Making a difference...together

Capital Regional District
625 Fisgard Street, PO Box 1000
Victoria, BC, Canada V8W 2S6

T: 250.360.3000
F: 250.360.3234
www.crd.bc.ca

March 11, 2014

File 5220-20
0400-50

Mr. Bill Brown
Director of Development Services
Township of Esquimalt
1229 Esquimalt Road
Victoria, BC V9A 3P1
Sent by email: bill.brown@esquimalt.ca

Mr. Brown:

Thank you for your advice, as set out in your email to me of March 7, 2014 that the information provided for the Terms of Reference as outlined in my letter of March 4, 2014 is what is expected from the Capital Regional District (CRD) to respond to your request for Terms of Reference under Esquimalt's Development Approval Information Procedures and Fees Bylaw, as set out in your letter to me of February 28, 2014.

With reference to your letter of February 28, 2014, and as a follow up to our initial response on March 4, 2014, the CRD wishes to reiterate that it takes exception to your characterization of the process as a failure on the part of the CRD to proceed with the rezoning application in a timely manner. For your information we are attaching a chronology of events related to the rezoning application (Attachment 1). The CRD formally applied for rezoning of Lots A to E Plan 33522 to allow the wastewater treatment plant use and made a formal rezoning application in January 2013. On June 24, 2013 without the CRD, as property owner, having been given any advance notice of the content of the bylaw, nor having been consulted regarding the approach or much of the content of the bylaw, particularly as it related to the stipulations for "amenities", Bylaw No. 2806 was introduced and given first and second readings. This rezoning Bylaw No. 2806, which added wastewater treatment plant as a permitted use, was then the subject of a public hearing process and adopted by Esquimalt Council over a matter of 3 weeks despite the objections of the CRD. We note the Township of Esquimalt adopted Bylaw No. 2806 without the need for the information currently being requested.

The purpose of the current rezoning application is to request amendments to the height and setback regulations that are in Bylaw No. 2806, to extend the McLoughlin Point Special Use zone to include two extremely small parcels to enable the public walkway to be constructed, and to amend the density bonusing for amenities scheme for Esquimalt to host the wastewater treatment plant. As such, the CRD cannot help but be aware that the Township of Esquimalt is setting a different standard of information for the amendments to the existing zone as set out in Bylaw No. 2805 compared to its own Bylaw No. 2806. If the Township needed the requested information in order to make a decision on the revised rezoning application, this could have been provided at any time within the past year. It is also unclear why Esquimalt is not prepared to accept the information already provided without third party review even though most of the information requested has already been prepared by qualified third parties with extensive experience in their respective fields.

However, despite the above noted reservations we are providing the following response to your request for additional information:

1. Implications of a Tsunami Wave on the McLoughlin Wastewater treatment Plant.

We have referred your questions to our third party consultants who have reviewed how the CRD has used the information in the tsunami report, *Modelling of Potential Tsunami Inundation Limits and Run-Up*, and have concluded that the use is appropriate and conservative. They have confirmed that the CRD's use of the report for determining the height of the tsunami wall at McLoughlin Point is appropriate and have also confirmed that the 6.1 m high tsunami wall proposed by the CRD is adequate for the most probable maximum earthquake. In addition, AECOM and Applied Research International have provided commentary on the other concerns raised in your request for information, included as Attachment 2.

Comments have been made concerning the version of the tsunami report prepared by AECOM that was sent to Esquimalt at its request. The version that was sent was not the final report but the April 2013 version presented to the Planning, Transportation and Protective Services Committee, prior to the amendments to the Executive Summary by the consultant. The report was downloaded from the CRD website which unfortunately still had the April 2013 version posted. The June 2013 report did not change the technical analysis or conclusions of the report, only the Executive Summary was changed. The latest version of the report has since been provided to Esquimalt.

2. A map showing the route or possible routes of the biosolids conveyance pipeline to Hartland landfill.

The routing has been discussed in detail with Esquimalt Engineering staff and reflects their input. A map showing the route in Esquimalt and Victoria was officially submitted to Esquimalt on March 7, 2014 (Attachment 3). We have also attached a map showing the full route of the residual solids pipe from McLoughlin to Hartland landfill (Attachment 4). The pipeline route generally reflects the route shown in Amendment No. 8 to the Core Area Liquid Waste Management Plan (CALWMP) with adjustments to reflect the preferences from the Township of Esquimalt engineering staff within the boundary of the Township.

3. A map showing the route of the upgraded electrical transmission and distribution lines from the Esquimalt Substation to the proposed wastewater treatment plant including details of proposed voltage increases from existing, location of any new transformers, and the location of any new switching boxes.

Refer to the attached map (Attachment 5). The line voltage will be 12.5 kilo volts (KV). The routing was discussed in detail with Esquimalt Engineering staff and reflects their input with respect to buried versus overhead services.

4. A map showing the route of the upgraded water transmission and distribution system from its entry into Esquimalt to the proposed wastewater treatment plant.

Refer to the attached map (Attachment 6). This routing was discussed in detail with Esquimalt and City of Victoria Engineering staff.

5. **Letter from the City of Victoria Water Works Department commenting on or otherwise relevant to the proposed alignment and upgrades to the water transmission and distribution system for the proposed Wastewater Treatment Plant.**

Refer to the attached letter from the City of Victoria (Attachment 7).

6. **Letter from the BC Hydro commenting on or otherwise relevant to the proposed upgrade and alignment of the electrical transmission and distribution system associated with the proposed Wastewater Treatment Plant.**

Refer to the attached letter from BC Hydro (Attachment 8).

7. **Letter from the Provincial Ministry of Health commenting on or otherwise relevant to the evidence related to the propagation of antibiotic resistant bacteria in secondary wastewater treatment plants and based on this evidence they support the construction of a secondary wastewater treatment plant at McLoughlin Point.**

Refer to the attached letter from the Provincial Ministry of Health and the Chief Medical Health Officer (Attachment 9).

8. **Letter from the Chief Public Health Officer for Island Health commenting on or otherwise related to the propagation of antibiotic resistant bacteria in secondary wastewater treatment plants and the construction of a secondary wastewater treatment plant at McLoughlin Point.**

A joint response has been received from the Provincial Ministry of Health and the Chief Medical Health Officer (Attachment 9). Of particular significance are the following comments: Antibiotic resistant bacteria are becoming ubiquitous in all surface water environments going through urban and agricultural environments. Due to the 'widespread and largely unregulated use of antibiotics' in China, 'the likelihood of larger numbers of ABR in municipal wastewater in China is likely more prevalent than in North America.' Also 'any wastewater management program also needs to deal with source controls.' Finally, 'the expectation for the design of any modern municipal wastewater treatment plant should be that microbiological (as well as chemical risks be addressed and that the operation of the facility be monitored on an ongoing basis to confirm those outcomes as well as updated, if necessary, to reflect new knowledge of these issues as it becomes available.' The CRD already has a comprehensive source control program, has made provision of the addition of advanced oxidation to the wastewater treatment plant and ongoing monitoring will be part of the operating requirements of the plant.

9. **From a third party, a detailed analysis of the costs associated with treatment of storm water from Oak Bay and how these costs are paid for. The analysis must include a calculation related to how the volume of storm water from Oak Bay affects the size and capacity of the proposed Core Area Liquid Waste Management Plant at McLoughlin Point. The analysis is to also ascertain whether or not the treatment of storm water at McLoughlin Point is consistent with all of the Capital Regional District's policies and programs related to inflow and infiltration.**

Amendment No. 8 to the CALWMP, approved by the B.C. Minister of Environment on August 25, 2010, contains the following statement about plant capacity:

> 'At Clover Point, a pump station will divert up to three times ADWF via a forcemain to McLoughlin Point in Esquimalt for secondary treatment This will reduce the total suspended solids load being discharged at Clover Point by about 99%. Any remaining wet weather flows at Clover Point will receive fine screening prior to discharging through the Clover Point Outfall. By 2030, flows above four times ADWF are expected to be eliminated.
>
> At McLoughlin Point, the flows diverted from Clover Point will be added to the flows from the northwest trunk and given secondary treatment for flows up to two times ADWF. The flows treated at this location will have originated in Oak Bay, Saanich, Victoria, Esquimalt, Colwood, Langford and View Royal. Wet weather flows up to four times ADWF will be given primary treatment and any flows above this level will be screened until 2030, by which time such excess flows are expected to be eliminated.'

Simply put, the capacity of the McLoughlin Point Treatment plant is based on average dry weather flow (ADWF) i.e., flows recorded during the June to August period and not on storm water flows (Attachment 10). There is no capacity provided at the treatment plant for flows above four times ADWF.

The CRD engaged with participating municipalities on cost recovery options for the Seaterra Program and it was agreed that operating costs would be allocated in proportion to current flows and capital costs (debt servicing) would be allocated on the basis of design capacity assigned to each municipality based on their requested capacity under the following allocation formula:

	ADWF	AAF Average Annual Flow
Operating (based on current capacity)	80%	20%
Debt Servicing (based on design capacity)	70%	30%

Under the formula, municipalities with higher Inflow & Infiltration (I&I) flows, such as Oak Bay, will contribute more to the operating and debt servicing costs. As a result, Oak Bay residents will be paying the highest average cost per household. Oak Bay is committed to separating the combined sewers in the Uplands area and has commenced preliminary work. Other municipalities have also committed to reducing their I&I by 2030.

10. From a third party, a detailed analysis of the potential implications on the design of the proposed sewage treatment plant if a treatment plant is built in Colwood now or in the near future, further to Colwood's request, instead of in 2030. The analysis to include the impacts of Langford having its sewage treated at the proposed Colwood plant.

The CRD is proceeding under the authority of the approved CALWMP Amendment No. 8, which includes Colwood. The CRD is legally obligated to implement the approved CALWMP until such time as an amendment is approved. An amendment to permit Colwood to build its own facility would be considered a major amendment to the CALWMP and require a full public process involving consultation and approval of the Minister of Environment.

