre-design schedule should include the establishment and coordination of regular teleconference and face to face *meetings.*

Core Area Liquid Waste Management Committee (CALWMC) – bi-weekly Wednesday 9am

Urban Systems/Carollo face to face with ToP – September, October, November bi-weekly alternating with teleconference (dates tbc)

ToP reporting to CALWM C – September 9, 2015, (October, November dates tbc)

ToP teleconference – September 2, 2105 (October, November bi-weekly alternating with face to face, dates tbc)

ToP/Urban Systems/ Carollo face to face with private sector technology vendors – October date tbc

ToP meeting with Eastside and Westside groups – September date tbc

Urban systems/ Carollo meetings – per workplan, exact dates tbc

ToP chair with Westside co-chairs – face to face date tbc

Other – tbc

This integrated planning/pre-design schedule should also include dates for the *deliverable reports and reviews* that are required to move the process forward including the outline of the various options:

Urban systems/ Carollo – reports delivered as per workplan – dates tbc

ToP – review period and dates for submission of recommendations – dates tbc

CALWMC / eastside/westside– review period and approval – dates tbc

Other - tbc

This integrated planning/pre-design schedule should also include key *milestone* dates for funding and preliminary re-zoning (if required) approvals of the preferred option

Municipal approval and re-zoning if required for preferred option – date tbc

Provincial approval if required – date tbc

Federal funding approval for preferred option – date tbc

Other – tbc

5. Planning/pre-design stage roles and organization chart

This chart will keep all team members on track with reporting, communication and delivery requirements. This chart should indicate roles, reporting and contractual relationships between:

CALWMC members, CRD staff, Eastside and Westside Group member, ToP members, all consultant key individuals, others

6. Planning/pre-design stage media communications plan and public outreach plan

ToP recommends that CALWMC hire an outside media communications expert to prepare a media communications and a public outreach plan. This plan should identify the public face of the project (recommend that this always be the chair of the CALWMC) and the technical resources. This plan should be proactive with a schedule of media releases to clearly communicate to the public the progress being made and be based on the integrated schedule for the pre-design phase of the project. A project statement that reflects the current state of the project should be updated weekly for all team members to reference if needed when speaking to the public or the media.

Status Report #2 from the Technical Oversight Panel to the CALWMC

September 25, 2015

Summary statement

The Core Area Liquid Waste management project is currently at the Task #1 stage of the development of the option sets.

The consultant team completed the Kick off meeting for Task #1 on September 14, 2015 with TOP.

The consultant team is preparing Technical Memo #1 and accompanying presentation materials, detailing design criteria, cost unit rates and analysis methodology and criteria for the evaluation of the option sets. These materials will be reviewed by TOP before presentation to the CALWMC in October.

The consultant team is also working with the CRD in the preparation of an updated detailed project schedule indicating deliverables, reviews and approvals.

The CRD is preparing a project charter which will be referenced by the consultant team and TOP.

The CRD is preparing an organization chart showing clear lines of reporting and communication which will be reviewed by TOP and presented to CALWMC.

The CRD established the Fairness and Transparency policy and procedures for this project in September meetings with the Fairness and Transparency Officer.

The CRD executed the TOP contracts in September.

The CRD assigned Dan Telford as CRD project leader in September.

Recommended action for this period

1. **Updated Detailed Critical Path Project Schedule**

A draft critical path schedule has been prepared by CRD with input from the consultant team. More inputs are required. The critical path schedule will be reviewed by TOP prior to issue to the CALWMC meeting on October 14, 2015. This schedule should indicate the critical path between all deliverables, reviews, meetings and approvals required for this phase of the work. Impacts on the funding schedule, if any, will be highlighted.

2. **Organization chart**

A draft organization chart will be prepared by CRD and reviewed by TOP prior to issue to the CALWMC meeting on October 14, 2015. This chart will keep all team members on track with reporting, communication and delivery requirements. This chart should indicate roles, reporting and contractual relationships between: CALWMC members, CRD staff, Eastside and Westside Group member, TOP members, all consultant key individuals, and others.

3. **Technical Memo #1**

A draft Technical Memo #1 has been prepared by Urban Systems and is in the process of review by TOP prior to issue to the second CALWMC meeting on October 14, 2015. TOP and the consultants discussed

the draft Technical Memo #1 Monday September 28, 2015. Technical criteria for flows need to be reviewed again. Regulatory approvals criteria needs to be addressed. Life cycle costing criteria need to be added. System solution options will need to be compared on both a life cycle cost, and a capital cost, basis. TOP will follow with written comments and will continue to provide input for discussion at the next meeting scheduled for Tuesday October 6, 2015. The consultants will revise the Technical Memo #1 as required for submission to the CALWMC meeting on October 14, 2015.

4. Final Deliverable, Technical Memo #4 Table of Contents

The consultants and TOP will work together to determine the Final Technical Memo #4 content to support the eventual funding and rezoning requirements of the project. The draft outline of the content will be provided to the CALWMC October 14, 2015 for comment. CRD will provide the outline of key TM#4 submission requirements to support the eventual funding and rezoning applications by others.

5. Private Sector Canvas

A meeting with vendors will be set up on the 23rd of October with TOP and the consultant team to both follow up on the RFI responses and to allow others to participate. The objective is to gain a good understanding of all systems options available.

6. Eastside and Westside participation

TOP met with Westside WTRRSC representatives on September 15, 2015. The consultants continue to be engaged by them. TOP and the consultants will meet again with both the Eastside and Westside representatives in October. Both the Eastside and the Westside must have their site options confirmed by October 14, 2015 for the project to stay on schedule.

Status Report #3 from the Technical Oversight Panel to the CALWMC

October 9, 2015

Summary statement

The consultant team that ToP is overseeing is currently completing **Task #1**. **:** At the conclusion of this task, the consultants will present the CRD with the following:
☐ Kick-off meeting minutes - **done**
☐ Technical Memo #1 (TM#1) and accompanying presentation materials, detailing design criteria, cost unit rates and analysis methodology and criteria for the evaluation of the Option Sets. – **draft** to be submitted to October 14, 2014 CALWMC meeting
☐ Updated detailed project schedule – **partially complete**

ToP has reviewed the first draft of the TM#1 provided by the consultants October 8, 2015 and will provide comments on the second draft for October 14, 2015. The second draft of TM#1 will be issued to the CALWMC October 14, 2015 for approval. TM#1 will be finalized by the consultants once the final ToP comments have been received. The final TM#1 will be issued to the CALWMC November 4, 2015. (It is expected that this final version will not differ substantively from the final draft version.)

The reviews of the TM#1 were not coordinated as the detailed schedule was incomplete. The critical path schedule will be updated and detailed to include consultant draft submission date, ToP review period, consultant resubmission timeline, ToP final review date, consultant final submission date to CALWMC for all future technical memos including TM#2, TM#3, TM#4. Public meetings, consultant and ToP meetings, CALWMC meetings and approvals will be integrated into the detailed critical path schedule.

All teleconference meetings in this period have been open to the public.

ToP members have not been paid which is becoming a concern, and there is an issue with the USA work visa for the Florida advisor. CRD is working on resolving the paperwork issues. We expect payments to be resolved in time for the face to face meeting October 22, 2015.

Recommended action for this period

1. **Updated Detailed Critical Path Project Schedule**

A draft critical path schedule was prepared by CRD with input from the consultant team and was reviewed by TOP. This critical path schedule will be more detailed with input from the consultant team and a summary critical path schedule will be available to the CALWMC after October 14, 2015. This schedule indicates the critical path between all deliverables, reviews, meetings and approvals required for this planning phase of the work. Impacts on the funding schedule, if any, will be highlighted. The key dates agreed are as follows: TM#1 final to CALWMC November 4, TM#2 final to CALWMC November 23, TM#3 final to CALWMC (Dec. 2, 2015? tbc) for CALWMC decision making on approval of sites and systems to recommend to CRD Board, TM#4 final to CALWMC (Jan 11, 2016? tbc) for basis of funding submissions. There is still work to be done on the critical path schedule.

To keep the team on track, ToP recommends that CRD issue a 'three week rolling' updated version of the schedule to the consultant team and to the Technical Oversight Panel every Monday.

2. **Organization chart**

A draft organization chart was prepared by CRD, reviewed by TOP, and will be issued to the team for review during the teleconference October 13, 2015. This chart will keep all team members on track with reporting, communication and delivery requirements. This chart indicates roles, reporting and contractual relationships between: CALWMC members, CRD staff, Eastside and Westside Group member, TOP members, all consultant key individuals, and others.

3. **Technical Memo #1**

The draft TM#1 submitted by the consultant team was reviewed by ToP and discussed in a teleconference October 6, 2015. The revised draft TM#1 was issued October 8, 2015 by the consultants and will be reviewed by ToP members in the teleconference October 13, 2015 with comments due October 16, 2015. The final TM#1 will be submitted by the consultants to the CALWMC November 4, 2015. The ToP review of the draft TM#1 memo included comments on the flow assumptions, the bypass assumptions on alternative membrane systems, the planning horizon, the flow source, and watershed connection, references to Stantec study, regulatory standards and proposed standards, value analysis of reuse and recycle and recharge options, and detailed comments on the costing section especially around life cycle cost analysis.

ToP recommends that the CALWMC accept the draft TM#1 as submitted, and confirms that the final TM#1 will be delivered y the consultants November 4, 2015. There should be no substantive changes between draft TM#1 and final TM#1.

To ensure the highest level of accuracy and reliability of the costing assumptions for this large and complex project, ToP recommends that the consultant team engage or assign an estimator dedicated to this phase of the work with expertise in life cycle costing, project delivery method impacts and large infrastructure projects.

To ensure the accuracy of the assumptions ToP recommends that CRD provide water supply projections.

4. **Technical Memo #2**

The consultant team is ready to proceed with the work required in TM#2. At the conclusion of TM#2, the consultants will present the CRD with the following:

- Technical Memo #2, detailing the finalized option sets that will form the basis for the costing and the financial analysis, to be completed in Task 3. TM#2 will include general site and system characterizations, operational strategies descriptions of treatment processes including influent and effluent, water quality and quantity, residuals treatment/management, flow scenarios and growth, phasing, performance targets, and approvals requirements.
- Presentation Materials

To maintain the schedule, ToP recommends that the consultants be instructed by CALWMC to proceed with developing draft Technical Memo #2 while completing the final TM#1

5. Final Deliverable, Technical Memo #4 Table of Contents

The consultants and TOP will work together to determine the Final Technical Memo #4 content to support the eventual funding and rezoning requirements of the project. The draft outline of the content will be provided to the CALWMC for comment.

To get ahead of the content requirements for the final report, ToP recommends that CRD provide any metrics, cost base timelines or other formatting information that will be required by funding agencies or zoning authorities that can reasonably be incorporated into TM#4 (under the original terms of reference) to ensure that the format of the information in TM#4 is the most useful format for the CRD

6. Public Sector Canvas

A preliminary meeting with interested vendors and project delivery agents is being set up for October 23, 2015 with TOP and the consultant team. CRD is organizing a 'go to' style meeting and receiving technical information packages from interested parties now. The objective is to gain a good understanding of all systems options and delivery options available at this time. The objective is to respond to those that have expressed interest. Active solicitation of proposals will occur later during the implementation phase.

ToP asks the CALWMC to forward contact information of all interested vendor parties who have approached the CALWMC.

Status Report #4 from the Technical Oversight Panel to the CALWMC

October 28, 2015

Summary statement

The consultant team that ToP is overseeing is currently completing **Task #2**. **:** At the conclusion of this task, the consultants will present the CRD with the following:

- **Technical Memo #2 (TM#2),** detailing the finalized option sets that will form the basis for the costing and financial analysis, to be completed in Task 3. TM#2 will include general site and system characterizations, operational strategies descriptions of treatment processes including influent/effluent water quality and quantity, residuals treatment/management, flow scenarios and growth phasing, performance targets, and approvals requirements.
- **Presentation Materials** from the CALWMC/CRD Meeting

ToP has reviewed the **final TM#1** and it will be submitted by the consultants to the November 4, CALWMC meeting for approval.

ToP worked with the consultants to oversee the development of TM#2, and will review **draft TM#2** now and provide comments to the consultant team for November 6, 2015.The consultant team will provide the CALWMC with the **final TM#2** November 18.

Phase 2 activities for TM#1-4 have been coordinated and the **detailed critical path schedule** is now complete and available to the CALWMC

Teleconference meetings October 13, 20 and private vendor presentations October 23 in this period have been open to the public.

There is an issue with the USA work visa for the Florida advisor. CRD is working on resolving the paperwork issues. Payment issues have been resolved.

Recommended action for this period

1. **Updated Detailed Critical Path Project Schedule**

The detailed critical path schedule is now complete and indicates the critical path between all deliverables, reviews, meetings and approvals required for this planning phase two of the work. The critical path schedule is available to the CALWMC for information.

ToP advises the CALWMC to hire a full time experienced scheduler to support the finance and implementation phases.

2. **Organization chart**

A final organization chart will be issued to the team for November 23, 2015. This chart will keep all team members on track with reporting, communication and delivery requirements. This chart indicates roles, reporting and contractual relationships between: CALWMC members, CRD staff, Eastside and Westside Group member, TOP members, all consultant key individuals, and others.

3. **Technical Memo #1**

Issues around the cost estimator and the presentation of cost have been addressed by the consultant team to the satisfaction of ToP.

To ensure the accuracy of the assumptions of the ongoing engineering work, ToP recommended that CRD provide water supply projections. CRD does not have these and expects to begin this work next year.

ToP advises the CALWMC to accept the final TM#1 as submitted.

4. **Technical Memo #2**

ToP and the consultant team met to discuss the assumptions and direction of TM#2. ToP and the consultants toured the proposed sites for distributed options. ToP and the consultants met with eastside and westside representatives to better understand their priorities for WWT.

