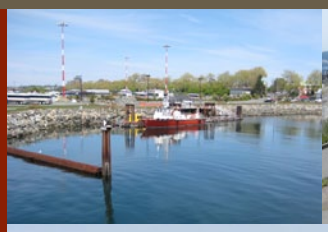
OGDEN POINT MASTER PLAN

PART A - FOUNDATION FOR GROWTH, VIABILITY & DEVELOPMENT TECHNICAL REPORT

Prepared for: **Greater Victoria Harbour Authority**



FEBRUARY 2012

In collaboration with:

Merrick Architecture ▪ Borowski Sakumoto Fligg Limited
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Final

Ogden Point Master Plan

Part A—Foundation for Growth, Viability & Development

(Technical Report)

Prepared for

Greater Victoria Harbour Authority

February 2012

In collaboration with:
Merrick Architecture ■ Borowski Sakumoto Fligg Limited
and Banjar Management Inc.

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Acronyms and Abbreviations

BC	British Columbia
CALUC	Community Association Land Use Committee
CBSA	Canada Border Services Agency
CNR	Canadian National Rail
DWT	Dead Weight Tonnes
FSR	Floor Space Ratio
ft	Foot or Feet
ft^2	Square Foot or Square Feet
GRT	Gross Registered Tonnes
GVHA	Greater Victoria Harbour Authority
ha	Hectares
LOA	Length Overall
m	Metre
m^2	Square Metre
MOU	Memorandum of Understanding
PAC	Project Advisory Committee
OPCTS	Ogden Point Cruise Transportation Strategy
RFI	Request for Information
ro-ro	Roll On-Roll Off
the City	the City of Victoria

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1. Executive Summary

The Port of Victoria is British Columbia's (BC's) third-largest port (measured in terms of gross revenue), and Canada's busiest cruise port of call. Greater Victoria Harbour Authority (GVHA), owns and operates Ogden Point and a number of other port facilities on Victoria's harbour, and is entrusted with the oversight and development of these strategic assets. Ogden Point is the most important of these marine assets. The strategic importance of this site derives both from its location and infrastructure, as well as its present robust business activity as a major cruise port of call, totalling 206 cruise ship visits, 5 weather-related cruise ship visit cancellations, bringing 449,000 passengers during the 2011 season.

To identify capability and opportunity, increase and broaden the range of business activities at Ogden Point, while preserving appropriate marine uses in perpetuity, GVHA commissioned CH2M HILL in 2009 to develop an updated comprehensive Master Plan for the Ogden Point site, with two specific goals in mind:

1. To assess the site capability and identify/describe business development opportunities, which may exist now or in the future, that could be hosted at Ogden Point and could serve to sustain and build GVHA's role as an economic engine for the Victoria area over the long term.
2. To identify the features of any future land-use management regime necessary to facilitate the future success of Ogden Point as a key marine terminal within the Port of Victoria, while effectively integrating the activities at Ogden Point into the regional development context and aligning site zoning with City planning parameters.
    - The above goals are intended to be addressed while seeking to create sustainable opportunities for local First Nations. This technical report is primarily intended to address the first goal, and to be a companion/support document for the future market assessment, rezoning and implementation strategy.

The CH2M HILL project team, CH2M HILL with subconsultants Merrick Architecture ■ Borowski Sakumoto Fligg Limited and Banjar Management Inc. (the project team), started work on this assignment by reviewing GVHA's present finances and operations, as well as the physical characteristics of the site. The project team, supported by comprehensive input from governments, the public, and stakeholders, then considered the potential future land uses for the site, ultimately structuring the site into a number of sub-zones, each suitable for a variety of potential land uses (both marine and non-marine). The non-marine sub-zones are briefly characterized in Section 6 of this document, including a high-level market description on potential development and proposed land use (to be further explored by GVHA through the planning and market assessment process).

For the marine-based site sub-zones, the project team developed a set of illustrative case studies to define the range of future business development and land-use opportunities available to GVHA for the Ogden Point lands. This is intended to inform both GVHA's future business strategy planning and the rezoning process. Accordingly, the project team adopted a structured options generation, screening, and characterization process to identify

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business opportunities for Ogden Point. Options generated by considering business activities at similar ports elsewhere were screened to eliminate business activities that could not be accommodated within the constraints of the Ogden Point site or available transportation infrastructure, or for which local markets (imports) or cargo (exports) are not present. The project team used the resulting short list (including key existing port activities at Ogden Point) to generate six case studies of potential future port development, including:

1. Passenger Cruise Vessel Port of Call/Niche Homeport
2. Boat Yard/Boat Storage and Yacht Transfer
3. Coastal Shipping/Roll On-Roll Off (ro-ro) Cargoes/Vehicle Ferry
4. Berthage (including Cable Ships Berthage and Storage) and Marine Technology Research and Development Vessels and Support Facilities
5. Liquid Bulk Products Terminal
6. Module Assembly Facility (including Ship-Building Support)

For each of these case studies, the project team carried out a brief analysis to characterize the opportunity, the required infrastructure, potential revenue, impacts on other land use, and access requirements. If available, the project team also provided brief descriptions of comparable businesses elsewhere.

Section 7 of this document sets out considerations for a proposed Implementation Strategy for the plan, and in particular the present economic viability and potential timing of each of the case studies summarized above. Section 8 considers the implications of future site access and articulates principles for transportation management to, within, and from the Ogden Point Site. In Section 9, the project team presents an overview of a potential approach to mitigating impacts to the environment, which may result from implementation of one or more of the development case studies described above.

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2. Background

Ogden Point is one of several marine properties owned and operated by Greater Victoria Harbour Authority (GVHA or the Authority) within Victoria's harbour (see Exhibit 2-1), but it is the only deep-sea marine terminal. The four deep-sea berths at Ogden Point handle passenger cruise ships and visiting commercial and Navy vessels. Port support services at Ogden Point include provisions and ships stores, customs and immigration facilities, stevedoring, warehouse, waste disposal, potable water supply, medical facilities, and pilotage services. Exhibit 2-2 provides an overview of the Ogden Point property.

Ogden Point is an important economic engine in the Capital Region and Canada's busiest cruise port of call. The facilities of GVHA serve a regional population estimated at over 400,000 and support key area industries, including fishing and tourism.

Today, Ogden Point is predominantly a passenger cruise terminal with cruise vessel calls in 2011 totalling 206 ship visits, 5 weather-related cruise ship visit cancellations and 449,000 passengers. As shown in Exhibit 2-1, this port facility lies adjacent to Canadian Coast Guard lands and a vibrant and growing residential neighbourhood.

For Ogden Point to sustain and create jobs in the Victoria area, support key industries, and further the goals of GVHA, it needs to face and address challenges brought by future changes in the market place, regional competition, and growth management. Accordingly, the Ogden Point Master Plan seeks to help GVHA respond successfully to change and anticipate future opportunities, while continuing to provide economic benefits to the community it serves.

2.1 Process

GVHA initiated the Ogden Point Master Plan process in June 2009 as a commitment to present a comprehensive master plan to the City of Victoria for endorsement agreed to by a Memorandum of Understanding (MOU) signed by both parties in 2006.

The Ogden Point Master Plan (the Master Plan) embodies GVHA's vision for its outer port property. The Master Plan consists of four parts:

- *Phase 1 – Technical Assessment - Foundation for Growth, Viability & Development* – An evaluation of site capability, potential future economic activity, and corresponding land uses for Ogden Point
- *Phase 2 – Market Assessment* – A quantitative and qualitative evaluation of current and future market appetite for the key potential future port development opportunities
- *Phase 3 – Zoning Framework and Guidelines for Complementary Zoning and Future Development Opportunities* – A community planning process to identify Design Guidelines to shape the built form of future development at Ogden Point and to serve as the basis of a site rezoning application planned for mid-2011

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- *Phase 4 – Implementation Strategy* – A strategic-level marketing and implementation plan, encompassing both third-party commercial development and infrastructure investment by/through GVHA, based on the identified site capabilities (Phase 1), market opportunities (Phase 2) and permissible zoning (Phase 3)

Phase 1 of the Master Plan is intended to define Ogden Point's role within GVHA's operations and the community, and assess potential future land-use options for the site to identify the envelope of potential future site land uses consistent with GVHA's mandate and economic viability. Phase 2 is intended to understand the current market place and future marine trends. Phase 3 is intended to ensure that the planned rezoning of the Ogden Point site accommodates the business insights gained from Phases 1 & 2, while reflecting community interests to guide the shape of future development. Phase 4 will determine the implementation plan for development at Ogden Point including how the supporting capital infrastructure may be staged and financed.

(Note: The scope of this report is strictly limited to Phase 1 – Technical Assessment)

2.1.1 Project Advisory Committee

Early in the planning process for the Master Plan, GVHA established a Project Advisory Committee (PAC) with members from:

- City of Victoria
- Greater Victoria Chamber of Commerce
- Capital Region District
- North West and Canada Cruise Association
- James Bay Neighbourhood Association
- Shipping Industry
- Esquimalt Nation
- Songhees Nation
- Tourism Victoria
- BC Ministry of Transportation and Infrastructure

The PAC has provided guidance to the planning process and has served as a catalyst to discuss community input received to date.

2.1.2 GVHA Board Ad-hoc Committee

GVHA also established a Board Ad-hoc Committee to oversee the development of the Master Plan. Its purpose is to oversee the advancement of the project deliverables, provide strategic advice to management and make recommendations for Board approval. The composition of this group varied somewhat over time, but included: Mike Williamson, Chief Andy Thomas, Dermot Loughnane, David Rand, Don Prittie. Support staff members included Ian Crocker, Sonterra Ross Rebecca Penz in the initial stage of the project, and Curtis Grad in the final stage of the project.

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EXHIBIT 2-1
Overview Map of Ogden Point and the Victoria Harbour

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EXHIBIT 2-2
Ogden Point Access Layout

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2.1.3 Consultation Process and Stakeholders

GVHA started the consultation process for the Master Plan in November 2009. Since that time, the consultation milestones achieved include:

- November 2009: Project startup and project website kickoff (including an electronic public survey)
- December 2009: Project introduction to City staff
- January and February 2010: PAC workshops to discuss interests of the involved agencies
- March 4, 2010: First community open house to present project vision and goals, consultation plan, and public survey results
- March 2010: PAC workshops on concept plans
- May 2010: Project update to City staff
- June 9, 2010: Presentation to James Bay Neighbourhood Association
- June 22, 2010: Second community open house to present founding land use principles
- October 2010: Project update to City staff
- December 2010: Community Association Land Use Committee (CALUC) presentation to James Bay Neighbourhood Association executive
- January 2011: Draft documentation circulation/review
- August 2011: Finalize and publish document

Additional details on the project consultation process can be found in GVHA's Ogden Point Master Plan Stakeholder Engagement Strategy document (GVHA, 2010d).