While there is no guarantee that Colwood will be permitted to construct its own sewage treatment facility, we are providing the following information on the implications for the current Program if such approval was obtained. Colwood has requested a capacity of 4.1 megalitres per day (Ml/d) ADWF at the McLoughlin Plant or 3.8% of its planned capacity. Should Colwood be permitted to opt out, the capacity at McLoughlin would not be reduced for the following reasons:

- Reducing the capacity by 3.8% will not reduce the cost of the McLoughlin Plant by an equivalent amount because at this capacity of plant there is not a linear relationship between capacity and cost. Cost savings would be minimal, if not non-existent.
- The cost of providing an additional 4.1Ml/d capacity at a future plant will be greater than any possible cost savings to the planned plant at McLoughlin.
- Given that Colwood has no plans to service the majority of its population currently not connected to sanitary sewers, no new capacity will need to be provided until at least 2040 and with modifications to the treatment process at McLoughlin, potentially not until 2065.
- The withdrawal of Colwood would provide the remaining core area municipalities with an additional 4–5 years of capacity at the McLoughlin plant.

The financial implications for the remaining participants of Colwood's withdrawal as determined by a third party will be sent under separate cover by March 14.

As there is no resolution or indication from Langford Council expressing an interest in either having its sewage treated at the proposed Colwood plant or pulling out of the Seaterra Program, and given the significant analysis that would be required to assess the implications, the CRD is not prepared to undertake the work required to address this hypothetical possibility. I would note that in 2009 the estimated cost of a 16.6Ml/d membrane bioreactor plant, the size that would be required to service Colwood and Langford, was estimated by Stantec/Brown and Caldwell to cost $148 million in 2009 dollars.

The CRD has spent a significant amount of time and resources to address these latest requests from Esquimalt and have responded in a very timely manner. We trust that Esquimalt is satisfied with the completeness of the CRD application and can now finalize the public process in a timely and efficient manner.

Yours truly,

Robert Lapham, RPP, MCIP
Chief Administrative Officer
Capital Regional District

Attachments: 10

cc: CRD Board Members
Executive Leadership Team, CRD
Albert Sweetnam, Program Director, Seaterra Program, CRD
Michael Peckham, Program Manager, Wastewater Treatment, Seaterra Program, CRD
Laurie Hurst, CAO, Township of Esquimalt

March 11, 2014

The following is a chronology of events related to the rezoning application for McLoughlin Point Property.

1. Staff received direction from the CALWMC on June 24, 2009, not to proceed with work beyond the planning phase of the Program until a response was received from both governments regarding a funding commitment for the procurement and capital construction phase of the program.
2. On August 25, 2010 the Core Area Liquid Waste Management Plan Amendment No.8 was approved by the Minister of Environment
3. For the remainder of 2010, 2011 and into 2012 the CRD was engaged in negotiations to secure senior government funding for the Core area Wastewater Treatment Program (Program).
4. In July 2012 the British Columbia, Infrastructure Canada and P3Canada formally announced funding for the Program.
5. Imperial Oil completed the clean-up of the McLoughlin site by the end of December 2012
6. The CRD submitted and Esquimalt accepted a rezoning application for McLoughlin Point in January 2013, prior to CRD taking ownership of the property.
7. CRD conducted due diligence on the geotechnical report on the site cleanup prior to purchasing the site in April 2013.
8. In April 2013, a Design Charette and public consultation process was held, resulting in the augmentation of Design Guidelines
9. The rezoning application was revised in June 2013 to include design guidelines resulting from the public consultation process
10. On June 24, 2013 Bylaw 2804, amendment to the Official Community Plan, was introduced and given first and second reading
11. On June 24, 2013 Bylaw 2805, amendment to the Zoning Bylaw (CRD requested changes) was given first and second reading and referred to public hearing
12. On June 24, 2013 Bylaw 2806 amendment to the Zoning Bylaw (Esquimalt's own bylaw) was given first and second reading and referred to a public hearing.
13. A Public Hearing on the three bylaws was held on July 8 and 9, 2013
14. On July 15, 2013 the Township of Esquimalt adopted Bylaw 2804 and Bylaw 2806.
15. In July 2013 Esquimalt and CRD met separately with the Minister of Community Sports and Cultural Development – and were encouraged to negotiate a resolution to allow construction to proceed.
16. Between July – October staff from the CRD and Esquimalt reached agreement on a revised Bylaw 2805 that would accommodate construction of a gravity flow, 108 Ml/day wastewater treatment plant, a Community Impact Mitigation and Operating Agreement, and a Host Community Impact 5-Year Agreement.
17. Between September and December, the McLoughlin proponents met, in camera, three times with Esquimalt's Design Review Committee.
18. At its meeting on December 3, 2013 the Design Review Committee confirmed that all three designs met the intent of the Design Guidelines, approved by Esquimalt.

19. The agreements were presented to the November 2013 CALWMC which did not approve the “agreement package” and requested information on the cost of barging and whether Esquimalt could be offered an amount of money in place of the barging requirements.
20. In December, the CRD brought forward a need for amendments to the draft bylaw 2805 from what had been agreed to in principle between Esquimalt staff in October/November, in order to accommodate the designs of the proponents specifically, the encroachment into the 7.5m Setback area and additional height requirements in the Low Height Area.
21. In December 11, 2013 supplementary information was provided to the CALWMC which essentially restored the agreement negotiated with Esquimalt in October 2013. On the recommendation of the CALWMC, the CRD Board approved the agreement package on December 11, 2013.
22. The revised rezoning application was submitted in December 20th, 2013.
23. On January 6th Council received the revised application and referred it to the Esquimalt Advisory Planning Commission.
24. On January 8th, Esquimalt staff discussed the revised application with the Design Review Committee, without the knowledge of the CRD.
25. On January 14 the Esquimalt Advisory Planning Commission acknowledged the changes that the CRD had made and were pleased that their previous concerns had been addressed. However, they voted to recommend that the Esquimalt Council reject the revised rezoning application.
26. On January 20 Esquimalt Council gave second reading to revised Bylaw 2805 and referred the bylaw to a public hearing.
27. The application was revised and resubmitted on January 30, 2014 to reduce the encroachment and coverage within the 7.5m setback zone, to add a Section 219 covenant related to the encroachments and to include 2 small parcels purchased from Transport Canada.
28. Public hearings were held on February 18 and 19.
29. At its Monday February 24 meeting, Esquimalt Council authorized reconvening the Public Hearing on March 20 and continued on March 22 if necessary, and, to write to the CRD a list of questions, the answers to which are to be provided in advance of the reconvened public hearing, to allow for consideration by the public.
30. The questions were e-mailed to the CRD’s CAO after close of business on Friday, February 28.
31. CRD staff responded to the questions posed on March 11, 2014.

AECOM

AECOM
200 – 415 Gorge Road East
Victoria, BC, Canada V8T 2W1
www.aecom.com

250 475 6355 tel
250 475 6388 fax

10 March, 2014

Project No: 60242933 Task 800.1

Mr. Mike Peckham
CRD Seaterra Program
510 - 1675 Douglas Street
Victoria, BC V8W 2G5

Dear Mr. Peckham:

Re: Review of CRD Determination of Tsunami Wall Elevation for Proposed McLoughlin Point Wastewater Treatment Plant

The Capital Regional District (CRD) recently requested that AECOM, and its key subconsultant Dr. K. F. Cheung of Applied Research International (ARILLC), perform a review of the Tsunami wall height that will form part of the proposed McLoughlin Point wastewater treatment plant (wwtp). Specifically, we were asked to review and comment on the following:

- CRD's use of the results of our study and report "Modelling of Potential Tsunami Inundation Limits and Run-Up" as an input to the tsunami wall height determined by Stantec
- Use of the Cascadia Subduction Zone (CSZ) earthquake as the initiating action for the tsunami
- Use of a magnitude 9.0 CSZ earthquake event
- Use, and appropriateness, of adding contingency values for sea level rise and storm surge to the modelling results to determine the 6.1 m tsunami wall height.

In addition CRD also asked AECOM and ARILLC to provide some commentary, where possible, to assist the CRD in responding to a series of questions posed by the Township of Esquimalt following public meetings held regarding the Rezoning Application for the site that has been submitted by CRD.

Our response and commentary is attached. In summary, it is our opinion that the CRD has used our report findings relative to the McLoughlin Point site appropriately and that the CRD's addition of allowances for storm surge and sea level rise in determining the height of a proposed tsunami wall at the site is both acceptable and conservative over the expected life-time of the planned treatment plant.

Please contact the undersigned if you have any questions.

Sincerely,
AECOM Canada Ltd.

Mike Brady, P.Eng.
Manager, Victoria Office
mike.brady@aecom.com
MB
Encl

K. F. Cheung, Ph.D., P.E. (Hawaii)
Principal, Applied Research International

Tsunami Hazards at McLoughlin Point
Esquimalt, British Columbia

McLoughlin Point is a headland at the entrance to Victoria Harbour near the eastern limit of the Strait of Juan de Fuca. The Modelling of Potential Tsunami Inundation Limits and Run-up project by AECOM undertook analysis of the Capital Regional District shoreline through a series of nested model grids with decreasing grid size so that results could be presented with increasing accuracy. For Victoria Harbour (and adjacent areas) the data used for development of the Digital Elevation Model (DEM) included LiDAR data from CRD, considered the most accurate of the topographic information that was available for inundation mapping, and bathymetric data obtained by CRD from Canadian Hydrographic Service, Pacific Region, which we understand is the best available.

The analysis of tsunami impacts for the Victoria Harbour area, including McLoughlin Point, used a grid size of 9 m x 9 m, the smallest used in this study. The required resolution for tsunami modelling is relative to the wavelength and the dimensions of land features. The 9-m grid used in the modelling work is more than sufficient to describe the shortest tsunami waves at the entrance of Victoria Harbour. The headland at McLoughlin Point measures approximately 200 m or over 20 grid cells across. The tsunami model can accurately describe wave transformation over the nearshore bathymetry and potential inundation on its shores. As a reference, the US National Tsunami Hazard Mitigation Program recommends a maximum grid size of 90 m for inundation mapping and the finest resolution used has been 9 m, the same as used for the Victoria Harbour area, including McLoughlin Point.

A Geological Survey of Canada study investigated historical and paleo-tsunamis from Pacific subduction zones as well as local crustal earthquakes and landslide sources and confirmed that Cascadia megathrust events dominate and define the tsunami hazard at the inner Pacific coasts of the Straits of Juan de Fuca and Georgia (Leonard et al., 2012; 2014). Kelsey et al. (2012) identified three new active faults at the northern end of the Cascadia subduction zone in the Bellingham forearc basin, but concluded that they are only capable of generating 6.0 - 6.5 moment magnitude earthquakes. Tsunamis waves generated by these earthquakes are very small, and their impact is most likely limited to the coastlines inside the Strait of Georgia. These findings corroborate an earlier study by the US National Oceanic and Atmospheric Administration that used a great Cascadia earthquake for tsunami inundation mapping along the shores of Bellingham, Anacortes, and Whidbey Island, Washington (Venturato et al., 2004).