The consultant team, overseen by ToP, identified four viable options to be put forward to the public. At this time all options include a significant site at Rock Bay with upgrades at Clover Point. The four options are:

> **One Plant**: Rock Bay secondary treatment with new lines in and out to upgraded facility at Clover Point outfall
>
> **Two Plants**: Rock Bay as above, with one additional water reuse tertiary treatment at Colwood with no outfall
>
> **Four Plants:** Rock Bay and Colwood as above with additional secondary treatment at Esquimalt with new lines in and out to Macaulay point upgraded outfall and one additional water reuse tertiary treatment at Saanich with no outfall
>
> **Six plants**: Rock Bay, Colwood, Langford, View Royal, Esquimalt and Saanich (Core and East) All but Rock Bay would be tertiary treatment water reuse WWTPs. The westside includes a new outfall

Each option will be costed against the one plant baseline.

To maintain the schedule, ToP advises the CALWMC to instruct the consultants to proceed with developing draft Technical Memo #3 while completing the final TM#2

In recognition of the direction of the work, and to support the funding application, ToP advises the CRD to secure a WWTP site at Rock Bay and confirm Clover Point as upgradable

To reduce costs, ToP advises the CRD to pursue an environmental impact study comparing the environmental impacts of the Rock Bay secondary treatment as proposed (with infrastructure cost of about $100M for the lines to and from Clover Point) with an option for a Rock Bay tertiary treatment plant outfalling at Rock Bay along seabed to deeper water, but not as deep as Clover point (eliminating infrastructure cost and disruption). Effluent will be cleaner than the stormwater that already drains into the harbour.

5. **Final Deliverable, Technical Memo #4 Table of Contents**

The consultants and TOP will work together to determine the Final Technical Memo #4 content to support the eventual funding and rezoning requirements of the project. The draft outline of the content will be provided to the CALWMC for comment.

Outstanding - To get ahead of the content requirements for the final report, ToP advises the CRD to provide any metrics, cost base timelines or other formatting information that will be required by funding agencies or zoning authorities that can reasonably be incorporated into TM#4 (under the original terms of reference) to ensure that the format of the information in TM#4 is the most useful format for the CRD

6. Private Sector Vendor Canvas

A preliminary meeting with interested vendors and project delivery agents was held October 23, 2015 with TOP and the consultant team. CRD is organized a webex style meeting and receiving technical information packages from eleven interested parties. Active solicitation of proposals will occur later during the implementation phase. Delivery included DBFOM (Design-Build-Finance-Operate-Maintain) and DBOT (Design-Build-Operate-Transfer). There were four generic categories of provider offerings:

- **DBFOM/DBOT Off shore WWTP** – EnviroNor, Shawla
  ToP has concerns with end of life tanker, tsunami risk, no history of municipal WWTP, risk of plant failure with no option for effluent flow. ToP recognizes that because these use the existing outfalls, there will be cost savings. There is no ToP support at this time for these options.
- **DBFOM/DBOT Biosolid** - Nefco, SRS,Enervoxa, ARK
  ToP generally supports the thermal drying and other pelletizing options as generic solutions and will wait to see how these fit into the option sets as they develop. The Enorvoxa technology would need to be investigated and properly vetted as the presentation and materials do not explain the technology. ARK reformer technology has no municipal applications and the team would require a better understanding of the actual technology.
- **DBFOM/DBOT WWTP+Biosolid – Hydra,EcoTek**
  ToP advises that these 'one stop shop' options will require a significant performance bond. Hydra has no built history and requires a pre-commitment before proceeding with a feasibility study. Eco-Tek is likely too small for the main WWTP and has had problems in the past. Identifying who holds the risk in the event of a plant or company failure is an issue with all of these options.
- **Tertiary Treatment – GE, Xylem, Fibracast**
  ToP is aware of and supports these and other innovative approaches to increased effluent quality. GE has proven technology and many installations, as does Xylem. Fibracast is appropriate as an innovation demonstration install.

ToP will hear Shewla again as there were technical difficulties with the presentation

The consultant team will incorporate opportunities for these and other generic technology options into their options sets as appropriate

ToP will hold a meeting with the consultant team next week to discuss biosolid treatment options

Status Report #5 from the Technical Oversight Panel to the CALWMC

November 17, 2015

Summary statement

The consultant team that TOP is overseeing is currently **completing Task #2 and starting Task #3**. **:**

Task #3 Deliverables*: At the conclusion of this task, consultants will present the CRD with the following:*
- ***Technical Memo #3****, detailing the 30 year financial (costs and revenues) model for each option set, including capital costs, life cycle costs, municipal allocations and revenue opportunities from reuse systems (and how these align with either municipal or regional services). Alternative revenue possibilities such as development oriented financial mechanisms, and market factors such as discount rates will also be included.*
- *Presentation Materials from Meeting with CRD/Core Area Municipalities*

TOP reviewed the intent of the consultant's content and wording of TM#3 November 17, 2015

Task #2 Deliverables*: At the conclusion of this task, consultants will present the CRD with the following:*
- ***Technical Memo #2,*** *detailing the finalized option sets that will form the basis for the costing and financial analysis, to be completed in Task 3. This will include general site and system characterizations, operational strategies descriptions of treatment processes including influent/effluent water quality and quantity, residuals treatment/management, flow scenarios and growth phasing, performance targets, and approvals requirements.*
- *Presentation Materials from the CALWMC/CRD Meeting*

TOP reviewed the consultant's second draft of TM#2 November 17, 2015

Phase 2 activities for TM#1-4 have been coordinated and the detailed critical path schedule is now complete and available to the CALWMC

Teleconference meeting November 3, 2015 was open to the public with a short closed portion and meetings November 10, and 17 in this period have been open to the public

The USA work visa for the Florida advisor is resolved and he will attend the November 23/24 meetings.

Action for this period

1. **Updated Detailed Critical Path Project Schedule**

The critical path schedule is available to the CALWMC for information. The detailed critical path indicates the critical path between all deliverables, reviews, meetings and approvals required for this planning phase two.

CRD staff report on proposed FT scheduler pending

2. **Organization chart**

A final organization chart will be issued to the team for November 24, 2015. This chart will keep all team members on track with reporting, communication and delivery requirements. This chart indicates roles, reporting and contractual relationships between: CALWMC members, CRD staff, Eastside and Westside Group member, TOP members, all consultant key individuals, and others.

TOP advises the CALWMC to direct CRD staff to develop an updated Organization chart for Q1 2016

3. Technical Memo #2

TOP met with the consultants to review the final draft of TM#2 November 17, 2015. This three hour meeting was open to the public. The consultants have prepared five options consisting of: one plant/16km of new pipe; two plant/36 km of new pipe; four plant/ 66km of new pipe; seven plant/ 86km of new pipe. The latest draft of TM#2 included the consultant response to, and incorporation of, many TOP items.

The latest draft of TM#2 did not resolve the following items which are to be incorporated into TM#3 once resolved by the consultants at the November 24, 2015 meeting with TOP:

Potential and costs for distributed solid waste treatment on distributed plant options

Cost clarification 1b) deletion of effluent lines from/back to Clover point with tertiary at RB

Cost clarification option 3 deletion of effluent lines from/ back to MacCauley with tertiary at EFN

Cost clarification for any options to a solid waste pipeline from tertiary plant at Colwood

Cost clarification of Storm water credit value in water reuse calculation

Clarification of recommended project delivery options to allow innovative technology providers to compete

Pricing of gasification and anaerobic digestion (no other technologies will be priced)

TOP advises the CALWMC that it supports site options 1a), 1b), and 2. TOP advises the CALWMC that site options 3 and 4 are possible but not optimal, as they are complex and expensive with marginal advantages over other options.

TOP advises the CALWMC that options 1a), 1b), 2 increase the flow through Clover Point and will likely necessitate significant upgrade of capacity there.

TOP advises the CALWMC that option 4 would be best advanced with a separate study to determine the optimal distributed solid and liquid waste reuse options that could be negotiated for the region.

TOP advises the CALWMC to study the effects of improved I&I on WWTP cost savings through reduction of the projected capacity increase for 2020-2045.

TOP advises the CALWMC to accept final TM#2

4. **Technical Memo #3**

The consultants are working to develop draft TM#3. The draft will be reviewed at the November 24 TOP meeting and submitted to the CALWMC with TOP recommendations December.

5. **Final Deliverable, Technical Memo #4 Table of Contents**

The consultants and CRD will work together to determine the Final Technical Memo #4 content to support the eventual funding and rezoning requirements of the project. The draft outline of the content will be provided to the CALWMC for comment.

Outstanding - *To get ahead of the content requirements for the final report, TOP recommends that CRD provide any metrics, cost base timelines or other formatting information that will be required by funding agencies or zoning authorities that can reasonably be incorporated into TM#4 (under the original terms of reference) to ensure that the format of the information in TM#4 is the most useful format for the CRD*

6. Private Sector Vendor Canvas

Eight more vendors are interested in presenting. Meetings have been arranged for November 23, 2015. These will be closed meetings as there are vendor concerns about proprietary information. CRD and TOP will attend. A summary will be provided by TOP to the consultants as they are unable to attend the meetings. A summary will be included in TOP Report #6 to the CALWMC.

TOP advises the CALWMC to determine the project delivery options that will accommodate innovation in technology as part of the implementation team terms of reference.

Making a difference...together

REPORT TO CORE AREA LIQUID WASTE MANAGEMENT COMMITTEE
MEETING OF WEDNESDAY, DECEMBER 9, 2015

SUBJECT **Technical Oversight Panel (TOP) Report #6**

ISSUE

TOP summary of recent period to December 1, 2015

BACKGROUND

Technical Memo #2R2 was issued to the Core Area Liquid Waste Management Committee (CALWMC) by the consultants previously. TOP has a series of notes that are to be addressed for the official record. The consultant advises that they will be submitting these notes as a document attached to their submission of TM#3.

Draft Technical Memo #3R1 is issued to the CALWMC by the consultants December 4, 2015. TOP has competed a detailed review of items that are to be addressed in TM#3R1 and incorporated into the final TM#3 when it is submitted January 12, 2015. TOP has discussed draft TM#3 comments with the consultants and the consultants have agreed to changes to be included in TM#3R1. Subject to these TOP recommended changes being reflected by the consultants in TM#3R1, TOP recommends acceptance of draft TM#3R1 by the CALWMC to be used as a basis for public consultation beginning December 9, 2015.

Draft Technical Memo #4 will be issued to the CALWMC by the consultants February 10, 2015. TOP has recommended, and the CALWMC has passed a motion to require, the provision of the details of the preferred TM#4 content requirements to support funding requirements. At this time, the information is not clear and the consultants and TOP need to agree with CRD on the final table of content requirements and metrics for TM#4.

The critical path schedule has been developed by the team for the planning phase. The CALWMC passed a motion November 25, 2015 for the CRD to develop a schedule for the project out to 2020. Work should begin on this in the new-year with TOP support.

The organization chart for the team has not been resolved and an overarching project delivery organization chart is needed. The CALWMC passed a motion November 25, 2015 for the CRD to develop this organization chart out to 2020. Work should begin on this in the new-year with TOP support.

TOP arranged to meet with an additional 8 private vendors November 23, 2015. **Organica** presented a 'living machine' type of system now common in Europe and Asia. Sechelt is a working example of their technology. **Kore** presented their resource recovery solution to biosolids management. Kore finances, designs, builds, owns and operates the facility under long-term performance-based contracts. **Ostara** presented a phosphorous recovery for fertilizer pellet type of system now common worldwide. Ostara is a UBC tech with 8 working and 8 pending facilities. **IWS** did not present, no reason given. **Catawater** presented a bio-bacteria process of a type now common worldwide, with no examples, yet, in Canada of their product. **Noram** presented a unique, proprietary deep shaft system with a vertical treatment plant taking the place of a horizontal layout, vastly reducing the area and impact of the plant on the site. Burnaby Chevron is an example of a local deep shaft facility (7MLD). **Matrix** presented a proprietary pyrolysis

system with a $4M feasibility study cost up front and no details on technology and no working examples at a comparative scale. **Shewla** presented again but continued to have technology issues with the presentation out of Brazil. They propose off shore barge treatment with no working examples at a comparative scale. Generic versions of the Ostara and Catawater products, and the Organica and Kore systems may be incorporated into some of the option sets as appropriate. Matrix and Shewla are proprietary treatment systems (not generic types) with no track record at the scale required for CRD and will not be reflected in the options. Noram is a proprietary deep shaft small footprint WWTP tertiary system that *might* possibly solve alternative site issues (saving hundreds of millions of dollars and eliminating kilometers of infrastructure now in the proposed options). TOP and consultant team will visit the existing deep shaft Chevron site in Vancouver to gain a better understanding of the performance and appearance. TOP team believes it is worth TOP further investigating the viability of a small footprint WWTP solution with Noram to determine if this should become an additional option to be addressed later in the implementation phase. This dialogue will not require the consultants in the initial stages and accordingly will not delay either TM#3 or #4.

The bid process is not defined and the funding parameters are not defined. As work progresses on the technical memos, it is becoming apparent that the WWTP side is traditional and the bio-solid treatment side is innovative. Current funding is structured for traditional bio-solid treatment. Once the details of the TM#3R1 cost charts are finalized, discussions should be held with TOP support to resolve the bid process and the funding application parameters to support innovation on the bio-solid treatment side as appropriate.