In addition to the above outreach efforts, which provided opportunities for stakeholders to highlight interests and concerns, the project sponsored a community survey through its website. The project received approximately 90 responses to the survey.

The top five topics mentioned in the survey responses, in order of frequency, were:

1. **Beautification of the Site:** Make the site a destination and a nicely landscaped 'people place' as an 'iconic' gateway to the City. Strive for an attractive well-designed curb appeal for visitors and residents alike.
2. **Maintain and Enhance a Working Port:** Create solutions that maintain appropriate existing uses, while creating improvements that will balance economic return with respect for the environment and the mental and physical health of an integrated community.
3. **Sustainable Solutions:** New solutions must incorporate Green Design Criteria, whereby new projects and infrastructure are designed to minimize and mitigate a wide range of environmental impacts (i.e. the LEEDS green building rating system) to demonstrate responsible stewardship of the site, the environment, and the community as a whole.

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4. **Responsible Cruise Ship Management:** The future requirements/projections of the cruise ship industry should be reviewed comprehensively to guide overall planning and development and future provision of cruise ship servicing needs. The foregoing will be the prime focus of the Phase 2 – Market Assessment.

5. **Transportation and Traffic:** Develop an effective traffic management framework to address offsite traffic concerns. In conjunction with the Ogden Point Master Planning project, the GVHA initiated a Request for Information to the market for cruise passenger shore transport options, the key outcomes of which are:

   - High-quality service to cruise passengers
   - Mitigation of impacts from transportation through the local neighbourhood
   - Environmental leadership
   - Impact to and from other capital plans and projects:
     - Consolidated terminal building
     - Master Plan
     - Traffic and pedestrian flow reconfiguration
     - Infrastructure requirements
   - Impact to shore excursion operations
   - Impact to existing cruise tourism transportation providers
   - Impact to GVHA revenues

Other topics identified in the survey responses included: improving/strengthening GVHA's relationship with the community; noise and air pollution abatement; and additional recognition of First Nations.

Appendix A includes a summary of the responses.

2.1.4 Use of Consultation Feedback and Rezoning Process

The feedback received at the workshops, open houses, and through the surveys served as the basis for documenting stakeholder input on Phase 1 of the Master Plan, which will serve as background for the future rezoning process with the City.

The project team (CH2M HILL with subconsultants Merrick Architecture ■ Borowski Sakumoto Fligg Limited and Banjar Management Inc.) developed Phase 1 of the Master Plan process between November 2010 and August 2011.

2.2 Vision

GVHA's vision for Ogden Point Master Plan reflects the importance of Ogden Point to the Port, First Nations, and the Capital Regional District (GVHA, 2010a):

> *Ogden Point will continue to serve as a working port facility, with sustainable, flexible options that can respond to the ever changing opportunities and challenges of the future. Development at Ogden Point will be financially successful and serve as an economic development engine for GVHA, the Esquimalt and Songhees Nations, and the region.*

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While there are other important considerations to be addressed throughout the Master Plan, GVHA's vision statement (above) captures the key aspirations that define the future of Ogden Point.

2.3 Governance

GVHA is a not-for-profit corporation which was incorporated under the BC Society's Act in 2002. Under the Federal Divestiture Program, the corporation received fee-simple interest in four Transport Canada public port facilities in Victoria harbour: Ogden Point Deep-sea Terminal, Fisherman's Wharf, Ship Point/Causeway Marina, and Wharf Street/Johnson Street Marina. GVHA's membership includes several organizations:

- Capital Regional District
- City of Victoria
- Greater Victoria Chamber of Commerce
- Provincial Capital Commission
- Esquimalt Nation
- Songhees Nation
- Tourism Victoria
- Township of Esquimalt
- Victoria/Esquimalt Harbour Society

A Board of Directors appointed from the member agencies and the community governs GVHA.

GVHA's mandate is "to be effective and respected advocates for best water, marine-related use and development of the whole harbour [Victoria Harbour] while optimizing current and future harbour assets" (GVHA, 2010a). This mandate is based on GVHA's four guiding principles: a*ccountability, working harbour, sustainability,* and *First Nation relationships*.

2.4 Goals

Through discussions with GVHA and its stakeholders, the project team identified a number of values and objectives that need to be recognized to move forward with the Master Plan for Ogden Point. As such, the project team defined the following values and objectives for the Ogden Point Master Plan (in no particular order):

- Maintain Ogden Point's multi-purpose function, public appeal, and destination-within-the-community character (i.e., a sense of place)
- Highlight Ogden Point's iconic importance as a centre with economic impact beyond the onsite buildings
- Leverage Ogden Point's financial success to positively affect GVHA, First Nations, and the Region
- Conduct a master planning process that leads to acceptance by the City, local community and the general public

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- Maintain a suite of sustainable, flexible options for the site within an overall responsible design
- Enhance Ogden Point's character as a functional landmark
- Include a First Nations component
  (e.g., store, art gallery, employment, business participation)
- Foster environmentally sustainable activities
- Support Ogden Point's gateway function (i.e., flow from one point to another)
- Engage the broader community through process and product
- Highlight Ogden Point primarily as a working port not limited by public uses
- Address movement of people and cargo and impacts to external infrastructure
- Respect the character of Victoria (e.g., First Nations, history, architecture)
- Showcase best practices (e.g., engineering, environmental)
- Magnify positive impacts and mitigate less desirable effects of port-related activity

Based on the above values, the project team initially identified six goals for the Ogden Point Master Plan:

1. Spell out GVHA's interests and objectives in the rezoning process
2. Provide a link to the vision of future port activity
3. Provide a way forward in terms of achieving revenue growth and diversification
4. Provide documentation of land-use opportunities, constraints, interactions, and externalities for reference when business development opportunities arise
5. Enable GVHA to evaluate and prioritize potentially conflicting land-use options and commercial opportunities in terms of their ability to support GVHA guiding principles of accountability, working harbour, sustainability, and First Nations relationships
6. Provide opportunity to rapidly identify and move on some "early wins" in order to establish momentum for the reinvention of Ogden Point. These are anticipated to potentially include:
   - Initial steps towards realizing one or more business opportunities (for example, boat storage or berthage)
   - Concrete business development measures to begin to pursue other longer-term business interests
   - Clear strategy for addressing cruise traffic issues

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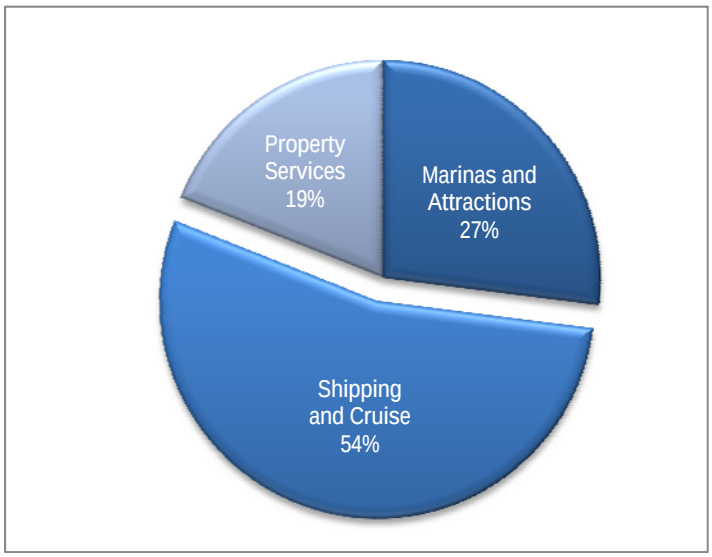
3. Current Situation and Financial Overview

3.1 Situation

Victoria's harbour is well positioned to provide continuing opportunities for commercial activities, and enjoys a position of relative strength amongst BC's regional ports. GVHA revenues for the fiscal year ending March 2010 totalled $6.1 million, representing an increase of 12.5 percent over the previous year (GVHA, 2010b). As illustrated in Exhibit 3-1, the GVHA generates revenue from three sources: shipping and cruise, marinas and attractions, and property services. Of these sources, shipping and cruise (which is dominated by cruise) represents the majority of GVHA revenue, a reflection of the strong performance enjoyed by Ogden Point in this market sector, the busiest cruise port of call in Canada.

EXHIBIT 3-1
GVHA Revenue Source Breakdown for Year 2010 ($6.1 million)



Source: GVHA's 2010-11 Strategic and Business Plan (GVHA, 2010b)

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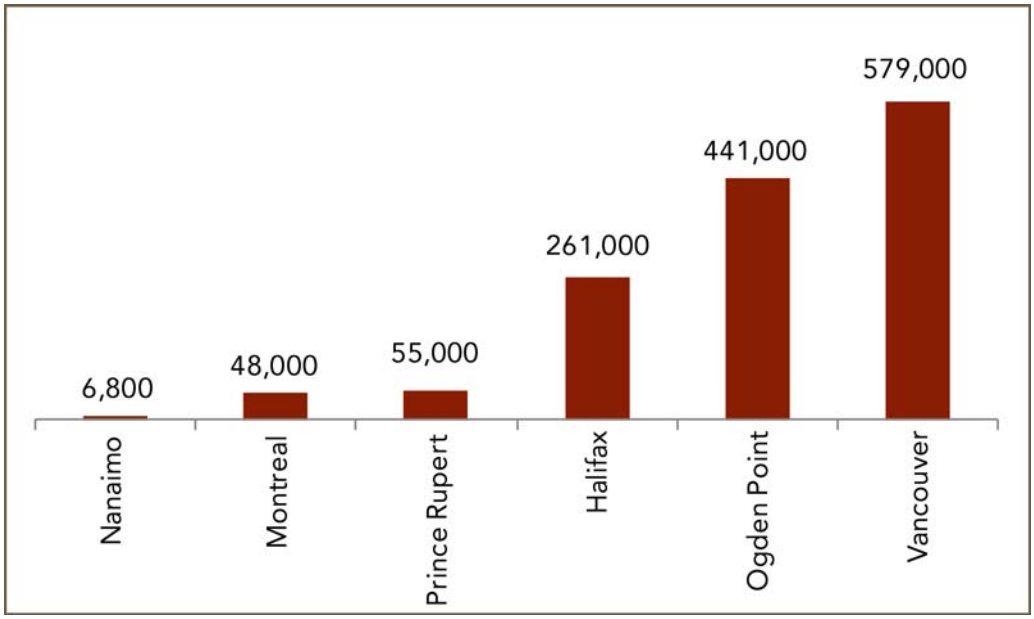
As illustrated in Exhibit 3-2, Ogden Point is an important cruise terminal relative to other Canadian Ports. While Vancouver is the only Canadian Port with a larger cruise business than Ogden Point, their cruise business is focused on homeporting of the Alaska fleet. This leaves Ogden Point (Victoria) as Canada's busiest cruise port of call.