The Cascadia subduction zone extends 1,100 km from northern California to British Columbia. Paleoseismic studies of tsunami deposits, tree rings, and coastal subsidence have identified seven great earthquakes that ruptured the entire subduction zone during the last 3,500 years (Darienzo et al., 1994; Atwater and Hemphill-Haley, 1997; Clague, 1997; and Goldfinger et al., 2003). These earthquakes have typical moment magnitude of 9.0 and recurrence intervals of 300 to 700 years. The current US National Seismic Hazard Maps assigns occurrence probabilities of 0.2, 0.6, and 0.2 for great Cascadia earthquakes of magnitude 8.8, 9.0, and 9.2 with a 500-year return period. First Nations oral histories, Japanese written records, and proxy data indicate the most recent event occurred in 1700 (Jacoby et al., 1997; Ludwin et al., 2005; Satake et al., 1996). Satake et al. (2003) inferred a magnitude 9.0 Cascadia earthquake from numerical modelling of the tsunami across the Pacific to reproduce the recorded tsunami inundation in Japan. A 2010 USGS workshop evaluated the sediment layer data of Goldfinger et al. (2010) to constrain the recurrence parameters of great Cascadia earthquakes for the update of the US National Seismic Hazard Maps in 2014 and reached a consensus on magnitude 9.0 for rupture of the entire Cascadia subduction zone with average recurrence time of 500-600 years (Frankel, 2011). The published technical information indicates that the most likely 1-in-500 year event will have magnitude 9.0. Three hundred and fourteen years have elapsed since the last great Cascadia earthquake. Given the current convergence rate, such an earthquake will likely reach magnitude 9.0 in another 200 years; other 500-year earthquake events could occur in less than 200 years but their magnitude would be lower than 9.0.

The AECOM study utilized the tsunami model NEOWAVE developed by Yamazaki et al. (2009, 2011) in a joint effort between the University of Hawaii and the University of Alaska. The model meets all the requirements specified by the US National Oceanic and Atmospheric Administration for tsunami inundation mapping as documented in National Tsunami Hazard Mitigation Program (2012), and most importantly, won the 2009 Benchmark Challenge sponsored by the US National Science Foundation by out-performing 10 tsunami models developed in the US and Europe. NEOWAVE is the official model for tsunami inundation mapping in Hawaii, American Samoa, the US Gulf Coasts, Puerto Rico and is distributed by UNESCO to government agencies around the world for tsunami hazard assessment. NEOWAVE describes the complete cycle of tsunami evolution that includes generation at the source, propagation across the ocean, and inundation at coastlines under the constraint of the DEM as in the real world. With high resolution topography and bathymetry in the Greater Victoria area, the tsunami waves were modelled to a high degree of accuracy with full consideration of their behaviors as they approach McLoughlin Point.

The AECOM report established a Tsunami Hazard Line (THL) for all of the CRD. For the McLoughlin Point site the THL elevation has been set at 4.0 m, based upon:

- 0.7 m of Higher High Water Mean Tide, which corresponds to the US terminology of mean higher high water that is recommended by the National Tsunami Hazard Mitigation Program as the starting water level for tsunami modelling,
- 1.8 m of tsunami wave amplitude from a magnitude 9.0 Cascadia earthquake,
- less than 0.2 m of subsidence from the earthquake rupture, and
- a margin of 1.3 m based on a factor for public safety of 1.5.

It can also be stated that the 1.3 m of safety margin in the tsunami runup can accommodate an earthquake with magnitude of up to 9.2, which is considered by the US National Seismic Hazard Maps as the probable maximum value for the Cascadia subduction zone.

The proposed tsunami wall at McLoughlin Point has a design height of 6.1 m, which the CRD has determined based upon the following:

- 4.0 m of tsunami runup, as identified by the AECOM report for the McLoughlin Point site
- 1.0 m of storm tide, adopted by Stantec based on recommendations of 0.5 to 1.0 m from Institute of Ocean Sciences (IOS), March 2011
- 1.0 m of long-term sea-level rise, representing the sea level rise forecast by the year 2100 as adopted by the recent BC Ministry of Environment/Climate Change Adaptation Guidelines for Sea Dikes and Coastal Flood Hazard Land Uses, January 27, 2011 and
- 0.1-m correction from the mean sea level to the geodetic datum.

This estimate is based on a linear combination of water levels and hydrodynamic processes that is reasonably valid and accurate as long as the site landforms are not overwhelmed by waves – as is the case for McLoughlin Point due to its natural ground elevations. The AECOM model study confirmed that adjustment of the starting water level by up to 2 m results in less than 5% modification of the computed tsunami amplitude. In this case the addition of the two one-metre increments to the modelling results is an acceptable approach for determination of the tsunami wall height. The 6.1-m tsunami wall will therefore suffice a probable maximum tsunami from a magnitude 9.2 Cascadia earthquake occurring during a storm tide together with 100 years of sea level rise. It should be noted that the coincidence or combination of these three extreme events has a low probability or likelihood within the expected life of the facility.

Regarding the 1.0 m value for storm surge referred to above, it should be noted that the Coastal Floodplain Mapping – Guidelines and Specifications prepared for the BC Ministry of Forests, Lands and Natural Resource Operations in June 2011 provides values for Suggested Deep Water Storm Surge for Coastal Floodplain Mapping for the entire BC coastline. For "Other highly developed areas such as: Squamish, Victoria, etc." the Suggested Design Storm Surge due to a 1:500 year storm is 1.3 m. As noted above, the concurrence of extreme events has a low likelihood which would be reduced even further if one was to consider both the 1:500 year CSZ earthquake and a 1:500 year storm occurring at the same time. Therefore, the use of a 1.0 m storm surge (rather than 1.3 m) while also using the tsunami wave generated by a 1:500 year CSZ earthquake to determine the elevation of the tsunami wall for McLoughlin Point wwtp appears to be sufficiently conservative.

The CRD has indicated that the proposed life of the wastewater treatment plant at the McLoughlin site is 75 years. During this time span the prediction for sea level rise is less than the one metre that has been allowed by CRD and any 500-year earthquake that could occur would have magnitude less than 9.0, resulting in a lesser tsunami wave amplitude than determined in the tsunami modelling investigation. Therefore it would be expected that the determination of a 6.1 m tsunami wall height would be considered to be conservative during the treatment plant's assessed lifetime so that a further assessment of risks should not be needed.

The foregoing concludes that the determination of a 6.1 m tsunami wall height for the McLoughlin Point site appears reasonable and appropriate. Provided that the designer-builder of the proposed treatment plant will build a suitably strong and resilient tsunami wall to protect the site, we would anticipate that the treatment plant, its equipment and its staff would be protected from harm in the event of a tsunami during its lifetime. As such we do not foresee that a risk of mortality analysis would be necessary relative to the site and its proposed development. Similarly, we understand that the CRD has proposed a rezoning bylaw that incorporates a definition of Grade that is intended to "allow for sufficient tsunami protection for the proposed development" and a number of siting requirements, including setbacks. It would seem to be appropriate that the zoning bylaw requirements are developed in conjunction with the knowledge that a tsunami wall at 6.1 m elevation is planned to be constructed to protect the site, the plant, its equipment and its staff.

The determination of the tsunami wall height does not include any analysis or discussion related to potential impacts of liquefaction of the seabed or of submarine landslides. The Geological Survey of Canada study by Leonard et al. (2012, 2014) included an extensive review of actual and potential tsunami sources from landslides and liquefaction on the Canadian coastline. They identified a number of sources on the coasts inside the Strait of Georgia, but none along the Strait of Juan de Fuca that can impact the McLoughlin site. The absence of historical and geological evidence of tsunamis generated by landslides and liquefaction does not rule out their occurrence in the future, but does imply the rarity of such events and explain their omission in the analysis. The use of a great Cascadia event as the critical scenario near the eastern limit of the Strait of Juan de Fuca is supported by the Geological Survey of Canada study by Leonard et al. (2012, 2014) as well as the NOAA study by Venturato et al. (2004).

Atwater, B.F. and Hemphill-Haley, E. (1997). Recurrence intervals for great earthquakes of the past 3,500 years at northeastern Willapa Bay, Washington. US Geological Survey, Professional Paper 1576, 108 p.

Clague, J.J. (1997). Evidence for large earthquakes at the Cascadia subduction zone. Reviews of Geophysics, 35(4), 439-460.

Darienzo, M.E., Peterson, C.D., and Clough, C. (1994). Stratigraphic evidence for great subduction-zone earthquakes at four estuaries in Northern Oregon, U.S.A. Journal of Coastal Research, 10(4), 850-876.

Frankel, A.D. (2011). Summary of November 2010 Meeting to Evaluate Turbidite Data for Constraining the Recurrence Parameters of Great Cascadia Earthquakes for the Update of the National Seismic Hazard Maps. U.S. Geologic Survey, Open-File Report 2011-1310, 13 p.

Goldfinger, C., Nelson, C.H., and Johnson, J.E. (2003). Deep-water turbidities as Holocene earthquake proxies – The Cascadia subduction zone and northern San Andreas fault systems. Annals of Geophysics, 46(5), 1169-1194.

Goldfinger, C., Nelson, C.H., Morey, A.E., Johnson, J.E., Patton, J.R., Karabanov, E., Gutiérrez-Pastor, J., Eriksson, A.T., Gràcia, E., Dunhill, G., Enkin, R.J., Dallimore, A., and Vallier, T. (2012). Turbidite Event History—Methods and Implications for Holocene Paleoseismicity of the Cascadia Subduction Zone: U.S. Geological Survey, Professional Paper 1661–F, 170 p.

Jacoby, G.C., Bunker, D.E., and Benson, B.E. (1997). Tree-ring evidence for an AD 1700 Cascadia earthquake in Washington and northern Oregon. Geology, 25(11), 999-1002.

Kelsey, H.M., Sherrod, B.L., Blakely, R.J., and Haugerud, R.A. (2012). Holocene faulting in the Bellingham forearc basin: Upper-plate deformation at the northern end of the Cascadia subduction zone. Journal of Geophysical Research: Solid Earth, 117(B3), 10.1029/2011JB008816.