TOP arranged to meet with various Citizen Groups to begin to address some of their very technical concerns with the project. Presentations were made by Brian Grover, Bryan Gilbert, Soren Henrich, Carole Witter, John Farquharson and Oscar Regier. Bryan Gilbert addressed process issues including the clarification of objectives and the establishment of a viable delivery team structure with appropriate capacity, and the establishment of financial QA protocols. TOP is aware of these protocols and is diligently working with the consultant team and the CALWMC and the CRD to ensure these protocols are established. Soren Henrich reported on concerns raised in draft TM#2 regarding biochar and biosolids treatment and lifting the ban on land application of sewage sludge. John Farquharson explained how TOP's role as outlined in its terms of reference and the Phase 2 project charter was expanded based on input provided by various citizen groups. Mr. Farquharson suggested new federal government direction has eliminated the PPP Canada (P3) screening requirement for federally funded infrastructure projects, which provides an opportunity for TOP to request a timeline extension. Carole Witter addressed issues around contaminants of concern and making sure there is room in the option sets for real distributed options with resource recovery and the tertiary treatment of effluent. TOP shares these concerns and is working with the consultant team to address these issues. Brian Grover and Oscar Regier identified specific cost saving options. Mr. Grover asked for TOP's help to achieve the desirable outcome at the lowest possible cost, and addressed six points of concerns (i.e., project preparation process, public participation, cost estimates, roles for consultants and contractors, managing project implementation, and timing of next steps). Mr. Regier spoke in favour of distributed tertiary treatment using membrane reactor technology with optimized resource recovery and existing conveyance infrastructure, and using site specific information to make costing decisions. Oscar reviewed capacity, flow data and redundancy of existing trunk mains, outfalls, inflow and infiltration, and overflow points. Mr. Regier provided diagrams which the consultant team agreed to review and respond to. This response is from the consultant team and TOP is pending.

TOP also met with Amanda Gibbs to begin to understand the format of the public engagement process scheduled for December. It became apparent that she did not have content for the initial proposed public engagement eastside start date of December 2, 2015, and that the timing of the review of TM#3 would not allow the vetting of the financial info before the public materials were scheduled to be issued. For this reason, the TOP previously requested a one week delay in the public process to December 9, 2015 to align with the delivery of TOP's first review of TM#3 to facilitate better financial information for the public process. TOP understands from Amanda that the Eastside and Westside public outreach efforts will be coordinated and that all communities will receive the same survey content to respond to

ALTERNATIVES

That TOP recommends that:

Alternative 1
That the Core Area Liquid Waste Management Committee receive this document for information and accept the recommendations.

Alternative 2
That the Core Area Liquid Waste Management Committee receive this document for information, and revise and accept the recommendations.

Alternative 3
That the Core Area Liquid Waste Management Committee receive this document for information and not accept the recommendations.

IMPLICATIONS

SOCIAL IMPLICATIONS
Draft TM#3R1 will form the basis of the public consultation process to begin in December 2015 and to complete in January 2016.
Some private vendor innovations support social desire for resource recovery and distributed plants and their involvement will improve the project outcomes.
Options as developed in TM#2R2 and TM3#R1 support social desire for resource recovery and distributed plants.

ENVIRONMENTAL IMPLICATIONS
Some of TOP's comments on the draft TM#3R1 relate to environmental impact.
Most private vendor innovations support higher environmental performance in terms of lower energy, reduced carbon, and improved effluent quality and reduced contaminants of concern.
Options as developed in TM3#R1 support higher environmental performance in terms of lower energy, reduced carbon, and improved effluent quality and reduced contaminants of concern.

ECONOMIC IMPLICATIONS
Some of TOP's comments on the draft TM#3R1 relate to cost issues. TOP and the consultant team are evaluating costs in TM#3R1. The costs now have a wide margin of error on the capital side. Examining the life cycle cost is important for decision making.
Some private vendor innovations save costs and should be examined further.

INTERGOVERNMENTAL IMPLICATIONS
Some of TOP's comments on the draft TM#3R1 relate to funding issues.
It may be more appropriate to fund the WWTP through P3 Canada and to fund the bio-solid

treatment through agencies that support innovative technologies. The cost sensitivity charts in TM#3R1 are being developed to confirm the best route to take.
TM#4 will support the intergovernmental funding applications and will need to be structured accordingly.

GROWTH MANAGEMENT IMPLICATIONS
Some of TOP's comments on the draft TM#3R1 relate to growth assumptions.
Some private vendor innovations address incremental growth.
Options as developed in TM#3R1 address incremental growth.

CONCLUSION

Notes referring to TOP comments on TM#2 are required as part of TM#3 and are being provided by the consultants.
Revisions to TM#3 are required and are ongoing by the consultants.
TM#4 content parameters are required and should be discussed at the meeting in January with CRD.
Private vendors should continue to be encouraged to come forward with ideas, and the team should develop methods to encourage innovation in treatment options in the bids.
TOP should follow up with Noram to determine if their technology is viable as small footprint WWTP(s) close to the outfall(s).
TOP supports the community involvement at this technical level and is aligned with the apparent goals of the eastside community.
Amanda Gibbs' work will be supported by the revised schedule.

RECOMMENDATION

That TOP recommends:

1. That the Core Area Liquid Waste Management Committee receive the draft TM#3R1 for information and for use in the public consultation process.

2. That the Core Area Liquid Waste Management Committee direct TOP to work with Noram to determine the potential viability of the deep shaft small footprint solution at the existing outfall(s).

Submitted by:	Teresa Coady, Chair, Technical Oversight Panel

TC:ll

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REPORT TO CORE AREA LIQUID WASTE MANAGEMENT COMMITTEE
MEETING OF WEDNESDAY, JANUARY 13, 2016

SUBJECT **Technical Oversight Panel Report #7**

ISSUE

Technical Oversight Panel (TOP) summary of recent period to January 4, 2016

BACKGROUND

TOP was directed by the Core Area Liquid Waste Management Committee (CALWMC) at the meeting of December 9, 2015 to further investigate the small footprint plant option at the outfalls. The objective of this exercise was to save the infrastructure cost and to alleviate disruption that will be caused during the construction of dual large diameter sewer lines to and from Rock Bay. Four TOP members (a quorum) visited the Noram Vertreat technology site at the Chevron Refinery in Burnaby on December 29, 2015 along with one consultant from Carollo and one consultant from Urban Systems, to better understand the deep shaft technology and its potential for this project. Further discussions with Noram relevant to CRD sites suggested that the small footprint plants conceptually did fit on the two sites identified as closest to the existing outfalls (Clover Point and Bullen Park) and although the two plants were mostly buried and not visible, and although the deep shaft technology itself is viable and proven, the solution set as proposed was not acceptable to TOP. This is because Noram advised that the combination of the MBR and the deep shaft is not proven and would need to be piloted first. Additionally, there are no built examples of deep shaft WWTPs at this scale so there is no confirmation that the technology is scalable without risk, and the operations and servicing activities were deemed to be extensive and disruptive and inappropriate for the local residential streets. Meeting minutes will be prepared and posted publically by January 31, 2016.

The eastside public group requested a response to their distributed sites proposal. This request was forwarded to the consultants, the report on their findings will be issued through the CRD to the chair of the CALWMC for January 13, 2016.

The CALWMC directed the consultants to investigate a three plant option at Colwood, EFN and Rock Bay and provide a report. The objective of this exercise was to save treatment plant costs and improve the performance of the system now described in the four plant option 5a) in draft TM#3. The three plant option set, 5b), will be reviewed by TOP as part of the final TM#3 submission January 20, 2016, and will be discussed at face to face meetings January 11, 2016.

The CALWMC directed TOP to prepare a summary document of all meetings with technology vendors. TOP is preparing a binder of materials and summary statement for each provider that will be available to the public and the CALWMC on line. TOP is meeting with a final provider, Pivotal, on January 12, 2016 to better understand how they propose to provide tertiary treatment and gasification for a total project cost of $250M. The summary binder will be completed after the meeting with Pivotal.

The CALWMC directed the consultants to prepare a report on the flow assumptions for the planning stage of the work. The objective of this work was to clarify and come to agreement on the assumptions made around ministry, municipal and regional standards used, infiltration and inflow upgrades cost allocations and impacts on system design, population growth assumptions

and impact on design, and the 2030 and 2045 capacity targets. TOP reviewed and commented on this report January 4, 2016 and the consultants will include TOP comments in the draft submitted to the CALWMC for January 13, 2106.

Draft TM#3R1 that was made available on line to the public does not include revisions to reflect TOP comments, or the new three plant option developed by the consultant team in December, and this should be clarified during public consultation scheduled to begin January 14, 2016, to avoid confusion. Draft Technical Memo #3R1 was issued to the CALWMC by the consultants December 4, 2015. TOP has competed a detailed review of items that are to be addressed in TM#3R2 when it is submitted January 20, 2016 for TOP's final review. TOP also has a series of notes on TM#2 that are to be addressed by the consultants for the official record as an appendix to the final version of TM#3.

Draft Technical Memo #4 is scheduled to be issued to the CALWMC by the consultants February 10, 2015. The critical path dates for the draft TM#4 documents, TOP's review, and the consultant presentation to the CALWMC need revision and reconfirmation.

The critical path schedule has been developed by the team for the planning phase. The CALWMC passed a motion November 25, 2015 for the CRD to develop a schedule for the project out to 2020 with TOP support. Work should begin immediately on this.

The organization chart for the project team has not been resolved and an overarching project delivery organization chart is needed urgently. The CALWMC passed a motion November 25, 2015 for the CRD to develop this organization chart out to 2020 with TOP support. Discussion and planning should begin on this.

TOP has provided expert technical oversight of the consultant work and the vendor presentations through the planning stage. Several of the six TOP members are willing to continue to support the project through the preparation of the project schedule and organization chart, detailed project cost planning, and the RFSI process and the implementation of the project to the final delivery to CRD. TOP will be meeting with the chair and vice chair of the Core Area Wastewater Treatment Program Commission on February 9, 2016 to determine if there is a need to extend the TOP mandate, and will provide a report on the results to the CALWMC for direction from the CALWMC to TOP in February.

ALTERNATIVES

That TOP recommends that:

1. *That the Core Area Liquid Waste Management Committee receive this document for information and accept the recommendations.*

2. *That the Core Area Liquid Waste Management Committee receive this document for information, and revise and accept the recommendations.*

3. *That the Core Area Liquid Waste Management Committee receive this document for information and not accept the recommendations.*

IMPLICATIONS

SOCIAL IMPLICATIONS
TM#3 should be updated to reflect the current options to avoid confusion.
Confidence in the project must be restored to attract the full participation of the market and support the most competitive bids.

ENVIRONMENTAL IMPLICATIONS
Some of TOP's comments on the draft TM#3R1 relate to environmental impact and will need to be incorporated.

ECONOMIC IMPLICATIONS
Some of TOP's comments on the draft TM#3R1 relate to cost issues and will need to be incorporated.

INTERGOVERNMENTAL IMPLICATIONS
Some of TOP's comments on the draft TM#3R1 relate to funding issues and will need to be incorporated.

GROWTH MANAGEMENT IMPLICATIONS
The report on flow and 2030 and 2045 targets is an important piece of the growth management of this project. The 2016 study by the CRD on water supply will inform 2045 targets. Design and construction will be to the 2030 targets.

CONCLUSIONS

TOP understands that the public consultation process through January and February 2016 will be directed at the public to garner comments and feedback on the options sets as presented. TOP will present its technical conclusions once the public consultation process is completed.

RECOMMENDATION

That TOP recommends:

1. That the CRD begin immediately to develop a schedule for the project out to 2020 with TOP support per the motion CALWMC passed November 25, 2015.
2. That the CRD begin immediately to develop an organization chart for the project out to 2020 with TOP support per the motion CALWMC passed November 25, 2015.

Submitted by:	Teresa Coady, Chair, Technical Oversight Panel

TC:ll

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REPORT TO CORE AREA LIQUID WASTE MANAGEMENT COMMITTEE
MEETING OF WEDNESDAY, JANUARY 27, 2016

SUBJECT **Technical Oversight Panel (TOP) Report #8**

ISSUE

TOP summary of recent period to January 20, 2016.

BACKGROUND

Technical memo #3 - The three plant option set, 5A), 5b), will be part of the draft TM#3R2 consultant submission January 20, 2016 and will be reviewed in the TOP open to public teleconference January 22, 2016. The draft TM#3R1 available on line to the public does not include revisions to reflect TOP comments. TOP also has a series of notes on TM#2 that are to be addressed by the consultants for the official record as an appendix to the final version of TM#3. Draft TM#3R2 will be finalized and TOP comments will be provided to the CALWMC February 10, 2016.

Summary Memo - Draft Technical Memo #4 (The Summary Memo) will be an executive summary for general use. It will be based on the final version of TM#3. It is scheduled to be issued to the CALWMC by the consultants February 10, 2015. The critical path dates for draft TM#4 documents, TOP's review, consultant presentation to CALWMC, and the final TM#4 will be revised January 22, 2016 during the TOP open to public teleconference.

Private Vendors - The CALWMC directed TOP to prepare a summary document of all meetings with technology vendors. TOP has prepared draft summary statements for each provider that will be finalized and available to the public and the CALWMC on line. At the January 13, 2016 meeting, the CALWMC passed a motion requiring three TOP engineers to provide individual opinions on the Capital Clear proposal. These opinions will be submitted to the CALWMC February 10, 2016. TOP is meeting with another technology vendor on February 5, 2016.

Commission Lessons Learned - TOP and CRD staff will be meeting with the chair and vice chair of the Core Area Waste Water Treatment Program Commission on February 5, 2016 to review their Lessons Learned document with regard to the consultant deliverables for the planning stage. TOP has identified gaps between the current planning stage consultant deliverables and the commission's position on handover deliverables as outlined in the Lessons Learned document. TOP will provide a report on the results to the CALWMC in February.

ALTERNATIVES

That TOP recommends that:

1. *That the Core Area Liquid Waste Management Committee receive this document for information and accept the recommendations.*

2. *That the Core Area Liquid Waste Management Committee receive this document for information, and revise and accept the recommendations.*

3. *That the Core Area Liquid Waste Management Committee receive this document for information and not accept the recommendations.*

IMPLICATIONS

SOCIAL IMPLICATIONS
Confidence in the project must be restored to attract the full participation of the market and support the most competitive bids. Addressing the Lessons Learned in the transition from the planning to the implementation phases will reduce uncertainty in the marketplace and increase fairness and transparency.

ENVIRONMENTAL IMPLICATIONS
Some of TOP's comments on the draft TM#3R2 relate to environmental impact and will need to be incorporated.