EXHIBIT 3-2
2010 Cruise Passenger Volumes for Canadian Ports



GVHA's revenue breakdown by port facility is led by Ogden Point with total revenues of $3.69 million (60%). This is followed by the Inner Harbour (comprising Ship Point/ Causeway Marina and Wharf Street/Johnson Street Marina) with $1.37 million (21%) and Fisherman's Wharf with operating revenues totalling $1.05 million (19%). The breakdowns by revenue source and port facility indicate that GVHA is heavily dependent on cruise activity at Ogden Point to achieve a break-even level, at present, however diversification and growth will be key factors in ensuring GVHA's financial sustainability in the long-term.

3.1.1 Cruise Passengers

In the 1990s, annual passenger ship calls ranged from 26 to 53 (GVHA, 2010b). The number of ship calls started to significantly increase at Ogden Point in 2001 when Norwegian Cruise Lines began to homeport ships in Seattle, WA.

Exhibit 3-3 illustrates that cruise passenger traffic has demonstrated sustained growth at Ogden Point over the past decade. This is in contrast to other BC passenger cruise ports of call, which have generally experienced declining volumes over the past few years and reflects Victoria's strength in market offering in terms of geographic location and local attractions. As such, this revenue source needs to be protected to provide financial viability of the Authority's current operation activity.

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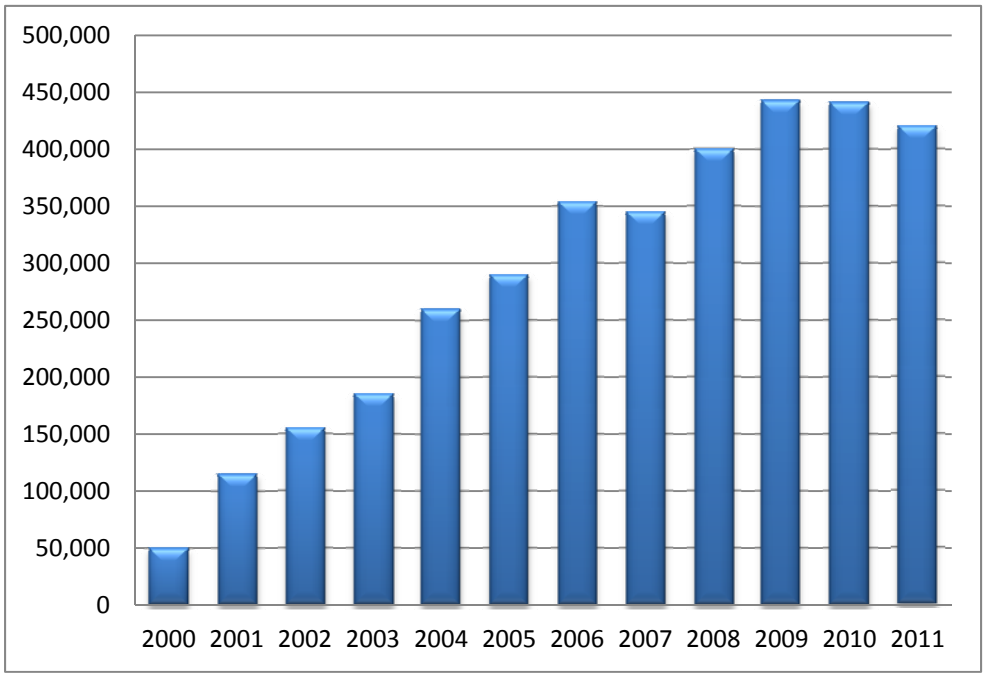
EXHIBIT 3-3
Cruise Passengers at Ogden Point



Sources: GVHA's 2010-11 Strategic and Business Plan (GVHA, 2010b); Western Stevedoring 2011 Cruise Ship Schedule (Western Stevedoring, 2011)

3.2 Financial Overview

This section compares the financial income statement and assets of GVHA, a BC Society, with the same data from the Ports of Nanaimo and Port Alberni, both Canada Port Authorities governed under the Canada Marine Act. Information for this section was taken from the most recent published financial reports of the three port entities (GVHA, 2010c; Nanaimo Port Authority, 2009; Port Alberni Port Authority, 2009). The project team selected the Ports of Nanaimo and Alberni as comparables because of the similarity of the roles they play as regional ports on Vancouver Island.

Exhibit 3-4 provides a comparative overview of the 2009 statements for GVHA, Nanaimo Port Authority, and Port Alberni Port Authority.

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EXHIBIT 3-4
Vancouver Island Public Ports Financial Overview in 2009 ($000)

	Greater Victoria Harbour Authority	Nanaimo Port Authority	Port Alberni Port Authority
Net income statement			
Revenues	$5,349	$5,635	$4,017
Less expenses	$4,007	$4,895	$3,506
Income before depreciation	$1,342	$740	$511
Less depreciation	$1,370	$1,497	$600
Income before gross revenue charge	$(28)	$(757)	$(89)
Less gross revenue charge*	$–	$119	$85
Operating income	**$(28)**	**$(876)**	**$(174)**
Plus investment and other income	$151	$479	$242
Net Income	**$123**	**$(397)**	**$68**
Assets			
Current assets	$9,576	$8,992	$8,665
Investment and other assets	$984	$7,172	$–
Capital assets (net of accumulated depreciation)	$54,119	$23,404	$4,813
Total Assets	**$64,679**	**$39,468**	**$13,478**
	March 31 year end	**December 31 year end**	

Sources: GVHA, 2010c; Nanaimo Port Authority, 2009; Port Alberni Port Authority, 2009

*Gross revenue charges apply to all Canadian Port Authorities to maintain letters patent in good standing. This charge is calculated on a percentage of gross revenues.

The key points from this summary information related to net income and assets are listed in Exhibit 3-5.

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EXHIBIT 3-5
Net Income and assets Key Points

Net Income	Assets
Victoria and Nanaimo have similar levels of revenues and Port Alberni operates at a lower level.	Each of the three port entities has a comparable (and high) level of current assets.
Victoria has the highest income before depreciation (25% of gross revenues), reflecting lower annual expenses. Nanaimo 15% of gross revenues, Port Alberni 12%	Nanaimo has a comparatively high level of investments, primarily represented by a harbour development fund. (18% of total assets)
Victoria and Nanaimo have comparable allowances for depreciation (25% of total expenses, 23% of total expenses respectively); Alberni is much lower (14% of total expenses) reflecting a smaller depreciable asset base.	Victoria has the highest level of capital assets ($54 million, of which $19.5 million is land).
Victoria has the comparatively best operating income at almost break-even.	Nanaimo and Alberni asset values are lower ($39 million and $13 million respectively) due to accumulated depreciation of improvements over a long period of time.
Victoria has the highest net income when investment and other income is added ($123,000), followed by Alberni with $68,000. Nanaimo recorded the worst financial performance with a net income of -$397,000.	
The net income for Victoria excluded deferred capital and non-capital contributions, which are recognized as revenues in the Harbour Authority Society statement.	

3.2.1 GVHA Operating Income

This section summarizes the GVHA's operating income over the 4-year period from 2007 to 2010 (based on March 31 financial year end) with a focus on segmented data—Ogden Point and GVHA's other marine properties. Segmented data was not available prior to the 2007 financial year. Exhibits 3-6 and 3-7 display the operating income for Ogden Point and the other GVHA marine properties for 2007 to 2010 (consultant's estimates based on GVHA, 2007; GVHA, 2008; GVHA, 2009, and GVHA, 2010c).

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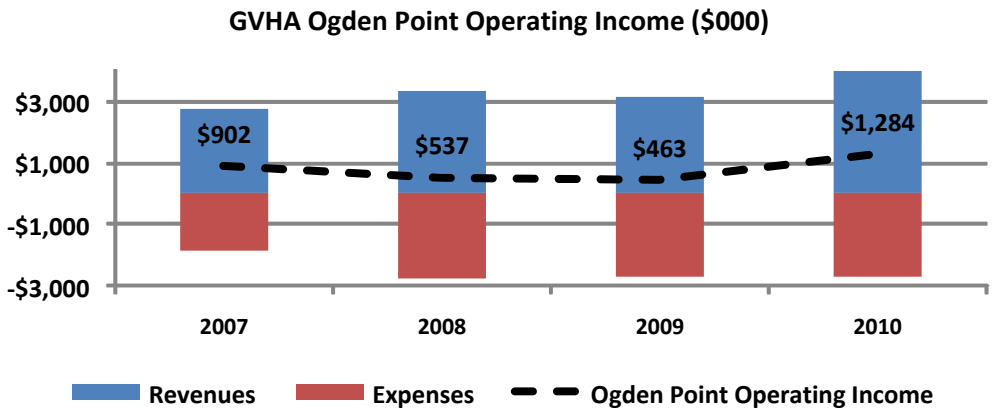
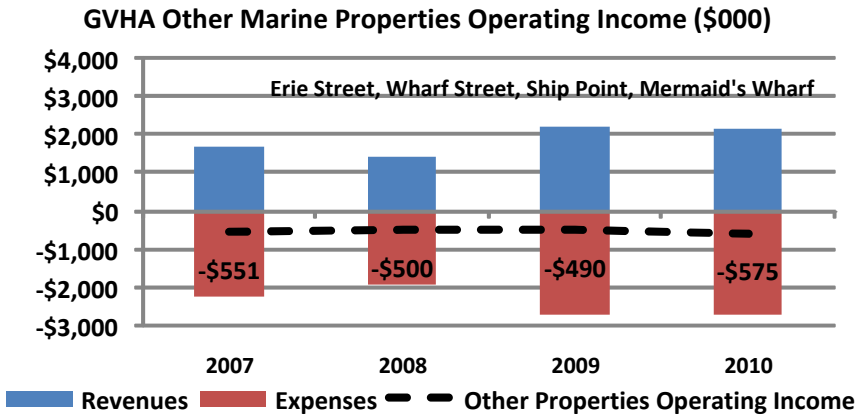
EXHIBIT 3-6
GVHA Ogden Point Operating Income ($000)



Source: Consultant's estimates based on GVHA's Annual Reports 2007 to 2010

EXHIBIT 3-7
GVHA Other Marine Properties Operating Income ($000)



Source: Consultant's estimates based on GVHA's Annual Reports 2007 to 2010

These operating results indicate that the Ogden Point operation essentially subsidizes the other marine properties held by GVHA. For example, in the most recent year ending March 31, 2010, GVHA achieved an operating income of $709,000. However, this operating surplus comprised an operating income of $1,284,000 at Ogden Point compared with an operating loss of some $575,000 at the other marine properties. Fisherman's Wharf generates positive net revenue while the Inner Harbour marinas operate at a loss for its location offering space to host festivals and events.