Leonard, L.J., Rogers, G.C., and Mazzotti, S. (2012). A preliminary Tsunami Hazard Assessment of the Canadian Coastline. Geological Survey of Canada, Open File 7201, 126 p.

Leonard, L.J., Rogers, G.C., and Mazzotti, S. (2014). Tsunami Hazard Assessment of Canada. Natural Hazards, 70(1), 237-274.

Ludwin, R.S., Dennis, R., Carver, D., McMillan, A.D., Losey, R., Clague, J., Jonientz-Trisler, C., Bowechop, J., Wray J., and James, K. (2005). Dating the 1700 Cascadia earthquake: great coastal earthquakes in Native stories. Seismological Research Letters, 76(2), 140–148.

National Tsunami Hazard Mitigation Program (2012). Proceedings and Results of the 2011 NTHMP Model Benchmarking Workshop. Boulder: U.S. Department of Commerce, NOAA NTHMP; (NOAA Special Report). 436 p.

Satake, K., Shimazaki, K., Tsuji, Y., and Ueda, K. (1996). Time and size of a giant earthquake in Cascadia inferred from Japanese tsunami records of January 1700. Nature, 379, 246-249.

Satake, K., Wang, K., and Atwater, B.F. (2003). Fault slip and seismic moment of the 1700 Cascadia earthquake inferred from Japanese tsunami descriptions. Journal of Geophysical Research: Solid Earth, 108(B11), DOI: 10.1029/2003JB002521.

Venturato, A.J., Titov, V.V., Mofjeld, H., and González, F.I. (2004). NOAA TIME Eastern Strait of Juan de Fuca, Washington, Mapping Project: Procedures Data, Sources, and Products. NOAA Technical Memorandum OAR PMEL-127, Seattle, Washington, 22 p.

Yamazaki, Y., Cheung, K.F., and Kowalik, Z. (2011). Depth-integrated, non-hydrostatic model with grid nesting for tsunami generation, propagation, and run-up. International Journal for Numerical Methods in Fluids, 67(12), 2081-2107

Yamazaki, Y., Kowalik, Z., and Cheung, K.F. (2009). Depth-integrated, non-hydrostatic model for wave breaking and run-up. International Journal for Numerical Methods in Fluids, 61(5), 473-497.

ATTACHMENT 3

COPY

seaterra program
510-1675 Douglas Street
Victoria, BC, Canada V8W 2G5
T: 250.360.3002 F: 250.360.3071
www.seaterraprogram.ca

March 6, 2014

RRC 0400-50

Jeff Miller, P. Eng
Director of Engineering and Public Works
Township of Esquimalt
1229 Esquimalt Road
Esquimalt, BC V9A 3P1

Dear Mr. Miller,

RESIDUAL SOLIDS CONVEYANCE PIPE ALIGNMENT ON TOWNSHIP OF ESQUIMALT ROADS

Further to the February 18 and March 5, 2014 meetings that Capital Regional District (CRD) staff had with Township of Esquimalt (Esquimalt) staff, we are writing this letter to confirm CRD's preferred conveyance pipe alignment in Esquimalt. The attached drawing identifies the proposed route which is located entirely within existing road right-of-ways. The route was identified by working together with Esquimalt staff to utilize a common corridor with BC Hydro and the proposed district energy system, and to minimize: rock blasting, arterial roads impacts, utility conflicts and avoid a railway crossing. Consistent with past practices, we request that Esquimalt Engineering review the proposed alignment to ensure that there are no engineering conflicts and to identify other capital plan works that we can coordinate with Esquimalt to minimize impacts to residents and commuters.

As discussed, the Seaterra Program is developing a public engagement process to address questions and concerns about the project. We have contacted local Community Associations and will arrange a meeting with them for next week. From there, we will look to work with them to develop Information Meetings and/or Open Houses for their communities. We anticipate these would occur in April 2014.

The Seaterra Program will continue to follow Esquimalt guidelines as the scope of work is further defined including review of the alignment within each road right-of-way so that we can better determine the restoration requirements. As you know, the CRD's policy for restoration is to restore to an "as good or better" standard and given that the proposed pipe diameter is only 200 mm, the trench width will be quite small and installation should be completed in an expeditious manner.

Thank you for your attention to this matter. Please call or email me if you have any questions require additional information.

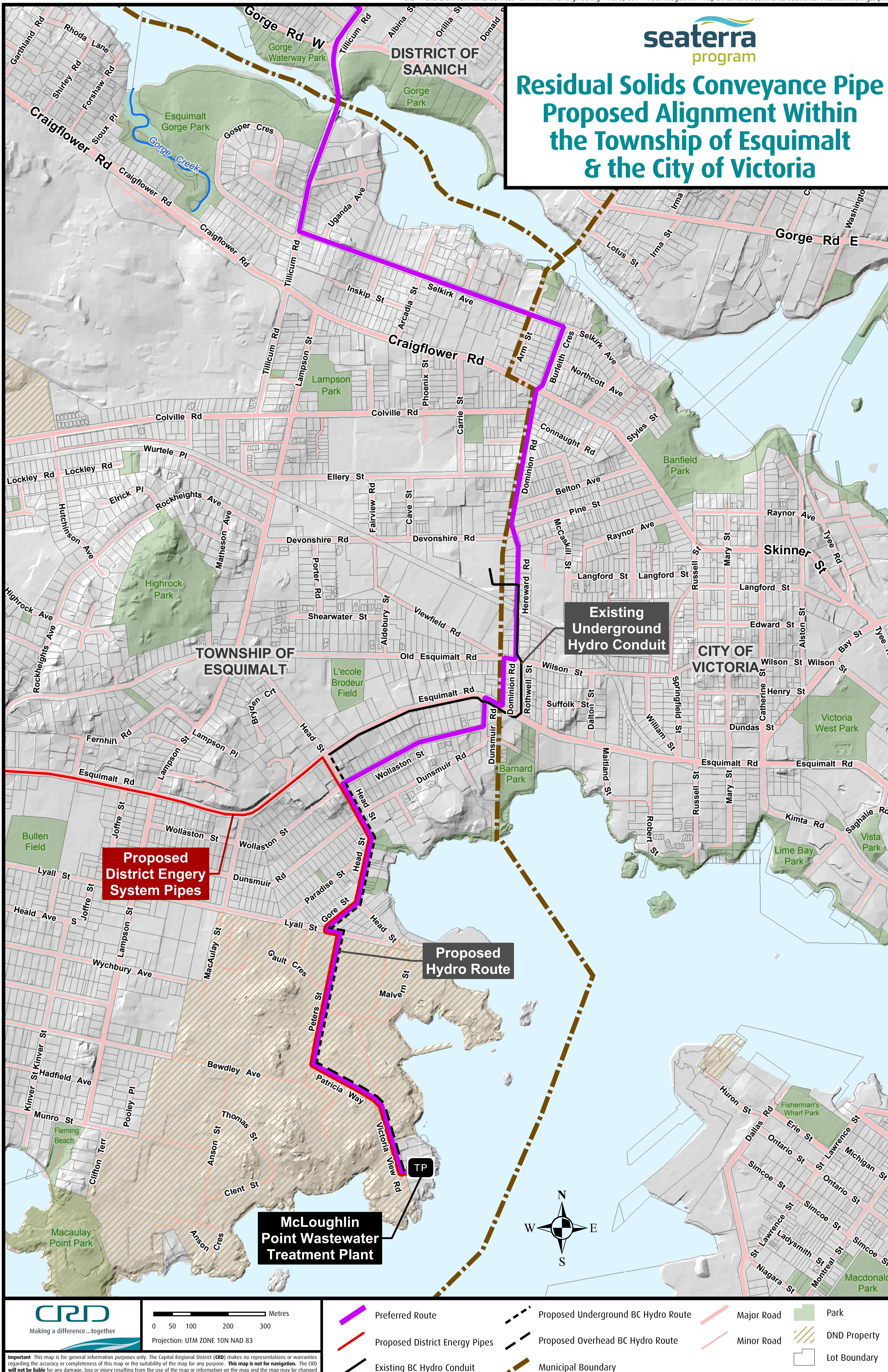
Sincerely,

Malcolm Cowley, P.Eng
Project Manager
Conveyance Infrastructure
Seaterra Program

Attachment: Residual Solids Conveyance Pipe Proposed Alignment Map in Esquimalt and Victoria

cc: Laurie Hurst, Esquimalt Chief Administrative Officer
Bob Lapham, Capital Regional District Chief Administrative Officer
Albert Sweetnam, Seaterra Program Director