ECONOMIC IMPLICATIONS
Some of TOP's comments on the draft TM#3R2 relate to cost issues and will need to be incorporated. Addressing the Lessons Learned in the transition from the planning to the implementation phases will increase the competitiveness of the bids.

INTERGOVERNMENTAL IMPLICATIONS
Some of TOP's comments on the draft TM#3R2 relate to funding issues and will need to be incorporated.

GROWTH MANAGEMENT IMPLICATIONS
The report on flow and 2030 and 2045 targets is an important piece of the growth management of this project. The 2016 study by the CRD on water supply will inform 2045 targets. Design and construction will be to the 2030 targets.

CONCLUSIONS

This is a progress report. TOP is completing its work on the TM#3 so that document can be finalized and published. TOP is providing three engineering opinions on the Capital Clear proposal. TOP is working with the consultant team to complete the Summary Document TM#4. TOP is completing summaries for the private vendors. TOP will advise the CALWMC on gaps in the consultant deliverables with respect to handover to the new commission and seek advice from the CALWMC.

RECOMMENDATION

That TOP recommends:

1. That the CALWMC receive this report for information.

Submitted by:	Teresa Coady, Chair, Technical Oversight Panel

TC:ll

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REPORT TO CORE AREA LIQUID WASTE MANAGEMENT COMMITTEE
MEETING OF WEDNESDAY, February 10, 2016

SUBJECT **Technical Oversight Panel (TOP) Report #9**

ISSUE

TOP summary of recent period to February 3, 2016

BACKGROUND

Technical memo #3R1- The TM#3 has been finalized for 7 options, and now incorporates many TOP comments. It will be issued as TM#3Revision1, although many revisions actually occurred during the process. Some TOP comments on TM#3R1 were not addressed.

TOP believes that the costs for the gasification are high and should include the municipal solid waste (MSW) stream. TM#3R1 carries very conservative (high) costs for the gasification option of the biosolids from the liquid waste stream only. TM#R1 identifies that an RFSI process will be required to determine the best solid waste management solution and costs, so gasification of the wastewater solids *only* is treated here as a theoretical and sample solution. The final solution would likely combine the MSW stream.

The costs for the membrane technology (MBR) and tertiary treatment are higher than TOP would advise, but again, the consultant chose to carry conservative costs. Since a certain percentage of its replacement cost will be budgeted on an annual basis, the higher MBR costs have a domino effect on operating costs in the tertiary plants.

The capital costs include a provision for financing during construction which will need to be adjusted once the details of the various Federal and Provincial grant funding arrangements are finalised and the construction schedule determined. The operating costs shown for each option set do not include annual debt service for long term financing of capital cost. Based on CRD guides of 5% over 16 years for option 1a this will amount to a sum, principal and interest, of the order of $1.2 billion. The long term financing cost for other options sets will be proportionally higher. All costs in TM#3R1 are recognized as being program planning level costs, not budgets or estimates.

The base case costs all include $258M for AD, not the gasification option at $233M. The base case costs all include solid waste trucking (or treatment at Rock Bay without trucking in options 1 & 2), not a sludge line to Hartland for integration with the MSW stream. The cost of a sludge line to Hartland and the consequent land cost savings at Rock Bay offset each other although this is not detailed as it was not part of the consultant scope.

The overall costs increase from the one plant option at $1,031M to the four plant option at $1,195M as the number of plants increases. The seven plant option is a significant increase to $1,348M. Operations costs also increase as the number of plants increase.

Summary Memo – TOP reviewed the proposed table of contents for the Technical Memo #4 (The Summary Memo) on February 2, 2016. This will be an executive summary document for general use. It will be based on the final version of TM#3R1. It is scheduled to be issued to the CALWMC by the consultants February 24, 2015.

Private Vendors - TOP has prepared draft summary statement for each provider that will be finalized and available to the public and the CALWMC. At the January 13, 2016 meeting, the CALWMC passed a motion requiring the three TOP engineers to provide individual opinions on the Capital Clear/ Vertreat technology proposal. These opinions are attached as Appendix A. TOP is meeting with five private vendors Friday February 5, 2016 and will finalize the summary documents after those meetings.

Commission Lessons Learned - TOP and CRD staff will be meeting with the chair and vice chair of the Core Area Waste Water Treatment Program Commission on February 5, 2016 to review their Lessons Learned document with regard to the consultant deliverables for the planning stage. TOP has identified gaps between the current planning stage consultant deliverables and the commission's position on handover deliverables as outlined in the Lessons Learned document. TOP will provide a verbal report on the results of the meeting with advice to the CALWMC February 10, 2016.

ALTERNATIVES

That TOP recommends that:

1. That the Core Area Liquid Waste Management Committee receive this document for information and accept the recommendations.

2. That the Core Area Liquid Waste Management Committee receive this document for information, and revise and accept the recommendations.

3. That the Core Area Liquid Waste Management Committee receive this document for information and not accept the recommendations.

IMPLICATIONS

SOCIAL IMPLICATIONS
Confidence in the project must be restored to attract the full participation of the market. Meeting private vendors supports the building of this trust. Addressing the Lessons Learned in the transition from the planning to the implementation phases will reduce uncertainty in the marketplace and increase fairness and transparency.

ENVIRONMENTAL IMPLICATIONS
Establishing high effluent quality deliverables for treatment levels, and establishing a coordinated approach to the liquid waste bio-solids and the municipal solid waste stream will have positive environmental implications.

ECONOMIC IMPLICATIONS
TM#3R1 indicates that the single plant option is more cost effective than the multiple plant options. Financing costs will need to be addressed. Addressing the Lessons Learned in the transition from the planning to the implementation phases will increase the competitiveness of the bids.

INTERGOVERNMENTAL IMPLICATIONS
The base cases as laid out in TM#3R1 reflect the scope of work given to the consultants, but not the preferred options for treatment of solid waste combined with MSW. Discussions with the Provincial Ministry and the Federal P3 group will be required if funding is to be secured for the preferred options to AD.

GROWTH MANAGEMENT IMPLICATIONS

The report on flow and 2030 and 2045 targets is an important piece of the growth management of this project. The 2016 study by the CRD on water supply will inform 2045 targets. Design and construction will be to the 2030 targets.

CONCLUSIONS

TM#3R1 is acceptable to TOP. It is understood that the planning level costs will be refined in the next stages. It is also understood that the integration of the liquid waste stream with the municipal solid waste stream will be addressed through the RFSI process in the next stages, and that discussions with the ministries will be undertaken to support the recommended and less costly options to AD.

TM#4 (the summary document) will be reviewed and issued to the CALWMC for February 24, 2016.

The Private Vendors summary document will be prepared following meetings with the final five vendors February 5, 2016. The Capital Clear/Vertreat proposal for small footprint sites is not supported by TOP and three individual engineering opinions are attached as requested.

The result of the TOP meeting with the Commission will be presented verbally at the February 10, 2016 CALWMC meeting.

RECOMMENDATION

That TOP recommends:

1. That the CALWMC accept TM#3R1.
2. That the CALWMC accept the engineering opinions for information.

Submitted by:	Teresa Coady, Chair, Technical Oversight Panel

TC:ll

Attachments: Appendix A – Technical Oversight Panel engineering opinions

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APPENDIX C

REPORT TO CORE AREA LIQUID WASTE MANAGEMENT COMMITTEE
MEETING OF WEDNESDAY, FEBRUARY 24, 2016

SUBJECT **Technical Oversight Panel (TOP) Report #10**

ISSUE

TOP summary of recent period to February 15, 2016.

BACKGROUND

1. Summary of planning stage work with reference to the project charter and TOP Terms of Reference:

The Core Area Liquid waste management committee (CALWMC) engaged the Technical Oversight Panel (TOP) August 12, 2015 to oversee Planning Phase 2 of Urban Systems and Carollo's (the consultants') work. TOP referenced the Final Project Charter dated November 2, 2015, the consultant scope of services Appendix A, and the TOP terms of reference dated August 12, 2015 in its work. TOP met on several occasions face to face and via teleconference. All meetings were public and recorded by CRD staff, except for a few closed sessions relating to land issues. TOP also had over twenty presentations from various private vendors who presented options ranging from complete solutions to minor components. The objective for the planning phase was to develop site options and to describe processing options for both liquid and solid waste treatment with costing. TOP's role was to provide expertise and advice to the consultants.

2. Project costing considerations:

The costing of the options sets submitted by the consultants represent a pre-concept order of magnitude value with a range of -15% to +25% per the consultants scope of services. Soft costs including engineering, project management, interim financing and cost escalation through the construction period are included in each option set. Long term financing following grant disbursement and project completion is not included but the interest rate given by CRD for long term financing are high and an aggressive loans broker could, in all probability, shave some points or fractions off the current proposed percentages. Operations costs for each option are included. Revenue income for water re-use are included, but should be viewed with caution pending definition of the re-use product and the capital expenditures necessary to produce it, and the market demand. At this very early stage, with so many unknowns, there are considerable financial risks and the contingency provision is quite high. Pending more specific detail from later stages, TOP believes this provision to be prudent. Following the selection of an option set, TOP advises that a project plan should be developed as early as possible covering all stages of the project and including a financing and expenditure pro-forma indicating projected funding draw downs and monthly expenditures in detail. This plan will form the basis of a regular reporting process.

The costs of a single plant are less than the costs of the multiple plant options. TOP believes the single plant option for the 108MLD plant to be the most cost effective for both capital and operating/equipment costs.

3. Project administration considerations:

The key to success in any project rests with the overall management. This applies through all the various project stages to project completion. Reference to the "Lessons Learned" report from The Commission highlights some of the shortcomings of the past, and indicates actions necessary to obviate them as the program moves ahead to definition stage. The report identifies that the key to a successful project is building trust between the parties which requires openness and good communications with regular reporting of both progress and costs. Also referenced is the need for a 'Champion" closely identified across the spectrum as the person in charge, and the need for a supportive Board.

TOP and CRD staff met with the chair and vice chair of the Core Area Waste Water Treatment Program Commission on February 5, 2016 to review their "Lessons Learned" document with regard to the consultant deliverables for the planning stage. TOP has identified gaps between the current planning stage consultant deliverables, and the Commission's position on handover deliverables as outlined in their "Lessons Learned" document. The Commission believes that technical decisions on technologies, effluent quality targets, energy generation targets, water reuse targets, operational layouts, plant locations, waste transport, and base cases and optional upgrades will need to be confirmed before their oversight of the implementation phase can begin. This will require expertise in plant operations and layout, major project delivery phasing, urban design and rezoning, gasification and other solid waste to energy technologies, and tertiary treatment technologies. At this time, several TOP members are prepared to continue to provide technical oversight to support the CRD role with the new consultants (Stantec) as they confirm technical decisions. The CRD has confirmed that TOP has completed its work with this report. TOP advises the CALWMC to engage a new TOP, or augment the CRD team, with the technical oversight skillsets to support the technical decisions outlined above, prior to handing the project over to the Commission for implementation.

4. Site option considerations:

The TOP and the consultants were provided with over thirty sites by the CALWMC as they emerged from public consultations conducted by the CRD. The sites ranged in size from less than an acre, suitable only for small ancillary plants, to multi-acre sites suitable for larger central plants. None of the major sites were close to the existing outfalls and all required extensive infrastructure upgrades. TOP explored options for feasible sites near outfalls, but none were forthcoming; thus the consultant team was limited to exploring options within the given sites and has proposed land options that are sufficient in size to accommodate the facilities. Given the sites available, TOP believes the single plant at Rock Bay is the most appropriate site for the initial 108MLD plant.

5. WWTP considerations:

Effluent criteria, under the current CCME regulations is driven by the Environmental Risk Assessment (ERA). This exercise is key to move the project forward to design and implementation, can take upwards of a year to complete, and is specific to the outfall location and flow volumes of the option selected. TOP advises that once the site selection is complete and the LWMP has been filed with the regulatory and funding agencies, the CRD should immediately begin discussions with the regulators to arrive at effluent criteria and outfall requirements for specific selected sites.

Current reports show that water consumption in the area has been falling steadily for some time shedding doubt on the likelihood of a local market for tertiary treated water. However, the WWTP will discharge directly to the ocean, and tertiary treatment does a better job of addressing

emerging contaminants of concern and of meeting newer and stricter regulations. Costs for tertiary treatment membranes are coming down. As reflected in TM#4, TOP has advised base levels of treatment for several option sets along with advanced level of treatment using membranes in other options. TOP believes that the additional cost of using membranes or other comparable technology to achieve a higher tertiary level of treatment is justified.

The flows have been decreasing steadily over the last 5 years and this trend is not reflected in the flow projections for the plant designs. This trend may be the result of I&I reduction programs, and thus there is a need to determine what impact I&I reductions will have over time. The current design of 195 l/d/p is lower than the national average of 325 l/d/p and TOP believes that this is a reasonable assumption for the planning phase. Regulatory approval for lower capacity for the system cannot be assumed so TOP believes the flows as reflected in the TM#4 are prudent at this time, but increases in 2045 and 2060 capacity requirements may not be as high as currently projected.

6. Bio-solid waste treatment considerations:

With the restrictions on disposal of sludge on the island, and in the landfill, anaerobic digestion (AD) should not be considered as a viable sludge solution moving forward. The base case for sludge disposal should be sludge drying, which will reduce the volume of sludge by 70% and leave a material that can be gasified, subjected to pyrolysis or used as a secondary fuel. Dewatering and drying of the sludge will have a big impact on the gasification or other waste to energy technology from an energy balance perspective. The consultants have provided the cost of centrifuges for the sludge dewatering as this is a standard technology for this application. TOP advises that the base case for sludge disposal should be sludge drying, not AD, and a higher level of sludge dewatering using more efficient technologies than the centrifuge shown in TM#4 should be considered in an effort to maximize energy recovery from sludge.