3.3 Diversifying Revenue Sources

Simultaneous with the need to protect the cruise ship revenue stream and given cruise tourism industry's volatility, GVHA wishes to explore opportunities to diversify its revenue sources by fostering growth of new business lines. As such, the Master Plan considers a

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select list of potential activities and land uses to guide GVHA in achieving its strategic objectives.

There are a number of benefits in supporting revenue diversification:

- Achieving greater utilization of port assets, presumably associated with greater community and/or economic benefits
- Developing new business lines for GVHA in anticipation of the day when existing business activity may experience decline or maturation
- Demonstrating leadership and innovation in the stewardship of the unique assets

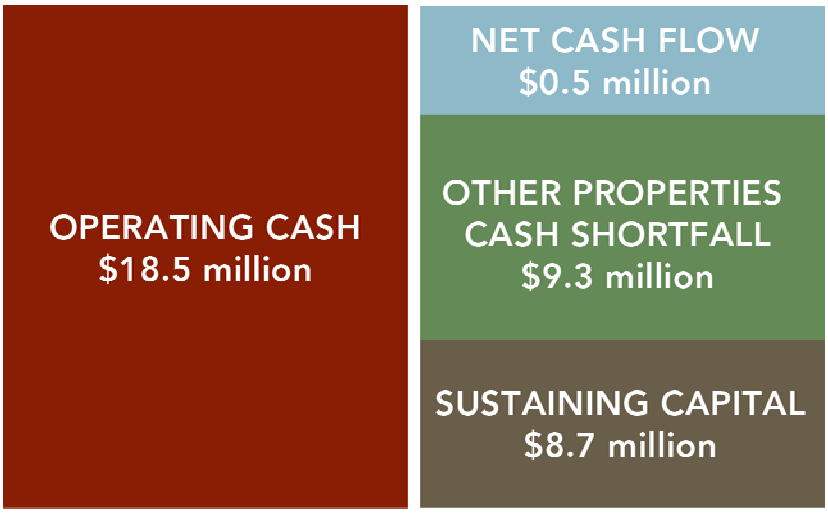
3.4 Economic Evaluation

The project team prepared a cash-flow model for GVHA's operations, starting from the present (2010) situation and taking a multi-year forward view. The purpose of this evaluation is to model the economic activities of the GVHA operations over the two decade time period ending 2030, and to gain an understanding of the relative financial viability of GVHA's operations over that timeframe.

The model covers estimates of cash flows of the Ogden Point operation and those of the other GVHA marine properties. These cash flows are discounted to a present value to estimate the overall economics of GVHA. Sustaining capital covers routine rehabilitation and maintenance expenditures but neither capital replacement nor capacity improvements.

The results of this evaluation appear at the top of the In Out worksheet in Appendix E. In summary, the results of this evaluation are presented in Exhibit 3-8.

EXHIBIT 3-8
Ogden Point Future Cash Flows (Present Value) 2010-2030



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It should be noted that the present value of combined net cash flow over this time horizon, as calculated above, is relatively small and equates to a very modest annual positive cash flow. This is consistent with GVHA's present situation, but illustrates a relatively fragile situation in terms of financial viability. Appendix E also contains worksheets containing estimates of Passenger Traffic, the value of the Capital Assets, and the Income and Cash Flow.

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4. Site Description and Current Operations

Ogden Point, one of several port facilities within the GVHA's' jurisdiction, is a deep-sea port facility located in the southwest corner of Victoria. During the last decade, it has become a major cruise ship destination for cruise ships travelling mainly from Seattle to Alaska. The facility also handles visiting commercial and Navy vessels. The Ogden Point site occupies approximately 12 ha (30 acres) of land and seabed. It includes four deep-sea berths (three 244-m [800-ft] berths and one 305-m [1,000-ft] berth) on two finger piers, as well as an approximately 9,300-m^2 (100,000-ft^2) warehouse (or transit shed) located on Pier A. The Customs Terminal that includes the Canada Border Services Agency (CBSA) Customs inspection area is located on Pier B. Additional operations located on the site include a gift shop and currency exchange; Western Stevedoring (terminal manager); CVS Cruise Victoria (bus operations); terminal security offices; Helijet; Trotac Marine Ltd.; Mercury Marine; Ogden Point Café and Dive Centre; Pacific Pilotage Authority; GVHA office and maintenance facility; and bus, automobile, and horse carriage storage facilities.

4.1 Ogden Point History

This section contains a brief history of Ogden Point, as portrayed in a number of sources, such as the Songhees Nation website (Songhees Nation, 2011) and GVHA's Ogden Point Master Plan: *The Way Forward* (GVHA, 2010e).

The City of Victoria lies in the Traditional Territories of the Esquimalt and Songhees Nations.

The Esquimalt and Songhees Nations are direct descendants from the following Coast Salish family groups: Kakyaakan, Teechamitsa, Whyomilth, Kosampsom, Swenwhung, Chilcowitch, and Chekonein.

The Esquimalt and Songhees Nations are now located in Esquimalt Harbour on Vancouver Island, 5 kilometres from Victoria, the capital of BC. Historically, the original site of the Songhees Reservation was located on the west side of Victoria's Inner Harbour, currently the site of the Ocean Point Resort. The main village sites for the Esquimalt were at the BC Legislature and James Bay, and across the harbour on the east side of Victoria.

The historical population was once in the thousands. This number was tragically reduced by small pox epidemics, and other diseases, in the 1800s. The Coast Salish people and culture survived the epidemics, as well as colonization.

The Esquimalt and Songhees Nations have existing Treaties with the Queen, the original Douglas Treaties of the 1850s.

"By the time the colony of Vancouver Island was established in 1849, British administrators had developed a colonial policy that recognized aboriginal title to land. In the 1850s the Hudson's Bay Company, which was responsible for British settlement of Vancouver Island as part of its trading

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license agreement with the Crown, began Treaty making for colonial settlement and industry from aboriginal peoples on Vancouver Island."

Between 1850 and 1854, James Douglas, as Chief Factor of Fort Victoria and governor of the colony, made a series of 14 Treaties with aboriginal peoples. The Douglas Treaties cover approximately 358 square miles of land around Victoria, Saanich, Sooke, Nanaimo, and Fort Rupert, all on Vancouver Island.

To date, business remains unfinished with the Douglas Treaties regarding ownership of land, resource sharing, and jurisdictions.

Ogden Point was named after Peter Skene Ogden (1790–1854), a prominent trader and explorer for the Hudson's Bay Company. The history of Ogden Point as a major deep-sea marine terminal started early in the twentieth century with the construction of the piers, a breakwater, and a railway. Below, we provide a few interesting historic facts on the port facility:

- 1916: Completion of Ogden Point Breakwater.
- 1918: Ogden Point marine terminal was completed in anticipation of the opening of the Panama Canal and the expected massive increase in shipping and sea trade.
- Mid 1920s: The initial port activity started with a grain terminal to export grain.
- 1928: B.C. Packers built and started operating a fish processing and cold storage plant.
- 1960s: Ogden Point became a major port for lumber shipping.
- 1968: Alaska cruise ship operations started at Ogden Point.
- August 8, 1977: A massive fire destroyed most of the infrastructure at Ogden Point, including a Canadian National Rail (CNR) 13,000-m^2 (140,000-ft^2) warehouse, a 1911 building, newsprint rolls, and 6,800 tons of baled pulp.
- 1978: CNR handed Ogden Point back to Transport Canada, which leased the site to Westcan Terminal. The warehouse was then built on Pier A, and the grain elevator situated on Pier B was dismantled. CNR discontinued rail service to Ogden Point and removed all remaining tracks and the rail barge ramp.
- 1984: Sooke Forest Products, the last major lumber shipper to Ogden Point Terminal, was forced into bankruptcy.
- 1985 to 1986: Passenger-only ferries operated at Ogden Point servicing Seattle and Vancouver.
- 1987 to 2000: BC Steamships (then Stena Line) operated a car-carrying ferry to Seattle.
- 1987: Helijet became the first scheduled helicopter service in Canada flying passengers from Ogden Point to downtown Vancouver.
- 1990: B.C. Packers ceased operations at Ogden Point.
- 1993: The five-storey concrete cold storage fish plant was dismantled.

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- 1992 to 2006: A fibre optic cable maintenance vessel home-ported at Ogden Point. The fibre optic cable depot was installed in the warehouse on Pier A. At the time of writing, there is some potential to see the return of these vessels to Ogden Point.
- 1996: A number of new businesses established their operations at Ogden Point, including the Tally Ho horse-drawn trolley service, the Ogden Point Restaurant, and a dive shop.
- 2001: the Norwegian Sky became the first weekly scheduled cruise vessel from a Seattle embarkation port.
- 2006: Yacht transport, providing seasonal pleasure-craft relocation up/down the West Coast.

4.2 Ogden Point-at-a-Glance

Ogden Point's port support services include provisions and ships stores, customs and immigration facilities, stevedoring, warehouses, waste disposal, potable water supply, and medical facilities.

In recent years, as it has become a significant port of call for cruise ships in the Pacific Northwest, the levels of activity at Ogden Point have increased steadily. Ancillary transportation services include buses and taxis to complete the trip ends to and from the cruise ships, as well as a Helijet terminal providing regularly scheduled flights to Vancouver downtown/harbour and to the Vancouver International Airport. Ogden Point is also home to a variety of other uses, including marine industrial commercial operations, a restaurant and (scuba) diving centre, and repair and depot facilities for horse-drawn carriages.

Several important tourist and recreational attractions are within the immediate proximity of Ogden Point, including; Dallas Road waterfront walkway and seawall, scenic James Bay community, Fisherman's Wharf, and Beacon Hill Park, which attract significant local and visitor interest to Ogden Point.