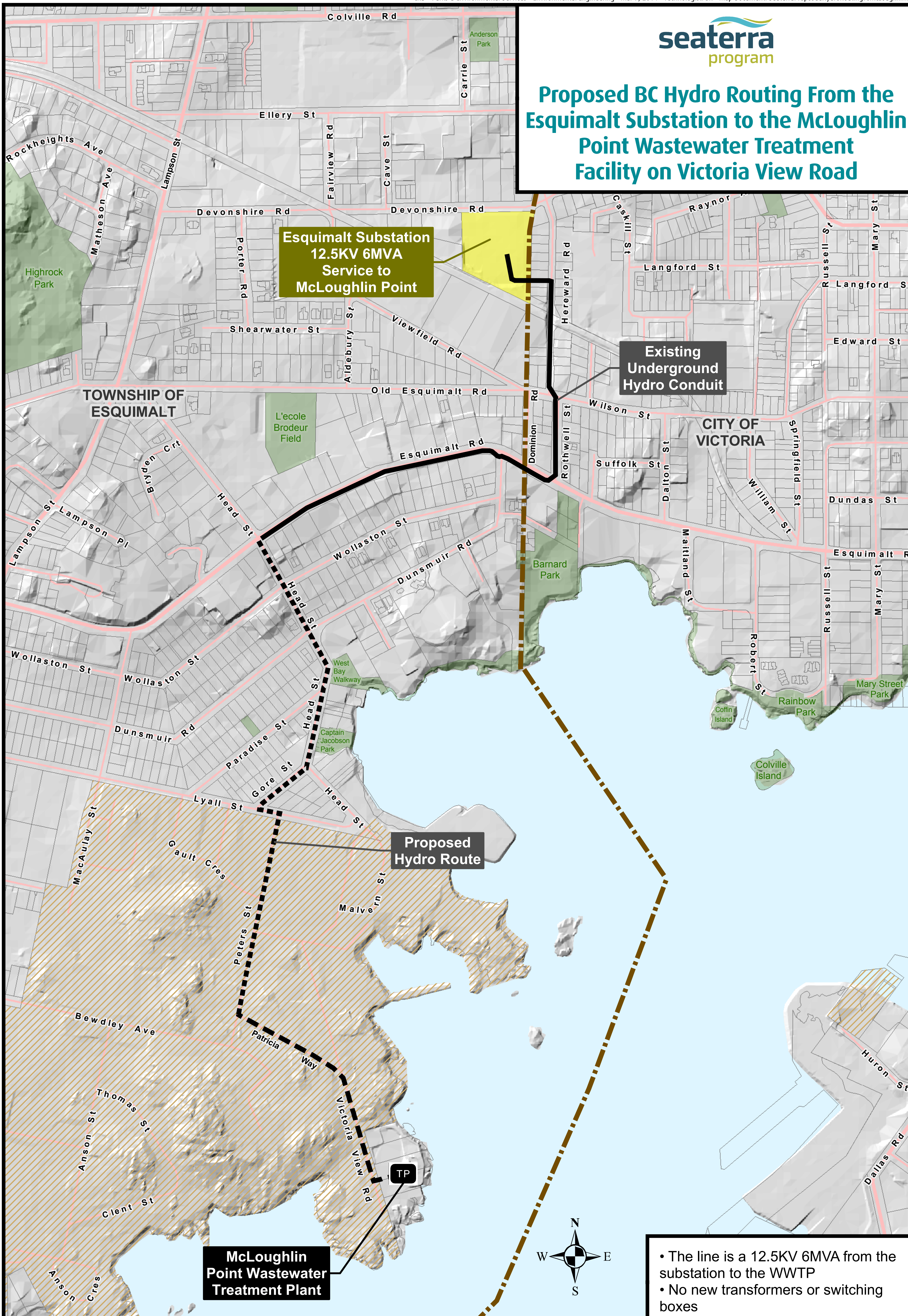
CRD
Making a difference...together


seaterra program
Residual Solids Conveyance Pipe Proposed Alignment Within the Township of Esquimalt & the City of Victoria
DISTRICT OF SAANICH
TOWNSHIP OF ESQUIMALT
CITY OF VICTORIA
Existing Underground Hydro Conduit
Proposed District Engery System Pipes
Proposed Hydro Route
McLoughlin Point Wastewater Treatment Plant
TP
Gorge Waterway Park
Gorge Park
Esquimalt Gorge Park
Gorge Creek
Lampson Park
Banfield Park
Highrock Park
L'ecole Brodeur Field
Barnard Park
Victoria West Park
Bullen Field
Lime Bay Park
Vista Park
Fleming Beach
Macaulay Point Park
Fisherman's Wharf Park
Macdonald Park
Gorge Rd W
Gorge Rd E
Craigflower Rd
Tillicum Rd
Selkirk Ave
Colville Rd
Lockley Rd
Devonshire Rd
Old Esquimalt Rd
Esquimalt Rd
Dominion Rd
Hereward Rd
Head St
Wollaston St
Dunsmuir Rd
Lyall St
Peters St
Patricia Way
Victoria View Rd
Bewdley Ave
Skinner St
Wilson St
Langford St
Kimta Rd
N
S
E
W
CRD
Making a difference...together
Metres
0 50 100 200 300
Projection: UTM ZONE 10N NAD 83
Preferred Route
Proposed District Energy Pipes
Existing BC Hydro Conduit
Proposed Underground BC Hydro Route
Proposed Overhead BC Hydro Route
Municipal Boundary
Major Road
Minor Road
Park
DND Property
Lot Boundary
Important This map is for general information purposes only. The Capital Regional District (CRD) makes no representations or warranties regarding the accuracy or completeness of this map or the suitability of this map for any purpose. This map is not for navigation. The CRD will not be liable for any damage, loss or injury resulting from the use of the map or information on the map and the map may be changed by the CRD at any time.


seaterra program
Residual Solids Conveyance Pipe
Proposed Alignment
RRC
Hartland Resource Recovery Centre
Potential Location for Underground Pump Station #4 (in road right-of-way)
Potential Location for Underground Pump Station #3 (in road right-of-way)
Natural Gas Return Line
DISTRICT OF SAANICH
Tie-in to Existing Natural Gas Line
Centrate Return Line
DISTRICT OF HIGHLANDS
Potential Location for Underground Pump Station #2 (in road right-of-way)
CentrateTie-in (525 mm sewer)
Marigold Pump Station
PS
Potential Location for Underground Pump Station #1 (in road right-of-way)
TOWN OF VIEW ROYAL
CITY OF COLWOOD
ESQUIMALT NATION
SONGHEES NATION
TOWNSHIP OF ESQUIMALT
CITY OF VICTORIA
McLoughlin Point Wastewater Treatment Plant
TP
Prospect Lake
Elk Lake
Beaver Lake
Swan Lake
Preferred Route
Centrate Return Line
Natural Gas Return Line
Existing Natural Gas Line
Municipal Boundary
Major Road
Minor Road
Park
First Nation Reserve
DND Property
Waterbody
Lot Boundary
Making a difference...together
Metres
0 100 200 400 600 800 1,000
Projection: UTM ZONE 10N NAD 83
N
E
S
W
Important This map is for general information purposes only. The Capital Regional District (**CRD**) makes no representations or warranties regarding the accuracy or completeness of this map or the suitability of the map for any purpose. **This map is not for navigation.** The CRD **will not be liable** for any damage, loss or injury resulting from the use of the map or information on the map and the map may be changed by the CRD at any time.
CRD - Parks & Environmental Services - Environmental Engineering - Mar 5, 2014 - Technologist: SR - Map Document: SeaterraResidualSolidsForcemainRoutingFullDSize.mxd

ATTACHMENT 5

CRD - Parks & Environmental Services - Environmental Engineering - Mar 7, 2014 - Technologist: SR - Map Document: SeaterraProposedHydroRoutingToMcLoughlin.mxd



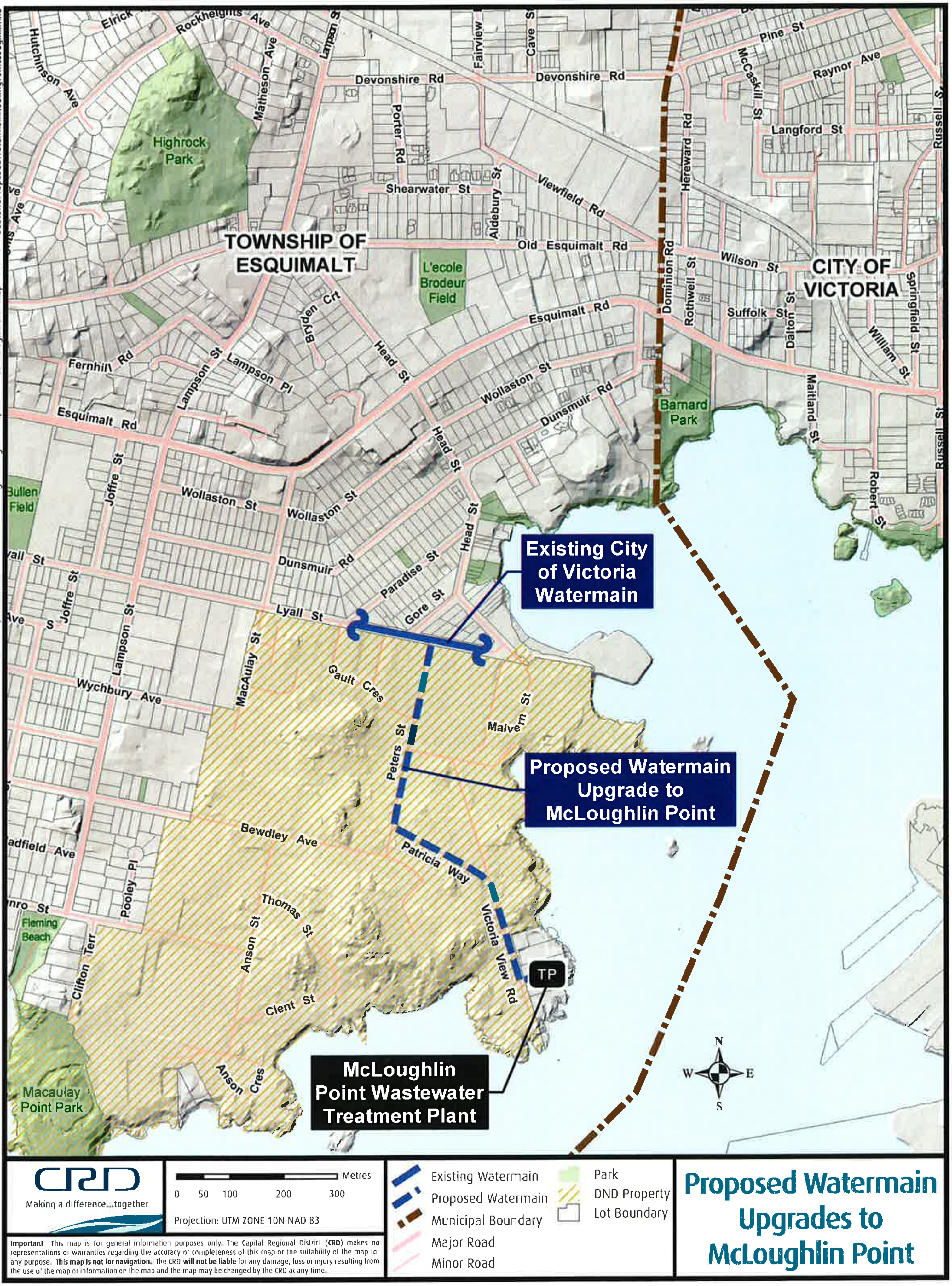
CRD
Making a difference...together

Metres
0 25 50 100 150 200
Projection: UTM ZONE 10N NAD 83

Important This map is for general information purposes only. The Capital Regional District (**CRD**) makes no representations or warranties regarding the accuracy or completeness of this map or the suitability of the map for any purpose. **This map is not for navigation.** The CRD **will not be liable** for any damage, loss or injury resulting from the use of the map or information on the map and the map may be changed by the CRD at any time.