A comprehensive solids waste plan should be implemented so that the CRD can gain the maximum benefits from gasification (or other solution) and energy recovery. The processing of other waste streams will require additional capital investment to preprocess the waste into a usable feedstock. The selection of technologies to process solid waste to energy should accommodate feedstocks including the components of the municipal solid waste (MSW) which have fuel value (plastics, wood, paper, food waste etc), the course screenings form Clover Point and Macaulay Point, and the septage collected from within CRD. TOP believes that a sludge line from Rock Bay to Hartland to integrate the bio-solid waste stream with the MSW stream will be cost effective and provide optimal resource energy recovery to the community.

The solids handling portions of this project has a higher technology risk than the liquid treatment portion of the project. TOP would advise the CALWMC to consider a solid waste handling ‘performance based’ RFSI that invites providers to provide proposals for gasification or pyrolysis combined with efficient dewatering.

TOP advises the CALWMC that the consultant will need a gasification expert on staff, and that the CRD will need to build operational gasification expertise.

Private Vendors - TOP has prepared draft summary statement for each provider that will be finalized and available to the public and the CALWMC by the end of February 2016. Some third parties have suggested procurement and operating costs considerably lower than the consultant’s costs reported in TM#4 but TOP has not pursued these submissions as they will be made redundant with the submission of detailed proposals at the procurement stage.

ALTERNATIVES

That TOP recommends that:

1. *That the Core Area Liquid Waste Management Committee receive this document for information and accept the recommendations.*

2. *That the Core Area Liquid Waste Management Committee receive this document for information, and revise and accept the recommendations.*

3. *That the Core Area Liquid Waste Management Committee receive this document for information and not accept the recommendations.*

IMPLICATIONS

SOCIAL IMPLICATIONS
Confidence in the project must be restored to attract the full participation of the market. Meeting private vendors supports the building of this trust. Addressing the Lessons Learned in the transition from the planning to the implementation phases will reduce uncertainty in the marketplace and increase fairness and transparency.

ENVIRONMENTAL IMPLICATIONS
Establishing high effluent quality deliverables for treatment levels, and establishing a coordinated approach to the liquid waste bio-solids and the municipal solid waste stream will have positive environmental implications.

ECONOMIC IMPLICATIONS
TM#3R1 indicates that the single plant option is more cost effective than the multiple plant options. Financing costs will need to be addressed. Addressing the Lessons Learned in the transition from the planning to the implementation phases will increase the competitiveness of the bids.

INTERGOVERNMENTAL IMPLICATIONS
The base cases as laid out in TM#3R1 reflect the scope of work given to the consultants, but not the preferred options for treatment of solid waste combined with MSW. Discussions with the Provincial Ministry and the Federal P3 group will be required if funding is to be secured for the preferred alternatives to AD.

GROWTH MANAGEMENT IMPLICATIONS
The report on flow and 2030 and 2045 targets is an important piece of the growth management of this project. The 2016 study by the CRD on water supply will inform 2045 targets. Design and construction will be to the 2030 targets.

CONCLUSIONS

TOP believes it is important for the CALWMC to understand that the *deliverables coming out of the planning stage* are not sufficient for the Commission to begin the implementation stage as many technical decisions remain unmade. The gaps as identified in the Commission's "Lessons Learned" document include technical decisions relating to technologies, effluent quality targets, energy generation targets, water reuse targets, operational layouts, plant servicing, waste transport, and performance metrics for base cases and optional upgrades. TOP advises the CALWMC to engage a new TOP, or to augment the CRD team, with the technical oversight

skillsets needed to support the new concept phase consultant team in their generation of technical decisions as outlined above, prior to handing the project over to the Commission for the implementation phase of the work.

With regard to the *site options*, TOP has reviewed the draft TM#3 and TM#4 and supports the central plant option as the most cost effective initial WWTP solution for a population of approximately 300,000. If a large, appropriately sized site near an outfall was put forward by a municipality, that would be the preferred site, but as such a site was not provided by the participating municipalities to the consultants, Rock Bay is acceptable to TOP among the sites that were provided. A central site allows the growth capacity response and redundancy requirements to be aggregated, which is most efficient. If desired, future modular expansion will also be possible at distributed sites to accommodate growth once the initial infrastructure is in place. TOP believes the single plant option for the 108MLD plant to be the most cost effective for both capital and operating/equipment costs. Given the sites available, TOP believes the single plant at Rock Bay is the most appropriate site for the initial 108MLD plant.

The TOP position on the *WWTP technology* is that the RFP call should be very clear and consistent in all aspects to attract the market back to the project with confidence. The WWTP RFP should be performance based to meet ministry and other standards for effluent quality and flow volumes. TOP advises that once the site selection is complete and the LWMP has been filed with the regulatory and funding agencies, the CRD should immediately begin discussions with the regulators to arrive at effluent criteria and outfall requirements for specific selected sites. Regulatory approval for lower flow capacity for the system cannot be assumed so TOP believes the flows as reflected in the TM#4 are prudent at this time, but increases in 2045 and 2060 capacity may not be as high as currently projected.

TOP's position on water reuse is that reuse piping is both costly and unnecessary as there is no water supply issue now, but that reuse might be considered in the future should conditions change. TOP's position on level of treatment is that money should be spent now on tertiary with preference towards the use of membranes as the membrane costs are coming down in price in a competitive market, and most communities are moving toward tertiary treatment if they can, considering that the regulations will be more stringent over time. TOP understands that the CRD's objective is to be a steward of the environment. Although the regulations are not yet in place, TOP believes it would be advisable for this community to consider tertiary treatment systems as they do a better job with the emerging contaminants of concern. Tertiary treatment now will also support water reuse later. TOP believes that the additional cost of using membranes or other comparable technology to achieve this higher tertiary level of treatment is justified.

TOP's position on *bio-solid treatment* is that the liquid sludge should be piped as sludge up to Hartland landfill site to limit potential odor issues at Rock Bay, and the trucking of sludge through the city. TOP believes that sludge processing at Hartland will be the most cost effective way to process the bio-solids for the community as other municipal solid waste streams may be integrated. TOP believes that a sludge line from Rock Bay to Hartland to integrate the bio-solid waste stream with the MSW stream will be cost effective and will provide optimal resource energy recovery to the community. Ministry discussions will be required to develop these integrated solid waste treatment options and funding for them.

Anaerobic digestion is not an option in TOP's opinion because there is no local use for the digested sludge. A clear high level specific acceptance criteria should be developed outlining the bio-solid waste treatment objectives considering the local constraints, such as no land application. TOP advises that the base case for sludge disposal should be sludge drying, not AD. A higher level of sludge dewatering using more efficient technologies than the centrifuge shown in TM#4

should be considered in an effort to maximize energy recovery from sludge. TOP advises that the Solid Waste (bio-solids) RFSI call should allow for efficient dewatering, generating secondary solid fuels, as a base case with gasification, pyrolysis or other acceptable thermal processing options.

The conclusions of TM#4 anticipate a cost effective, established technology baseline that allows for easy upgrades to both tertiary treatment on the WWTP side, and to gasification and integration with the municipal solid waste stream on the SWTP side.

Summary of TOP conclusions:

1. **The CALWMC should engage a new TOP, or augment the CRD team, with the technical oversight skillsets required to support technical decisions in the concept phase, prior to handing the project over to the Commission for the implementation phase.**

2. ***A* project plan should be developed as early as possible covering all stages of the project and including a financing and expenditure pro-forma.**

3. **A single plant at Rock Bay is the most appropriate site for the initial 108MLD plant.**

4. **CRD should immediately begin discussions with the regulators to arrive at effluent criteria and outfall requirements for specific selected sites.**

5. **Tertiary level of treatment is justified.**

6. **A sludge line from Rock Bay to Hartland to integrate the bio-solid waste stream with the MSW stream will be cost effective and will provide optimal resource energy recovery to the community.**

7. **The base case for sludge disposal should be efficient sludge drying, not AD.**

8. **The CALWMC should consider a solid waste handling 'performance based' RFSI that invites providers to provide proposals for efficient dewatering and drying to create a feedstock for gasification, pyrolysis or other thermal processing options.**

RECOMMENDATION

That TOP recommends:

1. That the CALWMC receive this TOP Report #10 for information.
2. That the CALWMC accept TM#4, the Summary Report, as complete.

Submitted by:	Teresa Coady, Chair, Technical Oversight Panel

TC:ll

Appendix G

Eastside and Westside Select Committee Public Consultation Summary Reports

APPENDIX D-3

EASTSIDE COMMUNITY DIALOGUE

wastewater treatment + resource recovery

PUBLIC CONSULTATION

Eastside Wastewater Dialogues | February 2016

PHASE 2

Making a difference...together

CONTENTS

INTRODUCTION

Meaningful infrastructure planning involves citizens, in particular those whose lives and communities are most affected by decisions on large projects. In this case, our consultation team has engaged the public on conceptual plans for federally and provincially mandated wastewater treatment to serve the Core Area of the Capital Regional District.

Involving citizens does not remove decisions from the hands of identified subject matter experts and elected representatives. Instead, it provides the public with genuine opportunities for input.

More opportunities to seek input can improve transparency and leave both decision-makers and the public with improved technical and planning literacy and a deeper understanding of the issues, ongoing concerns and priorities surrounding major projects.

Beginning in September 2015, the consultation team in support of the Eastside Select Committee (elected directors from Saanich, Oak Bay and Victoria) commenced planning for a second phase of consultation and engagement on specific option sets for wastewater treatment and solids processing in the Core Area. The team was tasked with creating a plan for taking option sets – developed, costed and sited – to the public for input and to test "acceptability" and listen for support and challenges.

The second phase of public input was initially scheduled for December, and then December and early January 2016. Despite the fact that promotion and outreach for consultation had begun in early December, due to ongoing CALWMC and technical deliberations, the consultation was re-scheduled for a period of one month between January and February 2016. Much of the information that would form the basis for public input, was available in near to final drafts on the CRD website and visible to the public for review from late November on, including costing information that was released in late 2015 and early 2016.

New option sets emerged in mid-January for inclusion in the consultation process.

While the first phase of consultation used deliberative approaches to surface priorities, challenges, values and ideas in the strategic planning of this infrastructure, this phase was intended to address the public's interest in more information around specific sites, proposed activities, levels of treatment and costs. It was also developed to test the acceptability of conceptual solutions for treatment and resource recovery. In short: we were asked to test options that had emerged through a municipal, technical and public process and then to subsequently gather public input and report back.

This document describes the approach for analyzing and reporting on the feedback provided by public participants in the Eastside process from January – February 2016, and to outline how it intersects with overall public engagement across the Core Area. It describes the process for planning and carrying out engagement activities and for reviewing and analyzing data generated through that process. This reporting is presented to help inform decisions by the Core Area Liquid Waste Management Committee and its constituent municipalities related to wastewater treatment in the Capital Regional District.

SUMMARY OF EASTSIDE PARTICIPATION

Participation in workshops, open houses, storefront drop-ins and meetings: **260**

Storefront: **185**

Participation in survey overall: **1357**

Survey participation from Eastside communities: **937**

Questionnaires and feedback forms: **68**

We will share:

- Approach and methodology
- Planning for Consultation
- Activities
- Themes and Priorities
- Challenges and Opportunities
- Appendices and Resources

APPROACH AND METHODOLOGY

Background/ Project Foundations:

The CRD and its municipal partners have engaged the public across the Core Area, to gather input that will inform decisions about wastewater treatment solutions. The work of engaging citizens has been divided between Westside and Eastside Select Committees, the latter including Victoria, Saanich and Oak Bay. Our approach starts from the perspective that durable solutions have three components: they are technically and practically feasible, municipally sanctioned and publicly supportable.

Following the previous unsuccessful attempts to advance treatment and resource recovery, the member municipalities of the Core Area Liquid Waste Management Committee, in collaboration with the CRD, committed to engage citizens in the identification of sites, planning approach and levels of service that would be used to treat wastewater. The foundational approach to this renewed effort was to broaden and deepen public involvement where there was a sense that both municipalities and key publics needed to be involved earlier, more deeply and with greater transparency throughout the process.

Timelines were established that allowed the process to meet deadlines set by the federal and provincial governments. At this time, provincial and federal contributions are available to offset a portion of local government investments, providing the Capital Regional District achieves a solution that meets already-established federal and provincial criteria for municipal-scale wastewater treatment and completes all political approvals and amendments by March 2016.

In summer 2015, using the suite of sites that had been advanced by the three Eastside municipalities, and the information we learned from the public about base principles for site acceptability, and models for treatment and recovery, the technical and planning team from Urban Systems team began to analyse and iterate loose option sets, to test assumptions, and offer potential directions forward for further study and analysis and feedback. The Urban Systems team developed models based on the existing “sewer sheds”, analysis of flow scenarios, and available land, and identified approaches for treatment and recovery. The approach enabled analysis and costing of several key options that reflected the bundles of the priorities, siting information and values that were provided through public input.

Following this first phase of engagement, the team of technical consultants, the Technical Oversight Panel (TOP) and CRD staff took public, technical and municipal input from phase one, and worked to forge, fine-tune and assess

option sets. They were guided by the development of a project charter that set goals and commitments for the work.

Following this work, a second round of engagement has provided citizens with the opportunity to compare multiple concept based option sets , including design elements, and approaches for resource recovery and energy generation, in order to inform the final decision. The level of detail was increased due to citizen requests during phase one of consultation. Accordingly, phase two provided detailed information including: specific sites, a comparison between costs (life-cycle and household), benefits and performance between secondary and tertiary treatment, an expanded set of centralized and distributed models of delivery, and information about two models of solids processing: anaerobic digestion and gasification.

The initial targets agreed to by the Eastside and Westside Select Committees asked that all public engagement in the first phase be complete by late July 2015, and initially, that all subsequent consultation be complete by December 2015. The second phase of consultation was delayed by ongoing deliberation on technical, municipal and costing information related to option sets presented by Urban Systems, the TOP and CRD staff. Accordingly, the second phase of public consultation was not given a go ahead until January 15th, 2016. Following this decision, the team planned, scheduled and promoted activities to launch public consultation by January 25th. Seven wastewater

option sets and two approaches as well as sites for anaerobic digestion and gasification were prepared for public for input and dialogue. Consultaiton activities were completed by February 20th with an initial report to the CALWMC by February 22, 2016.