4.2.1 Ogden Point Current Situation

Cruise ship operations are the main shipping activity taking place at Ogden Point. Cruise ship operations are currently handled by: Western Stevedoring, who operates and manages the piers, the warehouse, and the transportation staging area; King Bros. Ltd, who provide the ship agent services for the vessels; and Canada Border Services Agency, who provides customs clearance. Potential developments on the horizon for the cruise industry include the following:

- Widening of the Panama Canal, with the potential for larger vessels (larger beam or width)
- Potential for higher passenger volumes per vessel (up to 5,000 passengers per vessel)
- Continuing migration of Alaska homeporting from Vancouver to Seattle, resulting in an increased need for a Canadian port of call (as required by U.S. legislation)

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At present, GVHA's annual cruise volume is constrained by the availability of berth space on peak days. Cruise vessels that cannot find a Canadian port of call in Victoria (generally more attractive than other options) will stop at Nanaimo, Port Alberni, or other BC ports. However, larger vessels may enable GVHA to grow its market share for the port of call business by accommodating larger volumes of passengers at Ogden Point by using the presently available berth slots but with more passengers on each vessel. With the total volume of Alaskan cruise passengers expected to remain stable or grow slowly with the economy for the foreseeable future and as the Seattle-based fleet grows and with it demand for BC ports of call (and in particular Victoria), significant revenue growth is possible if larger vessels are introduced. However, the challenges of peak cruise day traffic will grow with this increase, adding complexity to the process of identifying and pursuing complementary business opportunities.

According to GVHA's 2010-11 Strategic Business Plan (GVHA, 2010b), aging infrastructure is of particular concern at Ogden Point. Recent shipping fee adjustments to market rates are expected to address maintenance needs for the piers and breakwater completed in 1918. GVHA is already addressing infrastructure issues by continuous/comprehensive investment into its facilities. For example, a new mooring dolphin at the end of Pier B was completed early in 2010 to allow for better handling of larger vessels. This improvement, along with the dredging of Pier B North berth recently completed in February 2011, will help provide for safer operations of vessels.

4.2.2 Other Land Uses

Other land uses at Ogden Point include:

- Pacific Pilotage Authority, who operates a wharf on the south east shore of Pier A
- Ogden Point Café and Dive Centre located on the southeast corner of the site along Dallas Road
- Marine retail services (Mercury Marine, Trotac Marine)
- Helijet terminal located at Camel Point (north west side of Ogden Point)
- Short-term leased parking for storage of new vehicles, buses, construction materials, storage sheds/containers, and the staging of horse carriage operations
- GVHA's workshop and corporate office building located along Dallas Road near the south entrance of the Ogden Point site
- Western Stevedoring (terminal manager), CVS Cruise Victoria (bus operations), CBSA Customs inspection area, the terminal security offices, and other commercial space, including a gift shop and currency exchange

4.2.3 Opportunities and Constraints

Ogden Point is a unique site offering a variety of opportunities. It is GVHA's largest continuous piece of prime waterfront land, and offers medium-draft (10-m) and protected berthage. The lands have a few major structures but are mostly clear and level, offering a

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broad canvas on which a variety of land uses may be considered to support a range of development, including community, commercial, and industrial uses.

Ogden Point also faces several constraints. Proximity to well-established residential communities (James Bay) places pressure on noise, air emissions, traffic, and parking generation that may not typically be faced by other marine community, commercial, and industrial zones. The road network surrounding Ogden Point is not particularly well suited for heavy trucks. Traffic into and out of Ogden Point must pass through James Bay and downtown Victoria, constraining the road vehicular volume that can be serviced. Opportunities may exist in alternate modes, including consideration for a harbour ferry service. In response, GVHA is exploring options for new modes of cruise transport, as outlined in the Request for Information (RFI) recently issued by GVHA (see Appendix F).

The challenge facing the development of the Master Plan for Ogden Point is in finding the innovative and optimized mixture of waterfront land use that can provide the highest and best use of its working harbour assets for the short-, medium- and long-term, while respecting the site and access constraints.

4.2.4 Site Characterization

Early in 2010, CH2M HILL prepared two environmental condition reviews and a planning-level geotechnical assessment for the Ogden Point site. The overview and assessment reports are provided in Appendices B and C. This section provides a summary of the findings from these assessments.

Environmental Conditions

CH2M HILL completed two environmental reviews in March and April 2010 (see Appendix B). The reviews indicated presence of soil contamination pockets over the breadth of the site, with higher concentrations typically towards the northern portions and including the berm adjacent to the Helijet terminal. A summary of the contaminants of concern findings can be found in Appendix G.

Subsequent to the technical work of this assignment, GVHA commissioned further environmental site characterization work by others in order to further delineate specific site contamination issues. A graphical summary of this work is incorporated in Appendix G for completeness and to provide the reader with further insight into the nature of the issues.

Ogden Point is located adjacent to the Victoria Harbour Bird Sanctuary, which is federally protected. The bird sanctuary has a number of Glaucous-winged Gulls and there have been reports of these birds nesting on the warehouse rooftop on Pier A. For any future works in this area, GVHA will need to consider the effect on birds in the sanctuary and the surrounding area. Under some circumstances, depending on the species, the presence of nesting birds can require mitigation measures and/or delay project construction. Further information on the species found in the Victoria Harbour Bird Sanctuary is provided in Appendix H.

CH2M HILL also identified ecological constraints surrounding in-water future works, including potential impacts on subtidal biological and physical features in the harbour and effects on wave patterns and currents.

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Geotechnical Conditions

Based on a review of the existing geologic maps and geotechnical reports for Ogden Point, CH2M HILL concluded that the site conditions are comprised of heterogeneous granular fill over either native soil or possibly bedrock. In the area near Dallas Road, the fill is thin and is located directly over the bedrock. West of Dallas Road, the fill becomes thicker and overlies sequences of native sands and silts. Where the fill extends below Mean Sea Level, it is typically "loose." Though compressed since the construction of the piers, a substantial thickness of fine-grained soil remains beneath two piers.

The high groundwater elevation and the loose consistency of hydraulic fills east of the piers will lead to construction issues in this area. Excavations below 2 to 3 m depth will require soil dewatering schemes, which, while adding construction cost, are relatively common for waterfront development sites. In the overall scheme of these projects, this additional cost is not a major consideration for the viability of site redevelopment, and many successful commercial developments have occurred under similar conditions.

As an important next step in the development of the site, GVHA should commission a limited geotechnical exploration program to characterize the soils and establish likely performance under gravity and seismic loads. With this information, master planning can proceed with more confidence. Once development plans are known, GVHA can then proceed with the required final exploration work and design studies.

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5. Proposed Site Sub-zones

GVHA has elected to pursue the development of the Ogden Point Master Plan in four phases. This first phase is focused on the physical site characteristics as well as the infrastructure requirements for potential future development on the site. This will be followed by three subsequent phases, as follows:

- Phase 2, Market Assessment, which will determine the market demand and economic potential associated with the identified development options;
- Phase 3, Rezoning, which will develop design guidelines intended to support and facilitate GVHA's vision for future development at the site, while providing foreseeability to third parties regarding future Ogden Point land use through the enactment of a new zoning scheme for the site; and
- Phase 4, Implementation, which will realize the development opportunities identified in the previous phases.

The Master Plan anticipates that over time numerous development projects will occur at Ogden Point, and that realizing the site's potential will require careful coordination and control of project siting and infrastructure. Accordingly, in order to support the goal of achieving the highest and best use for the overall site, a site Sub-Zone designation system has been developed to guide future project development and siting at Ogden Point.

5.1 Proposed Delineation of Sub-zones

The project team developed the proposed site sub-zones illustrated in Exhibit 5-1 as a framework to guide future development for Ogden Point. These sub-zones have been developed to support the highest and best use for each sub-zone, while recognizing the importance of the interlocking relationships between the various sub-zones and development which will occur in each. The description of the sub-zone characteristics and potential development types described below for each sub-zone are intended to guide the subsequent zoning and development process while retaining some flexibility between commercial and industrial uses in order to adapt to market evolution.

5.2 Overview of Each Proposed Sub-zone

During preliminary exploratory work in 2010, the project team identified a range of appropriate uses for the overall site that were deemed acceptable to GVHA's Board of Directors. Using hypothetical land-use scenarios, the project team created the list of potential uses summarized in Exhibit 5-2. This listing should not be considered exhaustive or static, but was developed to identify the potential range of land uses for the site.

Since the list in Exhibit 5-2 was tabulated in June 2010, the project team focused subsequent Phase 1 work on assessing the viability of selected uses for Sub-zone A: Flexible Marine-Based Zone, which has been dubbed the "Blue Zone". The project team selected these land

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use case studies for further analysis (see Section 6). This primary focus on Marine-Based development opportunities reflects the priority of marine-based commerce to any development considerations at Ogden Point, particularly in light of GVHA's mandate. However, some marine functions, most notably the cruise ship operations, generate land use patterns that will integrate with land-based activities, further strengthening the associated economic benefits. Accordingly, the following sections provide an overview commentary on the characteristics of each of the proposed sub-zones.

5.2.1 Sub-zone A: Flexible Marine-based Zone

As referenced in Exhibit 5-1, the primary "Blue Zone" (Sub-zone A1) covers roughly half of the available land area, including both existing piers. It is bounded on the north by the existing helicopter (Pacific Heliport) terminal and extends eastward to include a large central expanse of the property. Given its unique interface with the deep-sea berths, it is intended that it will be reserved for current and future marine use and marine support functions.

A secondary Sub-zone A2 is located north of the helicopter terminal and encompasses the water framed by the Canadian Coast Guard property and operations on the northern boundary of the Ogden Point lands. This much smaller marine zone does not include any land and, as such, potential uses would be considered entirely marine based. Activities considered for Sub-zone A2 may, however, influence consideration of uses in the sub-zones bounding it on the east (Sub-zone B) and on the south (Sub-zone C).

In addition to the large expanse of paved parking area, the building and land-based activities currently encompassed within the primary Sub-zone A area include:

- Virtually all of the land area currently used as a transportation marshalling area during the cruise ship season (May to October).
- The existing warehouse on Pier A, which includes a small office space on the southeast end, with the balance consisting of open (and largely unimproved) shell space.
- Marine infrastructure to support the Pacific Pilotage service for the Juan de Fuca Strait.
- The existing Pier B cruise ship administrative office, customs and immigration services, and gift shop building.