- Existing BC Hydro Conduit
- Proposed Underground BC Hydro Route
- Proposed Overhead BC Hydro Route
- Municipal Boundary
- Major Road
- Minor Road
- Park
- DND Property
- Lot Boundary

ATTACHMENT 6



CRD - Parks & Environmental Services - Environmental Engineering - Mar 6, 2014 - Technologist: SR - Map Document: SeaterraProposedWaterMainRoutingToMcLoughlin.mxd

ATTACHMENT 7

SEATERRA PROGRAM

MAR 0 6 2014

Received

CITY OF VICTORIA

Engineering and Public Works Department

#1 Centennial Square
Victoria
British Columbia
V8W 1P6

Tel (250) 361-0300
Fax (250) 361-0311

www.victoria.ca

March 6, 2014

Capital Regional District
625 Fisgard Street
Victoria, BC V8W 1R7

Attention: Bob Lapham, CAO CRD

Dear Bob:

Re: Watermain Improvements for McLaughlin Sewage Treatment Plant

We understand through discussions with Malcolm Cowley of Seaterra that some upgrades may be required to watermains that will supply water to the proposed treatment plant at McLaughlin Point.

The City of Victoria will work with Seaterra and their consultants to determine an appropriate design flow for the project and the required pipe sizes to meet the design flow. Pipes that are currently undersized, or which have reached the end of their design life will have to be replaced.

Yours truly,

Dwayne Kalynchuk, P.Eng.
Director Engineering and Public Works

c. Albert Sweetnam, Seaterra
Malcolm Cowley, Seaterra
Jason Johnson, City Manager

v:\wpdocs\admin\word\dk\2014\seaterra watermain.doc

BC hydro
FOR GENERATIONS

Mike Peckham, Project Manager
Seaterra Program
Capital Regional District
510 – 1675 Douglas Street
Victoria, BC, V8W 2G5

Dear Mike,

The Victoria CRD / Seaterra Program have approached BC Hydro to supply 6MVA to Victoria View Road to power the proposed Victoria Waste Water Treatment Plant – to be located on Victoria View Road, in Esquimalt BC by the end of summer of 2016. BC Hydro's preliminary plan is to supply a new 12.5kV distribution circuit (ESQ 12F424) from the Esquimalt Substation along the following route;

1. Underground using existing ducts down Hereward Rd and Rothwell St to Esquimalt Road.
2. Continue underground using existing ducts along Esquimalt Road to Head St
3. Underground along a new customer constructed ductbank along Head / Gore and Peters St (customer is planning to excavate along this route already).
4. Upgrade the existing overhead line along Patricia Way and Victoria View Road to customer site.

The Victoria Waste Water Treatment Plant distribution circuit (ESQ 12F424) will not supply customers until it goes overhead along DND lands where it will supply DND residences along Patricia Way and Victoria View Road. Therefore, there will be no transformers or switches utilized until the line goes overhead on DND lands.

Yours truly,

Rob Zeni, Interconnections Manager

ATTACHMENT 9

CRD EXECUTIVE OFFICE
Received
MAR 10 2014

BRITISH
COLUMBIA

☑ Chair ☑ Board
☑ CAO ☑ Communications
☑ GM all
☑ For action / resp. by A. Sweetnam
☐ Corresp. for Board / Committee meeting
☐ For Information Only
☑ Copies to A. Sweetnam
file 0400-20
5220-20

1005967

Mr. Robert Lapham
Chief Administrative Officer
Capital Regional District
625 Fisgard Street
Victoria, BC
V8W 1R7

Dear Mr. Lapham:

The Provincial Ministry of Health and the Chief Medical Health Officer provide this joint response to Questions 7 and 8 in your letter of February 28, 2014 requesting commentary on the relevant evidence related to the propagation of antibiotic resistant bacteria (ARB) in secondary wastewater treatment plants. This is an area of emerging science, but we can provide the following commentary related to the matter based on recent findings in the last decade.

Antibiotic resistant bacteria are becoming ubiquitous in all surface water environments going through urban and agricultural environments. In most urban environments, antibiotics are released into municipal wastewater due to incomplete metabolism in humans, or due to disposal of unused antibiotics. This condition can cause the emergence of ARB which have been detected in both treated and untreated municipal wastewater. Data from other parts of the world has shown a higher proportion of antibiotic resistant bacteria contained in raw and treated wastewater relative to surface water.

A recent study in China suggested that one genetic marker of ARB showed proliferation in one wastewater plant even though the final effluent was chlorinated wastewater. However, the authors also note that the wastewater plant had an unusual sludge recycle configuration. China is well known for its widespread and largely unregulated use of antibiotics; with some reports of antimicrobial administration at rates of ten times than that in North America. Therefore, the likelihood of larger numbers of ABR in municipal wastewater in China is likely more prevalent than in North America.

In modern sewage treatment plants, the concentrations of some antibiotics and other pharmaceutical compounds can be reduced or eliminated. Microbiological risks in treated effluent can be reduced through disinfection to reduce the likelihood of the presence of ABR through the use of chlorine, ultraviolet radiation and/or ozone, with varying levels of effectiveness. Heat treatment can also reduce ABR risks in sewage sludge or effluent. In all cases, risks to human health are not only dependant on the presence of the pathogen, but the likelihood that someone will be exposed.

As an additional note, we know that antibiotics can save lives, but poor prescribing practices can lead to unnecessary risk of super-resistant infections in any event. This is why any wastewater management program also needs to deal with source controls, and to that end, the medical community is taking action to reduce the use of antibiotics, for example, guidelines established through the "Do Bugs Need Drugs" program. Education and outreach through public communication on the responsible disposal of prescription drugs should also be part of any wastewater management system.

In closing, the expectation for the design of any modern municipal wastewater treatment plant should be that microbiological (as well as chemical) risks be addressed and that the operation of the facility be monitored on an ongoing basis to confirm those outcomes as well as updated, if necessary, to reflect new knowledge of these issues as it becomes available. Thank you for the opportunity to respond to your questions.

Sincerely,

Richard S. Stanwick, MD, MSc, FRCPC, FAAP
Chief Medical Health Officer

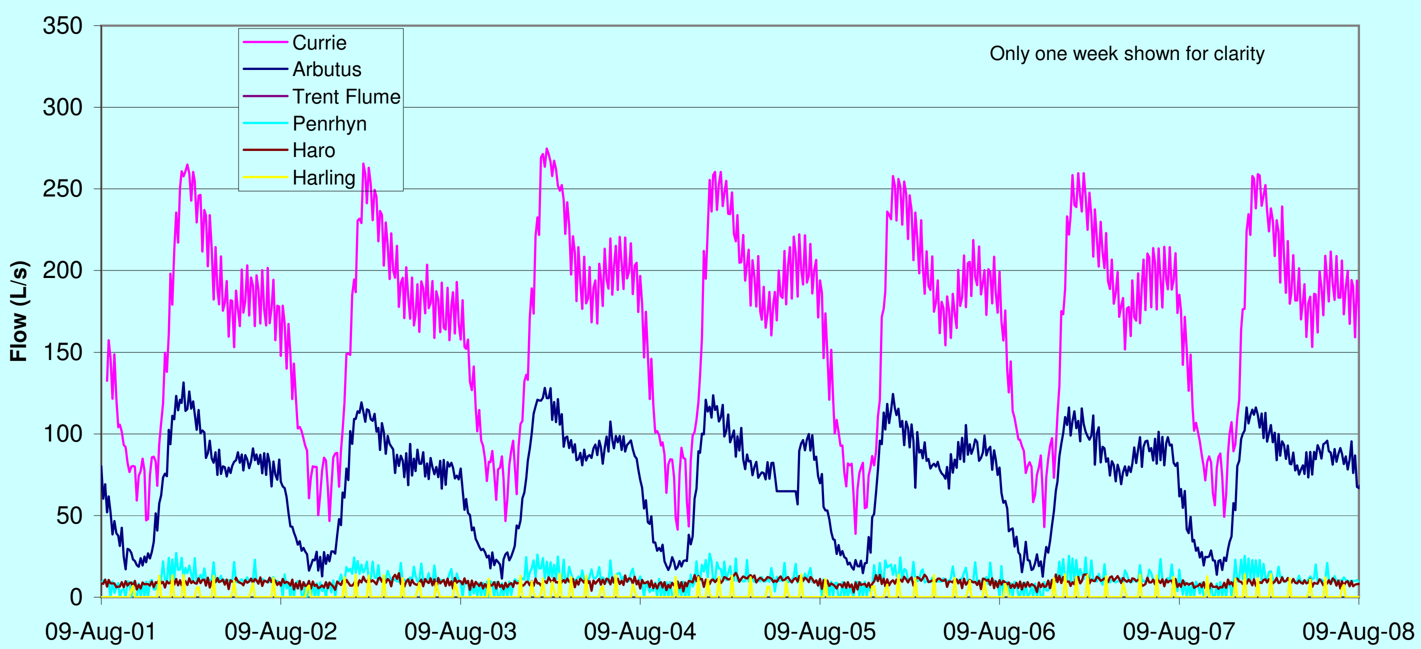
Yours truly,

Tim Lambert, Ph.D.
Executive Director
Health Protection Branch

Calculation of Domestic Discharge Rates (per person)

Usage	Current	Target (Longterm)	Comments
Toilets	5 flushes/day @ 12 L/flush = 60 L	5 flushes/day @ 6L/flush = 30 L	Replace typical 12 L/flush toilets with 6 L/flush models
Clothes-Washer	.37 washes/day @ 155 L/wash = 55 L	.37 washes/day @ 50 L/wash = 19 L	Replace typical washing machine with CEE Tier 3 Washer
Baths/ Showers	45 L/day	45 L/day	Low-flow difficult to enforce
Faucets	45 L/day	45 L/day	Low-flow difficult to enforce
Dishwasher	4 L/day	4 L/day	Small consumption
Leaks	16 L/day	16 L/day	Dripping faucets, leaking toilets, etc.
Total	**225 L/PE/day**	**160 L/PE/day**	*Carry these values to lines 11 and 12 on page 7*

Calculation of Summer Groundwater (GWI_{Summer})



GWI_{Summer} is calculated as 85% of the minimum average nighttime flows during August 2009 of the following stations:

	Average Minimum Nighttime Flow (L/s)		
	Currie	48.1 L/s	
	Harling	0.0 L/s	
subtract	Arbutus	15.6 L/s	
subtract	Trent Flume	1.3 L/s	
subtract	Penrhyn	2.3 L/s	
subtract	Haro	3.7 L/s	
	Total	25.2 L/s	
	X 85%	**21.4 L/s**	Carry forward to Line 21 on Page 7

Notes Specific to this Municipality

1. Humber and Rutland contain combined sanitary and stormwater systems.
2. Flow from UVIC land within Oak Bay is added to the District of Saanich.
3. Arbutus Flume data is corrected by multiplying a factor of 1.096 due to under reading.