Approach in Brief:

The challenge of such an undertaking in a short period of time is significant given the great variation among the Core Area's population in terms of expertise in the subject matter, awareness about the issue, and ability to participate in face-to-face activities. Despite this challenge and the difficulty of engaging multiple communities in an extremely short period of time, the process resulted in over 1300 touchpoints across the Eastside over 26 days.

There are two important considerations that guide understanding of this second phase of consultation on wastewater planning for the Core Area.

- First, the second phase of the project July 2015 – February 2016 has been guided by a project charter, developed and sanctioned by the Core Area Liquid Waste Management Committee. It outlines the commitment to treat wastewater by 2020, as well as goals and commitments in project planning overall. Public input informed the charter, alongside political and technical considerations.

- Second, while citizen engagement in the first phase of project planning looked at upstream explorations of the infrastructure planning (core values, priorities, challenges and desired outcomes) the second phase dealt mainly with how the project could proceed at the level of concept – specific options for review and input related to site, levels of treatment and approaches to resource recovery. Again, the lens was designed to identify options that were technically and practically feasible, municipally sanctioned and publicly supportable.

The mandate of the second phase of consultation was to provide the public with an opportunity to see and comment on a range of potentially practical options that emerged from the analysis of the consulting technical team of Urban Systems and Carollo and Associates and the Technical Oversight Panel (TOP).

The public was provided with summary materials and the capacity to review all technical background and detailed technical investigations online at www.coreareawastewater.ca. Our team was open to all input, and solicited feedback on trade-offs and comparisons on costs, levels of treatment, sites and possible approaches to solids processing.

PROJECT CHARTER

The project is guided by a set of goals and commitments that have been identified by CRD staff, elected directors, and informed by citizen and stakeholder input.

THE GOALS ARE TO:

- Meet or exceed federal regulations for secondary treatment by December 31, 2020
- Minimize costs to residents and businesses (life cycle cost) and provide value for money
- Produce an innovative project that brings in costs at less than original estimates
- Optimize opportunities for resource recovery to accomplish substantial net environmental benefit and reduce operating costs
- Minimize greenhouse gas production through the development, construction and operation phases and ensure best practice for climate change mitigation

THE COMMITMENTS ARE TO:

- Develop and implement the project in a transparent manner and engage the public throughout the process;
- Deliver a solution that adds value to the surrounding community and enhances the livability of neighbourhoods;
- Deliver solutions that are safe and resilient to earthquakes, tsunamis, sea level rise and storm surges;
- Develop innovative solutions that account for and respond to future challenges, demands and opportunities, including being open to investigating integration of other parts of the waste stream if doing so offers the opportunities to optimize other goals and commitments in the future; and
- Minimize greenhouse gas production through the development, construction and operation phases and ensure best practice for climate change mitigation

Planning for Consultation

Citizen advisors – the Eastside Public advisory Committee have served as a wisdom council and sounding board in the development of the public consultation process, materials and promotion of the process. They gave input in the development of a phase 2 plan and have received draft materials for review, but as often, the pace of the process has meant they are offering constructive strategic input without an expecatation of sign off. Members of the Committee have also been concerned with the governance and mandate of the committee over the last four months.

Planning Process - Input

We sought input from the Eastside Select Committee, the Technical and Community Advisory Committee and the Eastside Public Advisory Committee in the development of a phase 2 public engagement plan.

Education and Outreach in Advance of Consultation

We were asked to reach out to stakeholder groups in advance of the second phase of consultation. We met with the Burnside Gorge Residents Association, the Gorge Tillicum Residents Association and the Gordon Head Residents Association. We reached out to all community associations through our existing lists and SCAN – the Saanich Community Association Network, promoted participation. We also brought back architect Bruce Haden alongside local architects from Cascadia Architecture, to deliver an educational conversation about possibilities for wastewater, architecture and urban design in the region. Plans for outreach to schools and broader community groups were challenging in the face of deadlines and schedules. Newsletters and email updates to a growing eastside list provided updates as they were available to citizens and organizations in advance of consultation.

Core Principles:

Based on our work to date and the feedback from participants, consultants, elected directors and citizen advisors, this phase of work was grounded in key principles. These include:

1. Accessibility: We are committed to ensuring that clear information – technical, costing, performance, governance – is made available to citizens in a range of formats and accessible to a range of learners.

2. Transparency: Ensuring that all project information is made public in as rapid and clear a manner as possible.

3. Diversity: In the context of public problem solving, diversity refers to the different skills, knowledge, and

interests of participants, as well as ethnocultural background, age, and economic backgrounds. Diversity is essential for effective public problem solving.

4. Expanding Civic Literacy: That we make a sincere effort to reach out to the broader community with basic information about the role, importance and basic technical info about wastewater treatment. We will attempt to expand knowledge and engagement throughout the exercise.

5. Clear decision-making process: Being extremely clear about how public input is gathered, reported and how it feeds decision making by whom and when.

Methodology for Phase Two Consultation

At the next level of detail, the consultation methodology was organized around several commitments including:

- To identify the timelines and the decisions to be made and by whom;
- To ensure participants have access to information and multiple opportunities to offer input;
- To inform the public of the conceptual alternatives and identify key trade-offs;
- To provide a range of types of engagement to allow people with varying levels of time and commitment to participate; and
- To solicit input and reflect it back to the public and decision-makers rapidly.

ACTIVITIES IN DETAIL

Website – CoreAreaWastewater.ca December 2015
Feedback on the website during earlier phases of consultation, resulted in the CRD streamlining its online presence for wastewater planning and developing a direct and focused address to point the public to activities and resources. This became a clearinghouse for the latest planning information and engagement activities.

Storefront – Centennial Square CRD offices
January 26 – February 19
Because of the rapid nature of the consultation and the season, we determined that it would be important to provide a stop for citizens seeking information, resources, questionnaires and accessibility to boards and other materials provided at open houses. We were open weekdays from 11-7pm and some shifts on the weekend to ensure that we provided access after working hours . As well, we used the space to host various stakeholder meetings, a media launch and briefings. Through sign ins and daily counts we estimate 185 drop-ins to the CRD storefront.

Open Houses and Workshops – January 30 – February 17
We held a range of open houses and 90-minute workshops during the period of consultation. At each open house we had engagement and technical staff present provide briefings, answer questions and listen to input. These sessions included:

- January 30, Gordon Head United Church – Open House (40 participants)
- February 9, Burnside Gorge Community Centre – Workshop (22 participants)
- February 10, Victoria Conference Centre – Workshop (26 participants)
- February 11, Songhees Wellness Centre – Open House (26 participants)
- February 13, University of Victoria, Cadboro Commons – Workshop (35 participants)
- February 14, Burnside Gorge Community Centre – Open House (22 participants)

Focused Briefings with Community Organizations and Stakeholder Groups February
We reached out the Saanich Community also held a range of stakeholder focused briefings that including:

- January 25, Burnside Gorge Community Association Briefing (12 participants)
- February 12, Victoria West Community Association Briefing and Dialogue (30 participants)

- February 12, Rock Bay Business Briefing (2 participants + 5 calls and door knocking discussions)
- February 14, Burnside Gorge Community Association, Residents Briefing and Dialogue (22 participants)
- February 15, Greater Victoria Chamber of Commerce and Tourism Victoria Briefing (4 participants)
- February 15, Local place making, tech and cultural creative briefing (3 participants)
- February 16, Local conservation organizations (35 participants)
- February 16 CUPE briefing and conversation (5 participants)
- February 17, Burnside Gorge Residents Briefing and Dialogue (7 participants)

At each meeting we attempted to do the following: inform participants of the process and how their feedback would be incorporated; a briefing on all of the seven option sets and the two approaches and sites for solids processing; and an attempt to answer questions and gather comments. We offered questionnaires, feedback forms, an invitation to email thoughts and we captured comments and key themes via flipchart and detailed notes. The sessions varied in size, although common to all were smaller groups participating than in the first phase of engagement. We developed notes and themes from each conversation, which will be appended in the final report.

Self Selecting Survey January 25 – February 20

A self-selecting, open-link survey developed with advice from IPSOS Reid provided survey takers with information including municipally focused costing on each option, followed by a summary of concepts and their comparative performance. It provided a range of open-ended and multiple choice questions. This was a non-representative sample, and generated strongly-felt sentiments from those who seek to ensure that their positions are heard. There was a limit of four responses from each IP address to ensure that there was not at attempt to overload the survey with responses from one source. We were not tasked with asking participants to vote on options, but to share information and test options for acceptability and to gather commentary. We were not asked to test other options, but gave space for participants to opt out of questions or to provide detailed comments. The CALWMC decided to change a question at the mid-point in the survey. This had an impact on the results. The survey was developed with guidance from the citizen committee and was shown in beta and draft form to the Eastside and CALWMC. Questions were developed with assistance from Kyle Braid of IPSOS Reid. Despite the skewing of data from the change mid-

survey, overall the data provided quantitative analysis showing the most prominent issues in the minds of survey participants. The survey included open questions, which may identify additional areas of interest and concern in the minds of the public.

Print questionnaires: We distributed print versions of the questionnaire at all events, through municipal halls, at the storefront and on demand by phone or email. We mailed out dozens and picked up dozens at the municipal halls and other outlets. We included the data from the 68 completed print surveys.

Direct emails to wastewater@crd.bc.ca
We invited the public to send direct feedback via email, which was then subsequently coded for review and inclusion into the Core Area Report.

Promotion of Process
Ensuring citizens were aware of the opportunities to engage and could find our materials was a key pillar in our work. The channels we used to promote participation include:

Earned media
Media launch of consultation on January 26th.

Paid Media
Advertising in regional and community print media, radio ads and digital media.

Email Outreach
Using the CRD's list of community associations and individuals who expressed interest in the project, we would send out updates on all events.

Networks
Using networks through citizen advisors, directors and team members, we were able to promote the process and key events.

Materials Development
Developing videos, booklets and key information packages that offered visualization of challenging technical info.

THEMES AND PRIORITIES

Our goal is to provide an accurate reflection of the feedback from citizens on issues, themes and options for consideration by decision-makers, and articulate these in a manner that will assist subject matter experts and decision-makers understand their relevance for the decisions required.

There was a broad diversity of opinions, values and ideas expressed during the second phase of consultation. Examining all the data inputs, we were able to identify several strong themes that point to public priorities and concerns with the option sets and alternatives:

Levels of Treatment – Wastewater Treatment Options

Throughout our conversations in open houses and in workshops, via the written questionnaires, emails and as a finding in the survey, we heard a strong interest in tertiary treatment. This aligns with priorities gathered during the first phase of the consultation process around improving the quality of what goes into the ocean and an interest in water reuse.

There was specific concern identified for pharmaceuticals, household and industrial materials, micro-plastics and other chemical inputs and the ability to remove these inputs through tertiary treatment. Another line of inquiry focused on not simply meeting but exceeding government standards. Another theme identified a commitment to tertiary level of treatment in order to maximize the investment of infrastructure dollars and to prepare for future shifts in base requirements. Additionally, there were sentiments expressed around water reuse and future-proofing the region through a period of climate shift, and to recognize water as a valuable commodity now and in future.

Divergence:

Where we heard diverging streams on this theme was through

- questioning of the cost benefit analysis of tertiary versus secondary
- survey results showing nearly even support for one plant secondary and tertiary and lower for multiple plants
- survey results showing significantly higher support for one plant with tertiary treatment than for multiple plants providing tertiary treatment

Complexity, Cost and Options – Wastewater Treatment Options

Another rising theme for participants was the balance between cost, performance and environmental benefit. **This was manifest in support for one and two plant solutions** through the survey, during open houses and via questionnaires. Respondents weighed the impacts, benefits with cost overall and complexity of the options. Respondents reported that one and two plant options could provide increased levels of treatment and innovation with lower levels of complexity, conveyance infrastructure and environmental impact than options with more plants. The priorities articulated in a representative survey in spring 2015, identified priorities as preventing harmful materials from entering land and ocean and cost align with the public's ongoing balancing between cost and environmental performance. There was also a theme present around the opportunities to be responsive to growth or need in future, but while achieving a base level of service quickly. A number of participants discussed that while they are interested in possibilities for heat and water resource incomes with more distributed systems, they are weighing the costs and impacts of the operating costs and infrastructure. Many are coming down in favour of less complexity for one plant and two plant options with consideration for smaller plants in growth centres as need or opportunity emerges.

Divergence:

Where we heard diverging themes:

- interest in single plant but concerns for Rock Bay as a site and its need for conveyance to Clover Point.
- Concerns for resilience of single plant and scale of single plant sites versus smaller distributed sites

Feedback Re: Alternatives Outside of Wastewater Options Presented for Review

Many respondents provided strong feedback on the proposed options. The commentary coalesced around key themes:

1. A concern with rising costs;
2. Concern with siting , particularly costs and disruption of conveyance in Victoria;
3. Some respondents still feel that no treatment is required;
4. Interest in design alternatives, such as distributed systems and revisting sites already considered and rejected during phase one of consultation.

These themes and response can be summarized as follows:

“Return to McLoughlin”

In the context of media outreach by directors and a motion to bring this previous plan back to the table, we heard some commentary that supports reviving this option. We heard this in survey comments, via questions at meetings, and in emails and questionnaires. The interest in this option focused mainly on an assumption of lower cost in comparison to the options that emerged and were put in front of the public through the current and agreed upon process. Also, by siting at McLoughlin, some respondents argued it would avoid disruption of proposed infrastructure from Rock Bay to Clover Point.