Assets of Sub-zone A, from which GVHA could support a variety of uses, include:

- Substantial, well-sheltered deep-water berth capability
- Pier A Warehouse, Pier B Cruise Terminal, and ancillary buildings
- Ample paved terminal space
- Good views to the harbour
- Waterfront infrastructure and activities of potential interest to non-marine pedestrians (and cruise passengers)
- Established commercial presence nearby (existing tenants)
- Easy access/connection to existing roads and infrastructure
- Availability of land for larger-scaled development

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EXHIBIT 5-1
Ogden Point Sub-zones

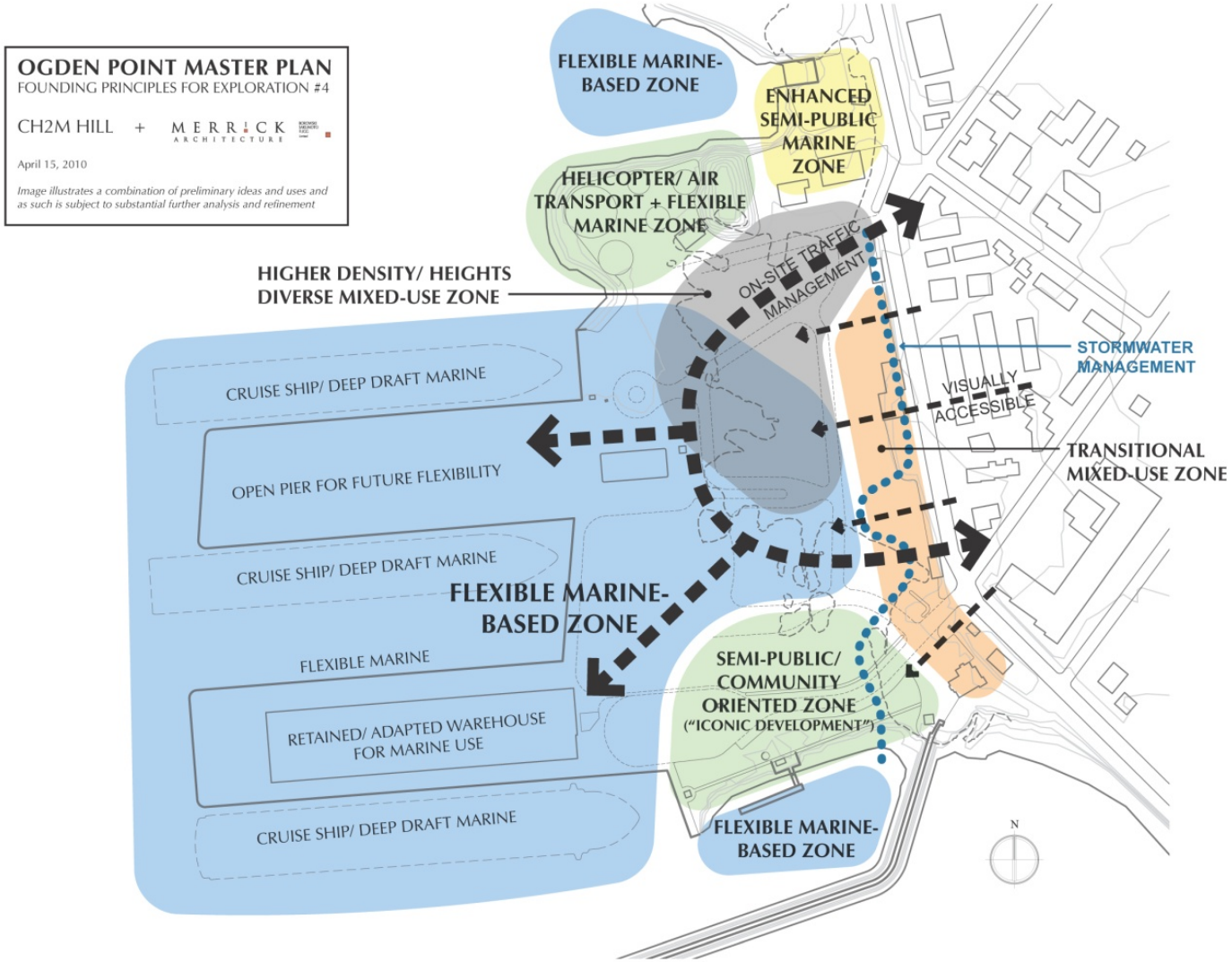

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EXHIBIT 5-2
Listing of Potential Uses by Contemplated Sub-zone

Uses are not listed in any priority; listings may not be complete or may include uses that ultimately may not be appropriate.

Precise configurations of sub-zones on accompanying Founding Land Use Prinicples diagram are schematic only and subject to further analysis and refinement.

No residential, hotel, or casino use is being considered anywhere on the Ogden Point Lands, at the direction of the GVHA

SUB-ZONE A (1&2)	**SUB-ZONE B**	**SUB-ZONE C**	**SUB-ZONE D**	**SUB-ZONE E**	**SUB-ZONE F**
Flexible Marine-based Zone	**Enhanced Semi-public Marine-based Zone**	**Air Transport and Flexible Marine Zone**	**Higher Density Diverse Mixed-use Zone**	**Transitional Mixed-use Zone**	**Semi-public Community-oriented Zone**
> docks, wharves, and piers	> docks, wharves, and piers	> docks, wharves, and piers	> trade schools/educational uses	> trade schools/educational uses	> docks, wharves, and piers
> trade schools/educational uses	> trade schools/educational uses	> trade schools/educational uses	> office uses (major occupancy)	> office use (support to other use)	> trade schools/educational uses
> office use (support to other use)	> office use (support to other use)	> office use (support to other use)	> office use (support to other use)	> professional services/offices	> office use (support to other use)
> retail (support to other use only)	> retail (support to other use only)	> restaurants	> retail, commercial, businesses	> high tech research/development	> retail (support to other use only)
> vehicle storage/rentals/services	> restaurants	> professional services/offices	> restaurants	> use-related parking	> restaurants
> storage warehouses	> use-related wholesale sales	> light industrial servicing/repair	> professional services/offices	> government offices/services	> museums
> use-related wholesale sales	> high tech research/development	> boat servicing and storage	> high tech research/development	> light industrial support uses	> use-related parking
> high tech research/development	> light industrial servicing/repair	> use-related parking	> use-related parking	> university facilities	> recreational uses
> light industrial manufacturing	> boat servicing and storage	> government offices/services	> government offices/services		> tourist attractions/services
> light industrial servicing/repair	> use-related parking	> air travel terminals	> university facilities		> university facilities
> wind or solar power generation	> government offices/services		> parking structures		> neighbourhood pubs
> seafood processing/packing	> air travel terminals				> community centres/services
> fuel storage facilities	> boat launch facilities				> parks
> boat servicing and storage					> seasonal markets
> government offices/services					
> taxi offices					
> air travel terminals					
> cruise ship services					
> bulk goods storage/transer					
> tourist services					
> seasonal markets					
> use-related parking					

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GVHA has expressed a desire to maximize flexibility within Sub-zone A, so design guidelines should be developed that preserve a broad range of uses related to support of marine uses, with some that would continue to require extensive marshalling areas.

5.2.2 Sub-zone B: Enhanced Semi-public Marine Zone

This sub-zone is intended to preserve and possibly expand or enhance the popular public use of the existing boat launch ramp. The project team envisions that uses within this area will favour marine-based activities, but could also include integrated or complementary land-based operations, typically in support of smaller-scaled and less commercial- or industrial-based marine uses than those anticipated in Sub-zone A. Land to the south of the existing boat launch, and possibly westward towards the existing helicopter terminal, could be developed more intensively to create a ship chandlers' neighbourhood (as an example) to serve regional recreational boating demands.

Assets of Sub-zone B, from which GVHA could support a variety of uses, include:

- Established users of the boat launch (local and regional)
- Well-sheltered in comparison to the balance of the site
- Located on the walking route to downtown
- Located adjacent to Canadian Coast Guard site (potential shared uses)
- Potential to serve as the "Gateway to Victoria" development, with little if any encumbrance to the balance of the site, while improving approach/exposure to the site
- Waterfront infrastructure and activities of potential interest to non-marine pedestrians (and cruise passengers)
- Established commercial presence nearby (existing tenants)
- Easy access/connection to existing roads and infrastructure
- Availability of land for relatively small-scaled development

5.2.3 Sub-zone C: Air Transport and Flexible Marine Zone

The existing Pacific Heliport (Helijet) operation is a long-standing and successful Ogden Point tenant, though not a marine use. It is located away from downtown yet offers a reliable transportation mode between Vancouver and Victoria. Providing the facility remains at the water's edge, it could integrate with a variety of passenger-based marine uses while offering potential for other related activity (such as charter or other float plane or marine operations). The site is also distinct and separate from Sub-zone A, and capable of supporting more-intensive shoreline development or expansion seaward (for example, floating piers).

Assets of Sub-zone C, from which GVHA could support a variety of uses, include:

- Established clientele (local and regional)
- Continuity of existing operation and tenancy
- Located close to the walking route to downtown
- Good exposure to seasonal cruise ship passengers and supporting services

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5.2.4 Sub-zone D: Diverse Non-residential Mixed-use Zone

Sub-zone D and Sub-zone E are the only sub-zones positioned entirely over the original rock shoreline, thereby offering an economical site for large building projects. It also straddles the existing main vehicular approach from downtown to Ogden Point, and offers the best opportunity to create a welcoming portal for cruise ship passengers without adversely affecting operations in Sub-zone A. Assets of Sub-zone D, from which GVHA could support a variety of uses, include:

- Good location relative to existing marine uses and the balance of the site
- Straddles the walking route from the site to downtown
- Potential to establish a significant "Gateway to Victoria" development with little if any encumbrance to the balance of the site
- Good exposure/interest to non-marine pedestrian users (and cruise passengers), creating better integration of the industrial uses and the adjacent residential neighbourhood
- Good proximity/exposure to cruise ship passengers and supporting services
- Moderate to good access/connection to existing roads and infrastructure
- Bedrock offering stable foundation for larger-scaled developments

5.2.5 Sub-zone E: Transitional Non-residential Mixed-use Zone

This portion of the site faces Dallas Road and is the "front yard" of Ogden Point. It is also the area that affords the best views looking west and southward over to the Olympic Mountains. This portion of the lands sits entirely on original shoreline, as does Sub-zone D. Current uses do not capitalize on either the James Bay frontage or access from the interior of the site. Adjacent land use on Dallas Road is residential. GVHA's current offices are in the small two-storey building at the south end of the sub-zone.

Assets of Sub-zone E, from which GVHA could support a variety of uses, include:

- Open east-west exposures to both the site and Dallas Road
- Located on the walking route/greenway between the breakwater and downtown
- Potential for "front yard" development, with little if any encumbrance to the balance of the site, while improving integration of activities with the neighbourhood
- Potential exposure/interest to non-marine pedestrians (and cruise passengers)
- Potential for commercial exposure
- Easy access/connection to existing roads and infrastructure

5.2.6 Sub-zone F: Semi-public Community Zone

The southeast corner of the site is presently considered the most public area of the site and features the highly popular Ogden Point Café and access to the breakwater from the walking and cycling paths along Dallas Road. It also contains a small area of recently

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improved landscaping with interpretive kiosks and a bandshell backdrop on the south edge of the zone adjacent to the foot of Pier A.