Flow Calculation Worksheet for Cost Sharing Analysis
District of Oak Bay

The purpose of this document is to provide Core Area Municipalities with data and calculations useful for cost-sharing discussions. A separate document has been prepared for each municipality to assist them with decision making. Previous discussion papers that were prepared for design purposes required projections to 2065, and hence used a specially prepared document from CRD Planning (October 2008). However, for cost sharing discussions this document uses the Regional Growth Strategy (August 2003) and the Urban Futures Report (August 2009) for growth projections to 2030 only.

This is Your Measured Average Dry Weather Flow (ADWF)

CRD billing flow meters are used to calculate the Average Dry Weather Flow (ADWF) for your municipality. These are the same meters that are currently used to allocate operation and maintenance costs. To see how this value is calculated, refer to page 4

2009 2,161,184 m^3/year

Line 1 (carried from Page 4)
Copied to Line 3 below

This is Your Measured Average Annual Flow (AAF)

CRD billing flow meters are used to calculate the Average Annual Flow (AAF) for your municipality. These are the same meters that are currently used to allocate operation and maintenance costs. To see how this values is calculated, refer to page 5

2009 2,805,120 m^3/year

Line 2 (carried from Page 5)
Copied to Line 3 below

How Do We Project these Flows into the Future?

This methodology uses a generically applied, geographic spatial overlay process. Census data for 2006 is combined with landuse information determined from BC Assessments codes. From these two sources a residential population and "equivalent" population (representing industrial, commercial, and institutional sewage flow) are determined. The increase in flow from 2006 to 2015 and 2030 is then calculated (including the effects of future water conservation efforts). Growth rates from two population forecasts (the R.G.S. and U.F.R.) are used. To see how these values are calculated, refer to pages 6 and 7.

	ADWF (m^3/year)		AAF* (m^3/year)		
Year	R.G.S.	U.F.R.	R.G.S.	U.F.R.	
2009	2,161,184	2,161,184	2,805,120	2,805,120	*Line 3*
flow increase 2009 to 2015	-12,805	4,645	-12,805	4,645	*Line 4*
2015 subtotal	2,148,379	2,165,829	2,792,315	2,809,766	*Line 5*
10% flow contingency**	214,838	216,583	279,232	280,977	*Line 6*
2015 Total	2,363,217	2,382,412	3,071,547	3,090,742	*Line 7*
flow increase 2015 to 2030	-32,012	11,614	-32,012	11,614	*Line 8*
2030 subtotal	2,116,367	2,177,443	2,760,303	2,821,379	*Line 9*
10% flow contingency**	211,637	217,744	276,030	282,138	*Line 10*
2030 Total	2,328,003	2,395,187	3,036,334	3,103,517	*Line 11*

*Note: * AAF is variable and can increase or decrease depending on how "wet" the year was.*
*** a 10% flow contingency is applied to all municipalities to account for uncertainties with flow meters, water reduction and population equivalent estimates.*

Definitions and Acryonyms

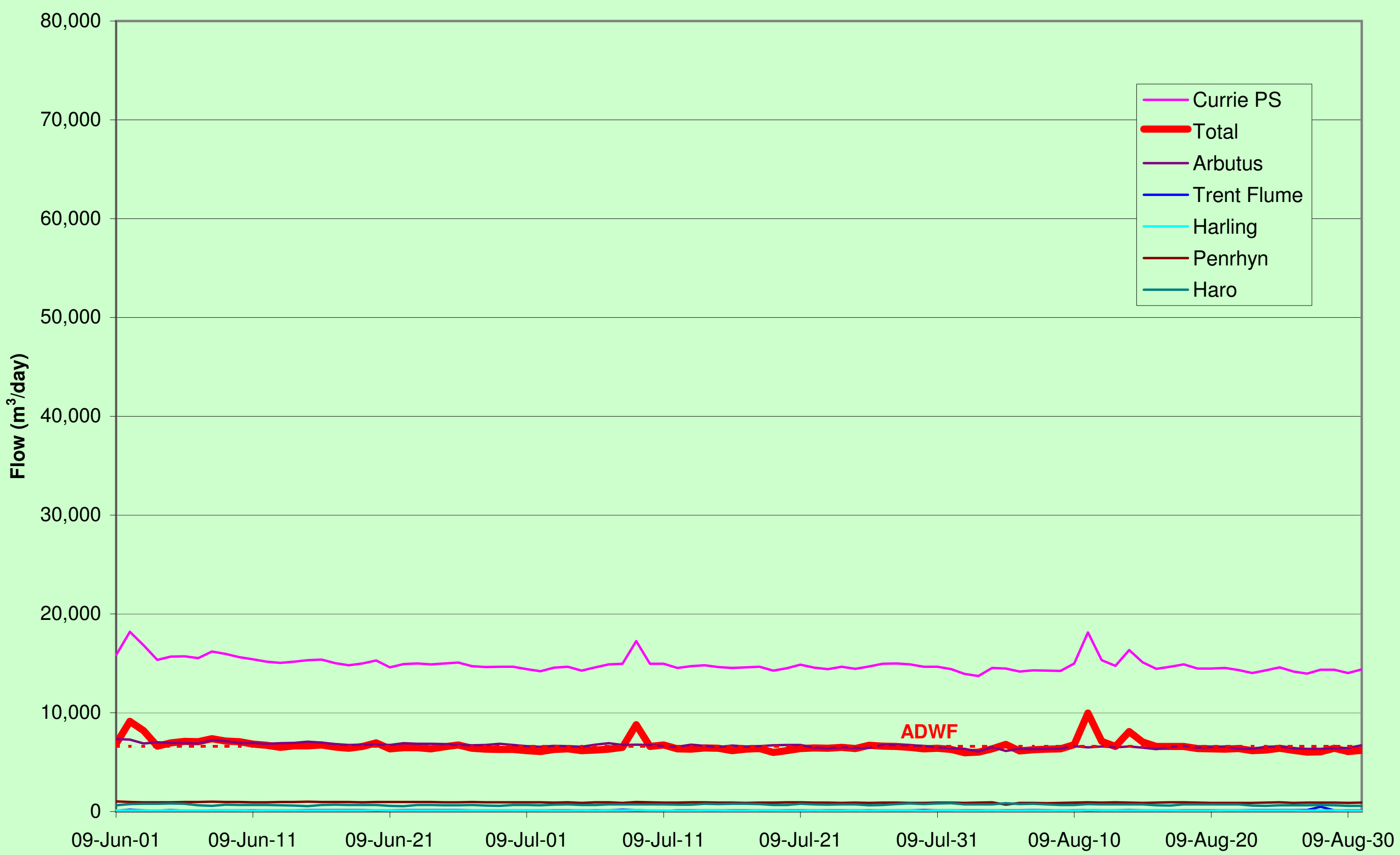
R.G.S. - Regional Growth Strategy (August 2003)
U.F.R. - Urban Futures Report (August 2009)
GWI_{summer} - groundwater infiltration in the summer
ha - hectare - unit of measure of land area
PE - population equivalent - a virtual "person" representing flow from industrial, commercial, and institutional sewage
L - litre - a unit of sewage volume (1,000 L = 1 m^3)
ICI - Industrial/Commercial/Institutional
L/PE/day - litres per "population equivalent" per day - amount of sewage a person or ICI equivalent produces in a day
ADF - average domestic flow - sewage flow generated by people and ICI processes only
ADWF - average dry weather flow - calculated by adding a summer groundwater allowance to the ADF to yield the average total flow expected on a dry summer day
AAF - average annual flow - the total amount of wastewater produced in a year including inflow & infiltration

This page intentionally left blank

Method 3 - Calculation of Residential and Equivalent Populations						Line #	What's This?
Step 1 - 2006 Census Populations							
2006 Census Population				**17,928**	people	1	The number of people in your municipality according to the 2006 census.
2006 Census Population inside CRD Sewered Area				**17,928**	people	2	The number of people connected to CRD sewers.
Step 2 - Amount of Sewered Area Classified as:							
	Industrial	Commercial	Institutional				The amount of sewered area classified
	1 ha	**5** ha	**6** ha			3	into 3 major landuse categories
Step 3 - Industrial/Commercial/Institutional Population Equivalent Rates							Commonly accepted rates used to
	25 PE/ha	**90** PE/ha	**50** PE/ha			4	convert ICI use to "equivalent" people
							Based on Greater Victoria sewer meters
Step 4 - Industrial/Commercial/Institutional (ICI) Population Equivalents (PE)							
	Industrial	Commercial	Institutional				Line 3 x Line 4 = "equivalent" number
	25 PE	**450** PE	**300** PE			5	of people used to estimate ICI flow
Step 5 - Total Population and Equivalents (2006)							
	Residential	**17,928** people					
	Industrial	**25** PE					
	Commercial	**450** PE					Line 2 + Line 5 = total number of
	Institutional	**300** PE					people and ICI "equivalents"
	Total	**18,703** PE				6	connected to CRD sewer system
Step 6 - Growth Rates and Population Equivalents into the Future							
		2009	2015	2030			Estimated growth rate and resulting
R.G.S.		**0.11%**	**0.11%**	**0.11%**		7	population equivalent using R.G.S.
		18,765	**18,888**	**19,197**		8	
U.F.R.		**0.38%**	**0.38%**	**0.38%**		9	Estimated growth rate and resulting
		18,915	**19,339**	**20,399**		10	population equivalent using U.F.R.
Step 7 - Water Use Reduction Rates into the Future							
	Current Domestic Discharge Rate:			**225**	L/PE/day	11	See back page
	Target Domestic Discharge Rate:			**160**	L/PE/day	12	See back page
Step 8 - Water Reduction Efforts Acceptance Rate (per year)							Yearly acceptance rate of new fixtures
		2009	2015	2030			for existing and new developments
Existing Development		**0.75%**	**0.75%**	**0.75%**		13	
New Development		**100%**	**100%**	**100%**		14	
Step 9 - Calculation of Average Domestic Flow (ADF)							
		2009	2015	2030			
R.G.S.	P.E.	**18,765**	**18,888**	**19,197**		15	From Line 8
L/PE/day	L/PE/day	**224**	**221**	**213**		16	Resulting L/PE/day from Step 8
R.G.S.	L/s	**48.7**	**48.3**	**47.3**		17	Line 15 x Line 16
U.F.R.	P.E.	**18,915**	**19,339**	**20,399**		18	From Line 10
L/PE/day	L/PE/day	**224**	**220**	**210**		19	Resulting L/PE/day from Step 8
U.F.R.	L/s	**49.1**	**49.2**	**49.6**		20	Line 18 x Line 19
Step 10 - Average Summer Groundwater Infiltration (GWI_{summer})							
Summer Groundwater Estimate				**21.4**	L/s	21	See Back Page
Step 11 - Calculation of Average Dry Weather Flow ($ADWF=ADF+GWI_{Summer}$)							
		2009	2015	2030			
R.G.S.	L/s	**70.2**	**69.8**	**68.8**		22	Line 17 + Line 21
increase	m^3/year		**-12,805**	**-32,012**		23	To Lines 4 + 6 on Page 1
U.F.R.	L/s	**70.5**	**70.7**	**71.0**		24	Line 20 + Line 21
increase	m^3/year		**4,645**	**11,614**		25	To Lines 4 + 6 on Page 1

How is Average Dry Weather Flow (ADWF) Calculated?