“Innovation and Lower Cost Alternatives”

There is a group of community advocates who have been longtime observers of wastewater planning and past participants in this process. Individuals have attended some consultation events and have been promoting alternative options that feature other sites that were not advanced during this process. This group is interested in options like “deep shaft” technology that was explored by the Technical Oversight Panel as well as a $250 million fully tertiary distributed option proposed by several community members and reviewed by all the technical teams. Some citizens who attended public meetings have expressed doubt about the environmental regulations that call for redundancy of pipes. In summary, the commentary can be summarized as promoting a distributed option that would result in 100% tertiary treatment with less need for ocean outfalls or back up infrastructure.

“Concern with Conveyance and Cost”

Some participants focused on the fact that all the options required new infrastructure from a facility at Rock Bay to Clover Point. There was concern with the cost of the new infrastructure, compared to costs of infrastructure at other sites that are not currently under consideration, as well as concern with the possible disruption to the downtown core of Victoria.

“No Need To Treat”

Despite the commitment of the Core Area Liquid Management Committee, some people question the need for treatment and therefore the need for any additional infrastructure. Another theme of conversation emerged around delaying the investment in treatment until a later date. This theme appeared in comments and questions from some participants.

Solids Processing:

While the survey shows even support for solids processing either at Hartland or Rock Bay, we heard concern about these sites during community conversations and from emails and questionnaires.

1. Residents of Rock Bay and Burnside were concerned about seeing processing of solids in closer proximity to residential neighbourhoods, and identified piping to Hartland to minimize truck traffic and impact on the neighbourhood. Without more information about design and impacts on the local community, Rock Bay and Burnside residents opposed solids processing in their neighbourhood.
2. Overall, there was concern for safety and possible environmental impacts of both anaerobic digestion and gasification.
3. There was a strong interest in further study of the opportunities for integrating municipal solid waste with wastewater solids provided at Hartland.

STAKEHOLDER ENGAGEMENT

We met with a range of organizations and communities to try to ensure we could canvass a broader group than those who might be highly attuned to the conversation on wastewater, but who may be impacted by any decisions or approaches going forward. They included:

- Burnside Gorge Community Association, local residents and business owners
- Greater Victoria Chamber of Commerce and Tourism Victoria
- Conservation organizations including Surfrider Foundation, T. Buck Suzuki and Sewage Treatment Alliance
- Designers, urbanists and business owners
- CUPE

Burnside Gorge Community

Perhaps the most significant activity during this short period, and where we put a good deal of energy was reaching out to residents and business people in the Rock Bay and Burnside Gorge areas. We held two workshops, one open house, one lunch mixer and several focused briefings for local residents, as well as meeting with the Board of Directors of the Burnside Gorge Community Association. We promoted these events through:

- The listserv of the Burnside Community Centre through the support and assistance of staff and board
- On site flyers and leaflets
- By leafletting businesses and the surrounding neighbourhoods
- Through our existing outreach and mail drops, including print, radio and mail outs to every household.

We had approximately 12 residents at one workshop and 32 at two subsequent briefing workshops, with open attendance of approximately 20 at an open house. We have also received numerous emails and questionnaires from residents.

We provide information about the options, as well as the two sites in question: the BC Hydro/ Transport Canada site and the mix of sites at Pleasant Street, the Municipal Works and David, closer to Point Ellice. We discussed the footprint, proposed activities, the opportunities for mixed use on the sites, the benefits and implications of various forms of treatment.

What we heard:

- Residents of the area feel that there is a mistaken perception among people in the region and among decision-makers, that Burnside Gorge is a solely industrial rather than residential community. There were concerns about the long-term implications of siting a large wastewater treatment plant because:
  - » the neighbourhood has a higher density of renters who tend to be more transient and may not participate as vigorously as those in other neighbourhoods;
  - » there are residents who have barriers to participation based on economic need; and
  - » the neighbourhood is often seen as a destination for siting industrial, activities that other neighbourhoods reject
- There was also a concern that not enough time was dedicated to consultation and more detailed information about possible local impacts was requested.
- There were mixed levels of support and opposition to wastewater treatment, and strong opposition to establishing solids processing in the area. Participants expressed this through concern for increased construction and operational traffic, as well as concerns for environmental impacts closer to residential neighbourhoods.
- There was some expression of concern for the loss of the industrial waterfront, as well as concern about state of remediation on either site.
- There were caveats that could affect support for any wastewater project in the neighbourhood:
  - » A commitment to the highest level of odour and noise control
  - » Commitments to manage and mitigate construction disruption to a minimum of what was proposed for the previous project in Esquimalt
  - » Addressing possible risk to property values
  - » Selection of a site that will cause the least disruption to business and community with the highest benefit in terms of mixed use and recreation.
  - » Excellence in design including strong design input by the community through ongoing involvement in project planning

- » Place making for recreation, business, education and culture onsite
- » Meaningful amenities packages that bring benefit to community
- » Access to waterfront and desire for harbour path and improved connectivity between downtown and Selkirk neighbourhood

Business Voices:

We had challenges getting numbers of business people out to events but had a robust conversation with the CEO of the Greater Victoria Chamber of Commerce as well as a small number of business people in the Rock Bay/ Burnside neighbourhood. We promoted these conversations through existing Chamber networks and the local business list of the Burnside Gorge Community Association.

We heard that:

- There is concern about rising costs and challenges that could be posed to local business by conveyance infrastructure in the downtown core of Victoria.
- There is concern about the ability to implement options with high complexity versus a one or two plant option – multiple site option sets versus the previous plan and/ or the lowest cost option available through the existing options.
- There is frustration and fatigue with the pace and getting something done
- There is concern for the state of remediation on the existing sites.
- There is some interest in improvements to the business zones in Rock Bay, especially for businesses like food and beverage and breweries, and the possibility to bring more animation and customers to the zones. For some businesses close to the existing industrial uses, there is a hope that a new wastewater plant could address air quality and disruption challenges posed by the existing industrial uses.

CUPE:

Following a detailed briefing, the Canadian Union of Public Employees have provided a detailed position on the proposed options. It is attached to this report.

Conservation organizations:

A group of conservation organizations attended a briefing and offered overall feedback on the option sets.

- Many were concerned that the process was headed for more delay and being derailed. Get on with it – was a strong sentiment
- A commercial fisher and long-time activist asked to flag that secondary removes a lot from the effluent and asked that the fastest most approach be taken to expedite treatment.
- There were questions about McLoughlin and whether it is a better or more feasible site
- Questions about the possibility of a hybrid model – with secondary and tertiary add-ons and plants as needed
- There were questions about technologies for treating solids and questions about openness to technologies outside of gasification and anaerobic digestion, like fluidized bed. Commentary about high heat and ability to remove toxins from sludge was provided.
- There were questions about McLoughlin as a backup to the existing option sets.

- There were questions about the costing post 2030 and whether demand would require new infrastructure.
- Overall, interest in moving ahead and finding most expeditious model for getting treatment to improve marine environment.

Creative Focus Group:

A group of three local creative and place makers gathered to discuss opportunities for urban design and wastewater. One of the participants was a former wastewater engineer, who expressed a desire to see wastewater infrastructure celebrated and used to educate – both children and the public – on the processes that help the city run.

Another local creative imagined improved public connectivity through either of the sites in Rock Bay and into local neighbourhoods, as well as the possibility of co-locating tasting rooms for local breweries in a mixed use setting.

Challenges For Consultation:

The original plan for consulting residents of the Eastside communities were developed in alignment with best practices for consultation on large infrastructure projects, including:

- Sufficient time and notification;
- Ourtreach to communities that are challenged to participate;
- A welcoming environment including food and sufficiently detailed background materials
- Accessible opportunities
- Multiple touchpoints that allow for participation despite varied working schedules
- Online and in-person opportunities

There were numerous challenges posed by the consultation:

1. **Scheduling Changes**
   We reached out to communities, planned, scheduled and began to promote consultation in early to mid December. It was frustrating and confusing to some stakeholders that we had to cancel our activities and then reach out again to reschedule. In some cases, this undermined trust in the process and confidence that input would be appropriately considered.

2. **Period of Consultation**
   We were given a short period of time to plan, schedule and promote consultation as well as to implement the formal consultation during the period of a month. More time would have meant we could have reached more citizens and stakeholders, allowing for a fuller conversation and understanding of the various perspectives.

3. **Diversity of Voices – Consultation Framework**
   While it is expected and welcome to hear a diversity of voices with a range of perspectives during a consultation period, many citizens came to events feeling overwhelmed by the competing information in the public domain. They reported being confused by CALWMC directors who were promoting alternatives to those being presented as part of the agreed-upon process. This resulted in staff having to manage anger and confusion by stakeholders, as well as try to support learning and input on already complicated option sets.

4. **Balance of Information**
   We were tasked with trying to provide information in such a way that allowed those who areless involved to participate. We attempted to provide high level summaries and comparisons, while linking to more detailed technical information as needed. While some respondents reported being overwhelmed by information, others requested more detail. It was challenging to get the balance correct.

5. **Emotional Debate**
   We had highly emotional participants, who frequently yelled at staff during the consultations. This was to be expected, but where challenges became highly charged is when advocates tried to prevent other participants from filling out questionnaires. This became especially challenging for the team in communities like Burnside Gorge, where local residents wanted more information about sites and impacts, and residents from outside the neighbourhood sought vocal debate and challenge. While louder voices could dominate, quieter voices at open houses and in smaller groups gave us a good picture of the overall debate.

OVERALL FINDINGS

In summary, our team attempted to balance a range of perspectives, voices and the expression of positional interests. We stand by the data and synthesis of commentary through multiple channels. Many participants came to learn and give feedback on the existing options. Still others pushed for alternatives. We listened for the range of commentary and have tried to reflect it as clearly and carefully as possible. We thank the citizens who participated, most of whom were thoughtful, curious, engaged and care deeply about their communities.

This report has been prepared by the consulting team of Amanda Gibbs, Principal, Public Assembly in support of the Eastside Select Committee and Core Area Liquid Waste Management Committee.

APPENDICES – TO BE INCLUDED IN FINAL REPORT

1. Session notes and flipcharts
2. Questionnaires
3. Letter from Canadian Union of Public Employees
4. Verbatim results from Eastside
5. Eastside Consultation Plan
6. Minutes from Eastside Public Advisory Committee, TCAC, CALWMC related to consultation planning, as required.

CUPE·SCFP | Canadian Union of Public Employees
Syndicat canadien de la fonction publique

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Wastewater Planning Consultation Representatives,

Thank you for this opportunity to provide some feedback on sewage treatment in the Capital Regional District. As many politicians have noted this is the largest infrastructure project that the CRD will take on for the foreseeable future and getting it done right is important not only to current residents, but also for future residents.

CUPE Local 1978 represents approximately 950 members in Greater Victoria, and is affiliated to both CUPE BC and CUPE National. CUPE is the largest public sector union in Canada with 635,000 members nationwide.

CUPE has been involved in the process to develop a wastewater treatment plant for the CRD from the beginning. Our primary concern is that this new infrastructure be publicly owned and operated and we, along with allies and residents, have advocated for this all through the process.

While this phase of consultation has not focused on procurement, we want to ensure that decision makers are still mindful that public ownership and operation is important to CRD residents.

Below we have briefly outlined the reasons we believe publicly owned and operated infrastructure is the right decision for CRD residents and we have also included a few comments and concerns we hope will be considered moving forward.

Please do not hesitate to contact us should you need further clarification on anything below.

Thank you,

Rick Illi
CUPE Local 1978 President

Benefits to Publicly Owned and Operated Infrastructure

- **Protecting the environment and public control are linked.** Public control means the public interest, and not private corporate interests, will drive decisions. Local government decisions are most often done in public and are much more accountable and transparent than those made by private corporations. And in the end, environmental risk and damage always end up as a public concern and responsibility.
- **Privatization costs more.** Public-private partnerships or P3s are a taxpayer rip-off. They cost more than public operation. Private corporations take on P3 projects to make money. They answer to shareholders, not the public or taxpayers. Private financing costs more and the "mark up" for taking on risk and meeting profit targets adds significantly to the cost of P3 projects. British Columbia's Auditor General, Carol Bellringer recently offered strong evidence of this in her annual report where she found that government is paying nearly twice as much for borrowing through P3s as it would if it borrowed the money itself.
- **Taxpayers "run the risk" in the end.** If things go wrong, private corporations can walk away. Government and taxpayers cannot. We end up with the problem and ultimately pay to clean up the economic and sometimes, environmental mess.
- **P3s lock us into decades-long contracts.** They lock our local governments and communities in to 30-or-more-year contracts. This limits current and future generations having a say in a key part of their community. Multi-decade contracts also limit how flexible our communities can be in terms of using new technologies or responding to new information.
- **P3 deals are very complex and secretive.** P3 deals are secretive and negotiated behind closed doors. By the time they are finished, the contracts are huge and incomprehensible even to the staff of cities that are "purchasing" the service.
- **Focusing on local employment and economic development.** When private corporations run the show contracts often go to big corporations and we lose local investment, tax resources and jobs. We want local government to be able to offer the next generations challenging jobs that pay decently and allow the students of today to stay in our communities and have successful careers. Investing in public services is part of that.

Public ownership and operation as a theme during public consultation

There has been many opportunities for public input both when developing the current funded and approved plan, and also over the past year while the CRD has explored new options for sewage treatment. One thing that residents have consistently said is that this infrastructure should be publicly owned and operated.

Most recently during phase one of the consultation the survey for the Westside showed that the majority of respondents (67 percent) supported a public option. On the Eastside, open-link survey respondents ranked 'publicly owned and operated' as one of the top three most important criteria when developing a sewage treatment facility. And, at other engagement events where there was opportunity for dialogue there was talk about the provision of public sector jobs, and opportunities to keep water and heat resources in public hands.

CRD residents clearly see the importance of public infrastructure and that should be honoured.

No further expansion of Private Operation

During the initial planning phase for sewage treatment there was a robust discussion about procurement, and after hearing from residents the CRD board went ahead with a plan that included a fully public wastewater treatment plant and a P3 solids energy recovery centre. While ideally the entire project would be publicly owned and operated, we ask that the CRD honour their previous commitment and not have any expansion of the P3 portion of the project.