The site offers the best view of the recently implemented First Nations murals on the north face of the breakwater. Assets of Sub-zone F, from which GVHA could support a variety of uses, include:

- Open exposures to both the site and Dallas Road and a spectacular vista of Juan de Fuca Strait and the Olympic Peninsula
- Located on the walking route/greenway between the breakwater and downtown
- Potential of creating a community-oriented precinct
- Good potential for commercial exposure, if desirable
- Easy access/connection to existing roads and infrastructure
- Good location for educational or other institutional facility
- Good location for tourist-oriented development

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6. Flexible Marine-based Zone: Case Studies

6.1 Introduction

For the marine-based site sub-zones, the project team adopted a case study approach to develop a comprehensive understanding of the full range of future business development and land use opportunities available to GVHA for these lands. Each case study was intended to capture a particular type of commercial activity that either exists today or could conceivably be hosted there at some point in the future. The case studies included in this section are not necessarily mutually exclusive or prescriptive, but rather describe a range of possible future outcomes in order to understand their strategic and tactical implications (both commercial and land use). This will inform both the GVHA's future business strategy planning, as well as the rezoning process. To consider as broad a range of options as possible, the project team adopted a structured options generation, screening, and characterization process to identify business opportunities for Ogden Point. This process is described schematically in Exhibit 6-1, and is further described in the following sections.

6.2 Options Generation for Future Marine-Based Land Uses

The Flexible Marine-Based Zone or "Blue Zone" in Exhibit 5-1 lies at the heart of the Ogden Point Terminal and GVHA's ongoing marine operations. Today, GVHA's operations rely critically upon the success of its marine operations at Ogden Point and the project team anticipates that this will continue for the foreseeable future. At the same time, cargoes will come and go in the future, as they have in the past. GVHA's commercial interests will be best served by ensuring the maximum flexibility for port uses on the site, supporting existing commercial activity, while pursuing business development initiatives to identify and secure new cargoes on advantageous terms, as conditions permit.

GVHA's desire for flexibility of land use in the "Blue Zone" is in direct tension with the nature of a site rezoning application, whose primary goal is land-use management and foreseeability. While the project team anticipates that rezoning of Ogden Point will introduce new limits to the variety of activities that can be accommodated at Ogden Point, testing these limits against the envelope of potential future marine terminal development on the site will be important.

In order to define the entire range of potential future activities (options) at Ogden Point, it was necessary to think broadly about the role of Ogden Point within GVHA, together with GVHA's role in current and anticipated marine transportation systems. Because it is not possible to rigorously analyze every potential future development, the team elected to create representative case studies for "families" of development types for more-detailed assessment. The case studies are representative of the families of potential future site activity and development, although they do not exhaustively describe every potential future

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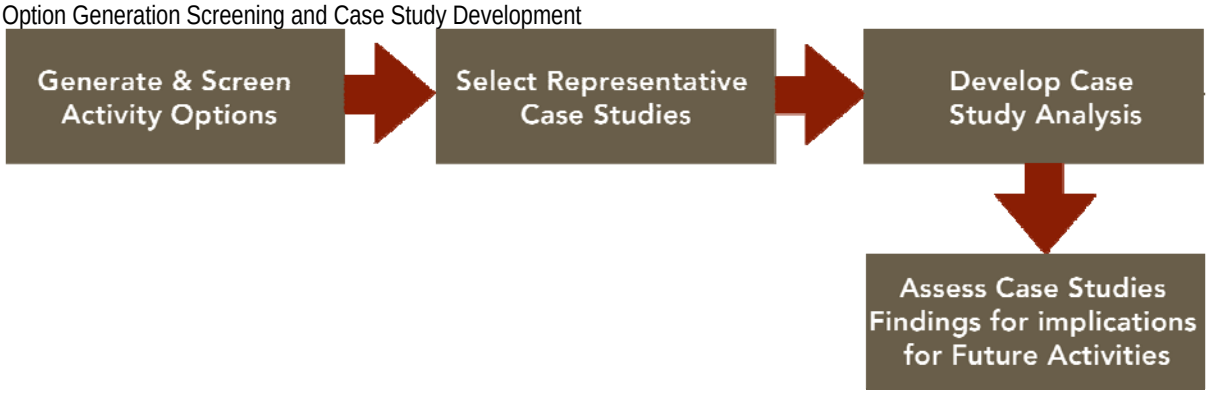
development scenario. By carefully grouping future activity options into families, the resulting case study analysis is able to capture the major implications of the entire family with reasonable accuracy for planning purposes. The analytical sequence can be summarized as shown in Exhibit 6-1.

EXHIBIT 6-1
Option Generation Screening and Case Study Development



To identify the range of potential activity options and land uses for the site, the project team relied primarily on a "top down" approach, which identified a long list of marine terminal activities from a number of comparable ports elsewhere and used high-level screening techniques to focus further work on those that could be feasible at Ogden Point, either now or in the future. To this list were added a number of locally generated or unique ideas from GVHA stakeholders to complement the list.

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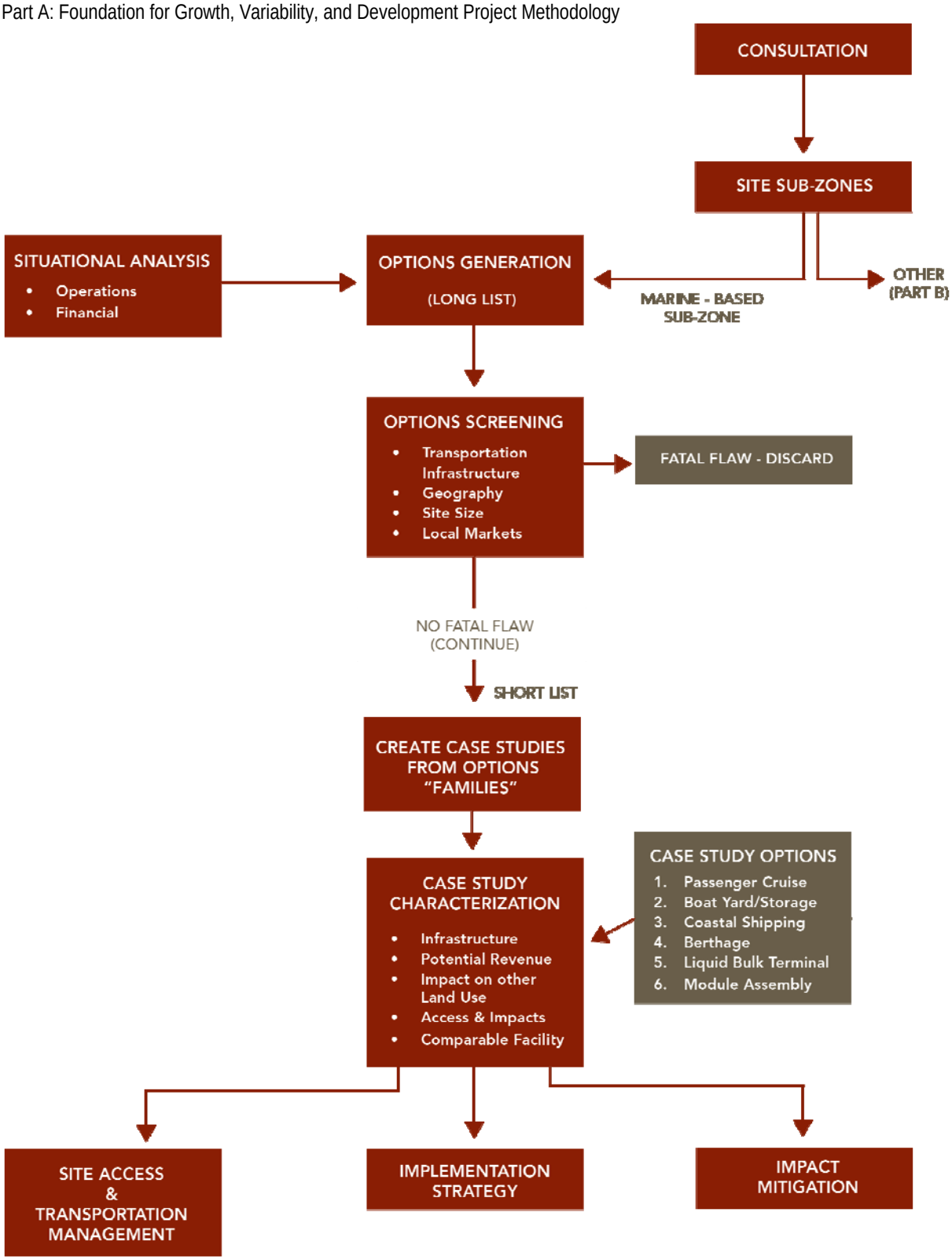
EXHIBIT 6-2
Part A: Foundation for Growth, Variability, and Development Project Methodology



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6.3 Screening of Options

Appendix D includes the long list of potential port marine-based activities. Recognizing that the unique characteristics of Ogden Point and, more generally, Vancouver Island, will not permit the development of some of these activities, the project team s**u**bsequently screened the options using the following four high-level criteria to arrive at a short list:

1. Need for land-side transportation access, including:
    - Rail
    - Road
    - Pipeline
2. Site size for World-economic-scale terminals
3. Marine conditions suitable for typical vessels for cargo in question, including:
    - Draft (Ogden Point limited to approximately 9 to 10 m draft) - current generation container ships typically require 12 to 15 m draft, bulk carriers require 15 to 20 m draft, and coastal vessels require 6 m draft
    - Berth length (Pier A South = 305 m; Pier A North, Pier B North, and Pier B South = 244 m)
    - Tidal range (3.3 m)
    - Wind/wave (breakwater protected)
4. Hinterland characteristics, including:
    - Consumption (gross domestic product in local market)
    - Presence of resources (export)

The project team developed these screening criteria to focus on the physical suitability of Ogden Point for a range of potential uses. Therefore, the screening of activity options does not consider the current economic viability of these options, recognizing that over the long term (up to 50 years), the nature and economics of port activities can change radically as new cargoes, new cargo-handling technologies, and changes in relative global competitiveness transform the port activities that may be considered for Ogden Point. In screening the long list of port activities, the project team focused on physical attributes associated with Ogden Point, the City, and southern Vancouver Island. Unlike considerations of relative competitiveness, these attributes are less likely to change significantly in the long term and should be more reliable filters when selecting inclusively for possible future port activities.