ADWF is calculated using the period from June 1 to August 31. The following graph shows the daily data for 2009.



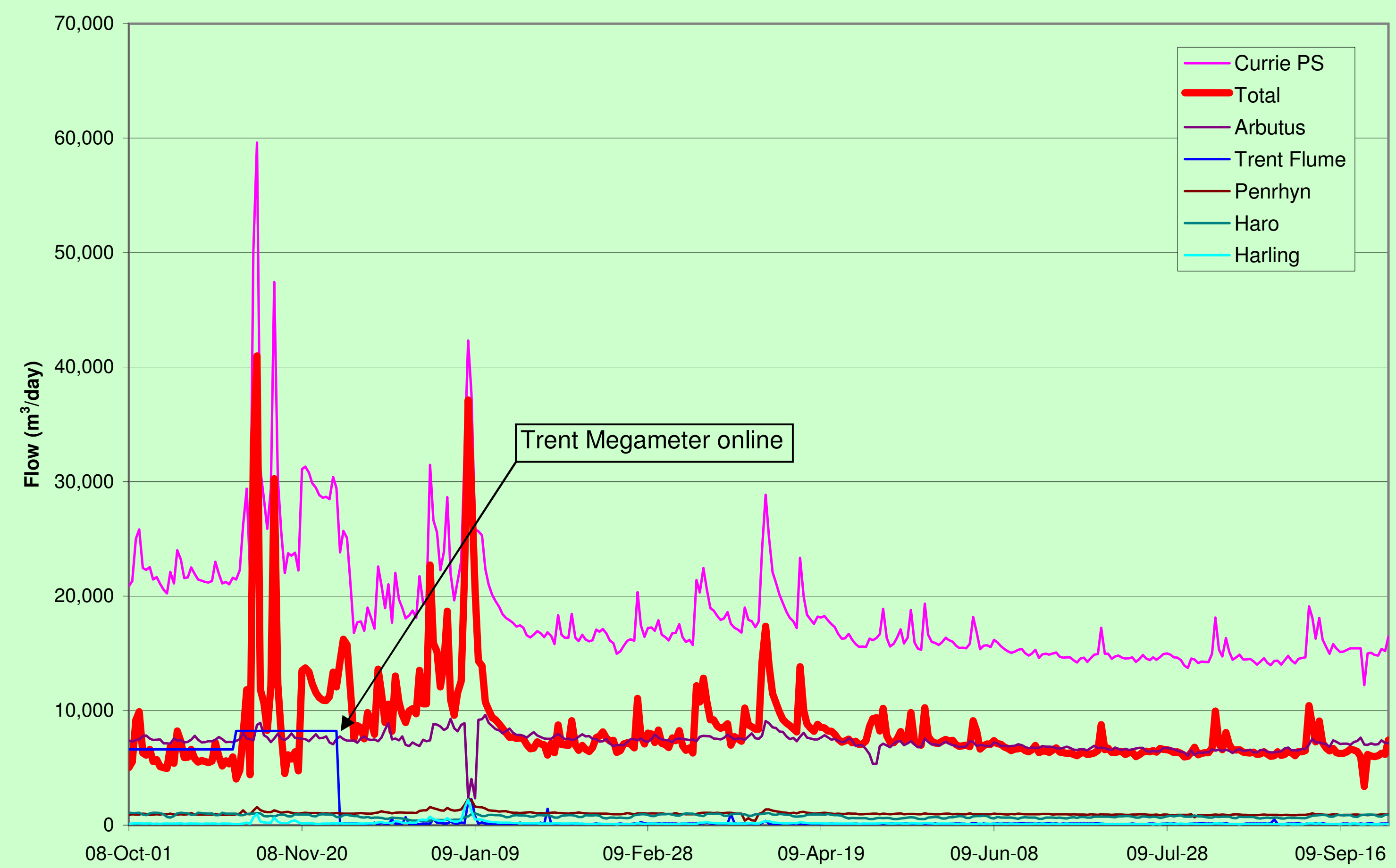
Values for ADWF (2009)

add	Currie	14,878	m^3/day	14,889
add	Harling	111	m^3/day	111
subtract	Arbutus	7,294	m^3/day	6,658
subtract	Trent Flume	161	m^3/day	130
subtract	Penrhyn	920	m^3/day	921
subtract	Haro	694	m^3/day	694
	Total	**5,921**	**m^3/day**	
		2,161,184	**m^3/year**	*Carry this forward to Line 1 on Page 1*

Notes: All of Oak Bay is metered. Humber and Rutland contain combined sanitary and stormwater systems.
Arbutus Flume data is corrected by multiplying a factor of 1.096 due to under reading.

How is Average Annual Flow (AAF) Calculated?

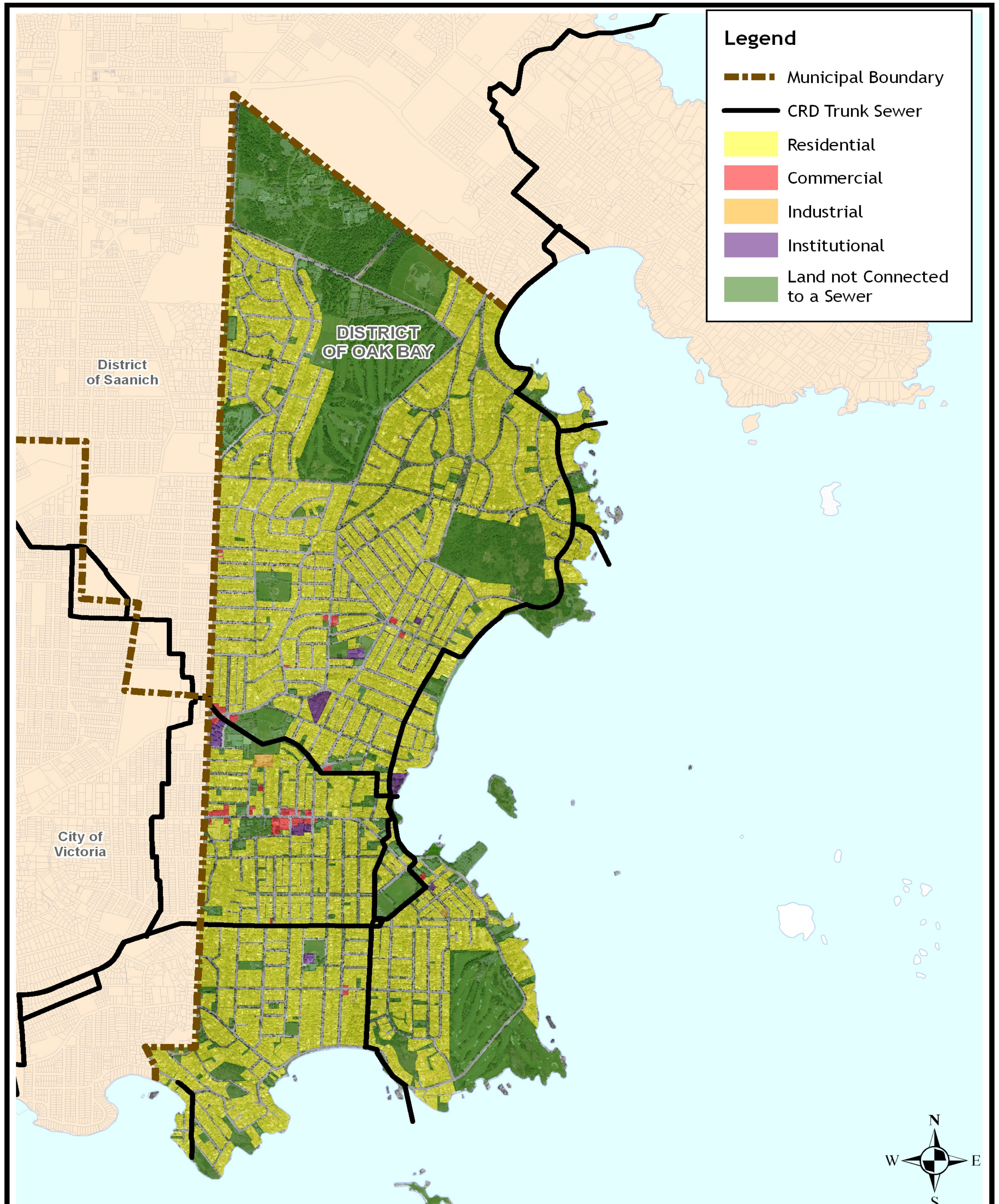
AAF is calculated using the period from October 1 to September 30. The following graph shows the daily data for 2009 (i.e. from October 1/2008 to September 30/2009)



Values for AAF (2009)

add	Currie	6,802,915	m^3/year	
add	Harling	62,038	m^3/year	
subtract	Arbutus	2,907,690	m^3/year	
subtract	Trent Flume	499,872	m^3/year	
subtract	Penrhyn	370,406	m^3/year	
subtract	Haro	281,865	m^3/year	
	Total	**2,805,120**	m^3/year	*Carry this forward to Line 2 on Page 1*

Notes: All of Oak Bay is metered. Humber and Rutland contain combined sanitary and stormwater systems.
Arbutus Flume data is corrected by multiplying a factor of 1.096 due to under reading.



DISTRICT OF OAK BAY METERED FLOWS

CLOVER POINT CATCHMENT AREAS