We have heard the commitment to maintain the current balance of funding with respect to limiting the P3 component to the solids-energy recovery portion. We were pleased to have this confirmation both in writing and as part of the Chair's report from Director Helps at the January 27 CALWMC meeting that other than the portion of the project that is already P3, the CRD is not contemplating expanding the private or public-private procurement or operating model portion of the current funding plan.

We believe that despite these assurances, it is critical to ensure that new P3 procurement opportunities do not arise as the project moves forward, for example as part of the Commission's mandate.

Private Transition back to Public

We remain concerned about the existing P3 and would like to see a plan to transition the solids-energy recovery portion into public delivery as quickly as possible.

CUPE suggests that any portion of the project that does go ahead as a P3 should be transitioned back into public hands in a timely manner. 30 years is too long for a private corporation to make money off of CRD resident's sewage.

P3 Funding

Although we understand that it is not the CALWMC's intention to re-examine procurement or funding options we would encourage elected officials to ask the new federal government if the $83 million committed to the solids energy recovery centre must remain tied to the Public Private Partnership fund.

It is our understanding that the new Federal Government is currently examining the P3 fund and its future. If the P3 fund was eliminated would the CRD be able to have an entirely publicly owned and operated project? Or would this project's funding be grandfathered and remain a P3? We believe these are questions that should be answered before moving forward with the procurement and implementation phases of this project.

Core Area Wastewater Treatment Program Commission Oversight

While we understand that the CRD is bound to have a commission in place to oversee the implementation phase of the eventual plan because of the Provincial funding agreement, if there is any opportunity to change the shape or scope of the commission we believe that this would be in the best interest of CRD residents.

Currently the commission has no elected representation, and we worry that in this form it could lack transparency and accountability. Once the commission begins their work there should be some type of feedback mechanism in place for the public that is structured and broadly accessible.

The Commission will also be in charge of procurement, and while the CRD's CAO has informed us that the Commission must implement the project based on CRD policies and the funding agreements in place, we want to reiterate that there should be no further expansion of private funding or operation.

Integration of Municipal Solid Waste

The Integrated Resource Management Task Force has been working to explore the potential integration of municipal solid waste with liquid solid waste and will report on their findings at the end of this month.

CUPE local 1978 members currently work at Hartland Landfill and should integration occur we have concerns around whether this would expand the private operation of this project.

The CRD should also consider the subcontractors and contracting out language in CUPE local 1978's collective agreement should they want to proceed with integration.

"ARTICLE 29, SUB-CONTRACTORS 29.01 All sub-contractors of the District shall provide wages which are at least equal to those specified in this Agreement when work of a similar or same nature is performed."

"ARTICLE 36, CONTRACTING OUT 36.01 No regular employee shall be laid off and placed on the recall list, terminated, or failed to be recalled to their classification as a result of contracting out."

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Westside Public Engagement Summary Document

Introduction

The Westside Select Committee launched the Westside Solutions Project in October of 2014. The Select Committee participants initially were from Colwood, Esquimalt, Langford, View Royal, and Songhees Nation. Esquimalt Nation officially became part of the Committee in the fall of 2015.

The scope of the Select Committee included both technical and public engagement activities including:

- Evaluation of existing technologies
- Evaluation of treatment levels
- Evaluation of resource recovery opportunities
- Site selection criteria
- Site selection
- Public engagement for wastewater and resource recovery options

Throughout the process the Committee has operated in an open and transparent fashion and has endeavored to inform, educate and involve Westside residents and stakeholders in decisions about Westside wastewater treatment and resource recovery.

During Phase I of the project the Westside Select Committee undertook a number of successful initiatives to fulfill their mandate, including open houses, innovation days, roundtables, community events, and online and telephone surveys. The public input around these programs helped guide the information and concepts that have been brought forward into Phase II of the overall project for the Core Area Liquid Waste Management Committee (CALWMC) of the Capital Regional District (CRD).

Phase II has consisted of a more thorough technical evaluation of possible sites and scenarios for wastewater treatment for both Eastside and Westside communities. As of January 13, 2016, the results of the technical work has been part of a concentrated public engagement process that was guided by an approved set of sound principles and clear objectives – recognizing the challenges in delivering a program of this size and complexity in a short period of time.

Over the course of the entire process to date, and through the efforts of municipal staff and consultants, thousands of residents have participated in the public consultation process.

- ✓ Principles:
  - Accessibility
  - Transparency
  - Diversity
  - Expanding Civic Literacy
  - Clear decision-making process
- ✓ Objectives:
  - maximize public engagement on sites, scenarios and costs
  - educate options benefits/drawbacks
  - educate on resource recovery options
  - identify further information requirements
  - engage a wider demographic for wider public feedback
  - identify and address concerns of citizens
  - Solicit constructive input to help guide decision making
  - general public acceptance

Overview

Methodology:

To help reach and engage the maximum number of Westside residents a number of tactics were engaged. These included utilizing earned media and paid advertising done in conjunction with the Eastside, social media, open houses, Westside newsletter and targeted meetings. Materials specific to the Westside along with a more comprehensive guide to the options was made available online, at public events, and at municipal halls and the CRD.

Survey:

The broadest reaching engagement tool was an online open survey targeted at residents across the Core Area. The survey was designed to give citizens the opportunity to examine and evaluate the seven options put forward for treatment of liquid waste and the two possible locations and technologies for treatment of solids. The options were developed by technical consultants, overseen by the Technical Oversight Panel and approved for consultation by the Directors of the CALWMC.

- ✓ Earned media
  - Press releases
  - Editorial meetings
  - Events
- ✓ Social media
  - Twitter
  - Facebook
  - Web sites
- ✓ Paid advertising
  - Black Press
  - Online TC
  - Used Victoria
  - Facebook
  - Postcard drop
- ✓ Targeted meetings and open houses
  - Community/neighbourhood associations
  - Business associations
- ✓ Online feedback
- ✓ Newsletter

Participation	Westside % just Westside communities (n=361)	Westside % to total participation across Core Area	Westside % of population in Core Area
Westside overall	100	27	28
Esquimalt	34	9	5.6
Colwood	26	7	5.7
Langford	24	6	11.9
View Royal	16	4	3.7
Songhees Nation	<1	<1	<1
Esquimalt Nation	0	0	<1

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Westside Wastewater Treatment & Resource Recovery

A total of 361 residents completed the online survey. While there was higher percentage of participation per population by Colwood and Esquimalt residents, and a lower percentage of participation per population by Langford residents, the overall participation by Westside residents is virtually equal to its population.

Liquid Treatment:

Acceptability for liquid treatment - Westside residents	**One plant secondary**	**One plant tertiary**	**Two plant**	**Three plant secondary**	**Three plant tertiary**	**Four plant**	**Seven plant**
Very acceptable	33	34	23	9	10	5	6
Somewhat acceptable	35	32	30	20	17	18	9
Not very acceptable	14	14	18	29	23	23	16
Not at all acceptable	17	16	26	38	46	50	66
No opinion	2	4	3	4	4	4	3
Very + Somewhat Acceptable	***68***	***66***	***53***	***29***	***27***	***23***	***15***

Please choose 3 options, in no particular order, that are in your view, acceptable options for wastewater treatment.	**Pre-change**	**Post change**
Two Plant - Rock Bay &Colwood - Secondary & Tertiary	69	51
One Plant - Rock Bay - Tertiary	70	47
One Plant - Rock Bay - Secondary	62	43
Three Plant Esquimalt Nation, Rock Bay & Colwood - Tertiary	25	20
Three Plant - Esquimalt Nation, Rock Bay & Colwood - Secondary	21	15
Seven Plant - Langford, Colwood, View Royal, Rock Bay, East Saanich, Saanich Core & Esquimalt	13	10
Four Plant - Esquimalt Nation, Rock Bay, Colwood & East Saanich	10	11
No answer	9	33

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Solids Treatment:

Preference for solids treatment site	West %
Hartland Landfill	35
Rock Bay	37
No preference	28

Q. Please rank your top three considerations among the following:	Top consideration	Top 1st, 2nd or 3rd consideration
Truck traffic for moving solids	20	42
Ability to be integrated with waste like food scraps, wood and construction waste, yard waste	16	41
Proximity of facilities to residential and business	13	42
Disposal of treated solids	11	45
Ability to generate resources like gas	13	35
Potential emissions	12	34
Piping to move solids	6	28
Ability to integrate into place	8	24

Priorities:

Ranking of your HIGHEST, SECOND HIGHEST and THIRD HIGHEST priorities for this project.	Highest priority	Highest 1st, 2nd or 3rd priority
How the project costs will affect my taxes	45	75
Level of water quality being discharged into the ocean	26	51
Opportunities for water reuse and heat recovery	9	43
Location of the treatment plants	10	36
How the treatment facilities will integrate with my neighbourhood and community	5	24

Completing the project on time	4	30
How construction will impact the quality of life in my neighbourhood	1	12
How truck traffic will impact the quality of life in my neighbourhood	0	12

Open Houses:

Westside hosted four Open Houses for Westside residents and participated in a joint Open House at Songhees Wellness Centre with the Eastside. The Open Houses were not as well attended as the ones hosted last year at this time – however there was a very interested and engaged public that did come to the events. As well – it should be noted that all the Open Houses were well supported by municipal staff and politicians.

Participation	Date	Attendance
Langford	February 10, 2016	~20
Songhees Wellness Centre (Joint with Eastside)	February 11, 2016	~30
Colwood	February 13, 2016	~75
Westshore and Esquimalt Chambers	February 15, 2016	~20
View Royal	February 15, 2016 (AM)	~30
Esquimalt	February 16, 2016	~85

Correspondence

Residents of the Westside who were unable to attend the Open Houses and/or were unwilling to complete a survey were encouraged to email coreareawastewater.ca, staff or consultants to voice their concerns and ideas. As most emails received did not specifically identify were the respondent resided it is difficult to quantify which proportion of those who wrote in were from the Westside. However, it should be noted that themes coming from correspondence coincided with the quantitative data collected through the survey and at Open Houses.

All correspondence will be made available in accordance with *Freedom of Information and Privacy Act.*

Qualitative Themes:

1. Financial

The priority concern of Westside residents is perceived cost escalations for the overall project. This issue was exacerbated by the comparison to the previous plan in spite of it being at a more preliminary stage in the process (the initial estimate for the previous plan was $1.2B in 2007) and the claims put forward by citizen advocates of a less costly solution.

There are also concerns by citizens regarding the cost allocations published with the options and that they were unfair to smaller municipalities. Specifically there is a great deal of anxiety for those on septic and what, if anything, they

should contribute to the overall system. This is a particular concern of Colwood residents as 70% are currently not on the sanitary system – but as there are those on septic in Langford and View Royal there are potential impacts there as well.

The issue of protecting the grants was raised occasionally – however people who participated in the events were more concerned about getting the scale of the project to the right size and then convincing senior levels of government to support that plan financially.

2. Environmental

In spite of the financial concerns there is still a great degree of concern for the quality of discharge into the environment. Concerns mainly centre most notably around the discharge of pharmaceuticals and micro-plastics, their impact on wildlife and the aquatic eco-system, and potential impacts on human health. Regardless of costs – there are a substantial number of residents who would be willing to pay more to do what they see as the right thing and protect the environment.

There is also a substantial interest in the opportunities for recovery of both heat and water. Particular interest to residents is not only the potential for both benefitting the environment, but also creating a revenue stream to offset costs. Of recovery potential – water reuse was the most mentioned by participants.

3. Community impacts

In July of 2015 Westside Solutions conducted a public education and survey on proposed sites for wastewater treatment on the westside. From that consultation sites were narrowed into the six (6) that were part of the current initiative. As residents had already weighed in on site selection – there was very little negative feedback on Westside sites.

As well – because of the previous technical and public engagement work done on the Westside there is an interest by some members in the community to pursue a “Westside Solutions” that would have a single plant that would treat wastewater generated on the westside, and potentially all wastewater currently being discharged out the McCaulay outfall.

In earlier engagement events, the Westside has put an emphasis on community integration. While residents are always concerned that there will be a negative impact – there is a much higher level of comfort that any facility can be a positive addition to a neighbourhood, and not a negative. However, concern over impacts of truck traffic and disruption during construction must be acknowledged and minimized during construction and in operation.

4. Other

Other issues that were raised with some frequency at events include:

- confusion on why Rock Bay is in every option
- no analysis of impact on business taxes
- no analysis of impact on tourism if the stalemate continues
- frustration over conflicting information
- frustration of the length of time it is taking to make a decision

WESTSIDE SOLUTIONS
Westside Wastewater Treatment & Resource Recovery

Conclusion

The Westside Select Committee's engagement strategy for the current phase of the Core Area project was built on a number of previous successful public engagement initiatives. As well as collaborating with the Eastside on the survey and advertising, over the course of the past few weeks the participating communities promoted activities and materials on their websites, at municipal halls and through social media; hosted five (5) Open Houses (including a joint Open House with the Eastside); communicated directly with community associations and citizens in person and through correspondence; and participated in a breakfast meeting with members of the Esquimalt and Westshore Chambers of Commerce.

Key themes that emerged include:

- concerns over costs and cost allocations;
- how application of costs will affect people on septic systems;
- concerns around discharge quality and having a treatment level that deals with substances such as pharmaceuticals and micro-plastics; and
- opportunities for water re-use and energy extraction.

There was very little negative feedback from participants on the proposed sites either in this round of engagement, or in the earlier SiteSpeak online survey that appears to speak to an understanding that facilities can be integrated into communities successfully. As well there is some interest, primarily from members of the business community, to further explore a "Westside Solution" with a single facility to treat wastewater generated by participating west-side communities as per the Engineering consultants report delivered to the Select Committee in November, 2015.

Public sessions were fairly well attended, had a cross section of residents – including many new faces - and were very respectful. It was clear that people who come to the public events came to learn more about the issue so as to contribute positively to the solution. It noted and appreciated by many citizens that the Westside public events were very well supported by municipal staff and politicians.

Design with community in mind