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6.4 Short List of Marine-based Land Uses for Analysis

After screening the options, the project team selected six potential marine land uses for further study. Some of these options were aggregated somewhat to represent general classes of port activity, rather than single clients. The short list of marine-based land uses includes:

1. **Passenger Cruise Vessel Port of Call/Niche Homeport:** The importance of the passenger cruise ship sector to GVHA's present economic sustainability is such that further analysis of this option is warranted. This case study also addresses the potential for future home-porting of cruise vessels.

2. **Boat Yard/Boat Storage and Yacht Transfer:** The potential for storage, inspection, and repair of pleasure craft at Ogden Point is a natural complement to GVHA's existing marina operations and has the potential to add year-round animation and community connection to the Ogden Point site. This case study includes consideration of the potential for further growth in the yacht transfer business, currently served by the YachtPath organization.

3. **Coastal Shipping and Ro-Ro Cargoes/Vehicle Ferry:** A number of variations on coastal freight operations were identified through the options generation process, including short-sea shipping transshipment hub and a coast-wise shipping service between west coast ports. All of these are focused on roll-on roll-off vessel configurations, and so this case study specifically includes the potential for a vehicle ferry terminal (a variation of coastal ro-ro service).

4. **Berthage (including Cable Ships Berthage and Storage) and Marine Technology Research and Development Vessels and Support Facilities:** Because GVHA is well set up to berth vessels in the off-season, pursuing the winter homeporting of a number of suitable size vessels is a business development activity for which GVHA has a competitive advantage. Proximity to the services available in the Greater Victoria area provides further competitive advantage for some of these customers. Examples of potential berthage customers that have expressed interest in GVHA as a deep-water berth include marine cable ships (berthage and storage) as well as marine technology research and development vessels and related support facilities.

5. **Liquid Bulk Products Terminal:** While bulk materials storage generally requires land-side transportation access and/or resource production in the port hinterland, import of bulk liquids (potentially refined petroleum products) is a possible future land use for the Ogden Point facility.

6. **Module Assembly Facility (including Ship-Building Support):** Ogden Point's location on the waterfront may be of use to local industry engaged in heavy equipment or module fabrication and/or assembly. These major, customized projects are infrequent, but often require an assembly facility on deep water to permit loadout to the ultimate customer. Major users of this fabrication approach and typical customers for this activity include the shipbuilding industry, the oil and gas industry, and the materials handling industry. Of historical note, Ogden Point did host activity of this type during the 1970s as part of the development of the North Slope oil resources in Alaska.

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6.5 Economic Viability of Options

While marine transportation was the dominant mode of goods movement in the development of BC in the nineteenth and early twentieth centuries, the second half of the twentieth century saw significant consolidation of marine transportation in response to a number of factors, including:

- Focus on World-economic-scale facilities and vessels, together with greater centralization and rationalization of port facilities
- New technologies (such as containerization), which changed the nature of cargo handling, reducing labour
- Decline of primary natural resources industries in the coastal zone of the province
- Globalization of trade
- Development of land-based transportation systems, which became the primary distribution system necessary to connect centralized, World-economic-scale ports to consumers

Over a period of decades, these factors together have profoundly affected port activity throughout BC, including Victoria. While BC's volume of trade with Asian ports is at or near all-time high levels, this trade passes through two World-economic-scale gateway ports (Port Metro Vancouver and Prince Rupert). Import cargoes are distributed from the gateway ports via land- and coastal shipping-based distribution networks, and export cargoes are agglomerated at "load-centring" ports. Victoria's location at the southern tip of Vancouver Island, so advantageous in the nineteenth century era of coastal shipping, is a disadvantage in terms of attracting significant volumes of marine cargo in the context of the twenty-first century supply chain logistics system.

That said, GVHA can still realize marine-based economic activity and potential for growth in marine-based activity at Ogden Point. However, the project team identified a number of important factors for consideration:

- **New cargo and new marine-based activity will be situation-specific and not easy to forecast.** New port users will be motivated by specifics of Ogden Point's location and other attributes as they relate to their specific business activities. For instance, marine research, heavy construction and infrastructure projects, and recreational boating are three industry segments that can potentially contribute—likely on a small scale, at least initially—to Ogden Point's future marine activity growth. Each of these are relatively small in scale (compared with import and export containerized cargo or other major commodity flows), generally have a number of alternative providers of the required services in the Southern Vancouver Island area, are price-sensitive, and are highly mobile. In these markets, GVHA is essentially a "price-taker" in a highly competitive "buyer's market" with excess capacity due to the long trend of reductions in local cargo volumes.
- **New cargoes and new marine-based activity will be opportunistic in nature.** Thus, shippers, tenants, and other potential port clients will seek to create new business

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opportunities based upon the specifics of their operational needs and the existing site infrastructure, rather than locating new port activities at Ogden Point because it is the only logical option for their requirements. The potential for construction of new large-scale infrastructure in response to new customers is low—in a highly-competitive market the cargo or activity will simply relocate to an alternative location that already offers the requisite infrastructure. GVHA must beware of constructing expensive new infrastructure to attract new customers. The long-term reliability of the associated revenues to service the associated project financial obligations is generally low. It also follows that in the face of substantial competition and their relative lack of unique product differentiation for many commercial opportunities, economic returns to GVHA on the activity will be relatively low. Put simply, for many potential users and tenants at Ogden Point, the competitive advantage accruing to them through their use of GVHA facilities (and therefore the economic rents available to GVHA through securing their business) will be only as large as the costs of relocating their operations to nearby comparable facilities. In the face of this competition, GVHA should generally not expect major contribution from many new activities. At the same time, securing these tenants and clients on a selective basis builds the revenue diversity, vitality, and economic spinoffs associated with Ogden Point, all important elements of the GVHA mandate.

- **While change in the marine transportation sector may seem slow and incremental, significant economic and structural changes can emerge over a period of decades that have the potential to markedly change the function of a particular marine terminal.** As an example, the sustained growth in cruising as a popular form of recreation created a major marine transportation business in coastal BC. Post-9/11 concerns with travel outside the United States combined with vessel technology have given rise to the homeporting of a significant portion of the Alaska cruise fleet in Seattle rather than Vancouver. Combined with the Jones Act's requirement for a foreign port of call, this created a strong and profitable business for Victoria. The key drivers of this market emerged over the past 30 years or less; while they appear durable, changes in economics, security, legislation, demographics, etc. may once again alter the landscape. When a combination of these factors emerges that can support a new business venture or a new, more economical means of delivering an existing service, significant and relatively rapid (when a tipping point is reached) changes to the business activities at the affected port(s) can be realized. Many activities that are clearly not economic at Ogden Point today may in fact become economic at some point in the future. Identifying emerging situations that create these sorts of opportunities for GVHA will be crucial to future business strategies; retaining the ability to act on these when they emerge is therefore a strategic imperative for GVHA.

An example of a potential business opportunity that may become viable for GVHA would be the possibility of home-porting, particularly for niche and specialty markets. Victoria has many of the attributes necessary to homeport success (large air access capacity; good ground transportation capacity; local supply chains for vessel resupply; strong local hospitality sector; and modern terminal facilities. Although homeport decisions are entirely at the discretion of the cruise lines and are presently biased towards US homeports due to security concerns, this could change, particularly for niche markets. Presently, BC destinations are marketing extensively to Chinese nationals, for whom Canada is now an approved tourism destination. Early indications suggest strong interest in the Greater

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Victoria/Vancouver Island experience, and the potential for home-porting cruise vessels to serve tourists destined for Victoria. This could be a good diversification opportunity for GVHA, but would be in tension with the port of call business for berth utilization, terminal use, transportation access and other key resources. At present, it is anticipated that development of home-ported cruise vessels for Ogden Point is a number of years away, but it is worth considering for future planning.

6.6 Marine-based Land-use Case Studies

The case studies contained in this section provide a description of a variety of potential future marine-based land-use options for the Ogden Point site. For each option, the project team developed a case study, including the following information:

- Description
- Background
- Required infrastructure
- Revenue projected
- Impact on other land uses
- Access requirements and neighbourhood impacts
- Discussions and next steps
- Comparable facility

While these are presented as case studies, the project team developed them only to a level necessary to anticipate the associated infrastructure needs and potential traffic and other impacts. Professional judgment and experience supplemented by applicable information in the public domain was used in their development. The marine-based land uses are not necessarily mutually exclusive and, in fact, the GVHA goal of diversifying revenue sources will best be achieved by co-locating one or more of these activities together (though not necessarily contemporaneously).

Exhibit 6-3 contains a high-level overview of the six case studies carried out for the Ogden Point Master Plan assignment. Further detail on each is contained in the following sections.

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EXHIBIT 6-3
Case Study Overview

Case Study	Required Infrastructure	Projected Revenue ($,000 p.a.)	Impacts on Other Land Uses	Access Req'ts, Neighbourhood Impacts	Next Steps	Comparable Facility Elsewhere
1. Passenger Vessel Port of Call/Niche Homeport	Limited (Terminal Expansion with volume growth)	Ca. $3,000	Seasonal, but significant	Terminal vehicle needs substantial, episodic; air emissions.	Explore incremental business growth opportunities (for example, homeporting); consider implications of larger vessels.	Port of Call: St. Thomas, BWI Homeport
2. Boat Yard/ Boat Storage and Yacht Transfer	Boat Launching Facility (Travelift or similar) Cost approx $1.5 million	Up to $750	Limited, Seasonally comple-mentary with cruise business.	Limited, infrequent access, minimal impacts to neighbours.	Market study, capital project definition	Shelter Island Marine and Boat Yard, Richmond, B.C.
3. Coastal Shipping/Ro-Ro Cargoes/Vehicle Ferry	Ro-Ro terminal improvements (ramp, secure compound) (est. cost $15 million)	Up to $750	Potential conflict with cruise business.	Limited for Ro-Ro Freight; significant traffic from ferry terminal.	Monitor market developments	Freight: Seaspan terminals at Swartz Bay, Nanaimo; Vehicle Ferry: Belleville Street Wharf
4. Berthage (including Cable Ships Berthage and Storage) and Marine Technology Research and Development Vessels and Support Facilities	None	Up to $50	Potential conflict with cruise business	Limited	Market research, passive marketing	Nanaimo, Port Metro Vancouver Fraser River terminals
5. Liquid Bulk Products Terminal	Receiving facilities at berth, tank farm, and truck loadout facility: est. cost $10-$15 million	Up to $600	Potential conflict with cruise business	Limited	Monitor market developments	Hatch Point, Bare Point terminals
6. Module Assembly Facility (including Ship-Building Support)	None/ Limited	$50 per acre	Moderate, depending on scale	Limited, depending on scale	Market research	Astoria Oregon, Tacoma, WA (historical)

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6.6.1 Case Study 1: Passenger Cruise Vessel Port of Call/Niche Homeport

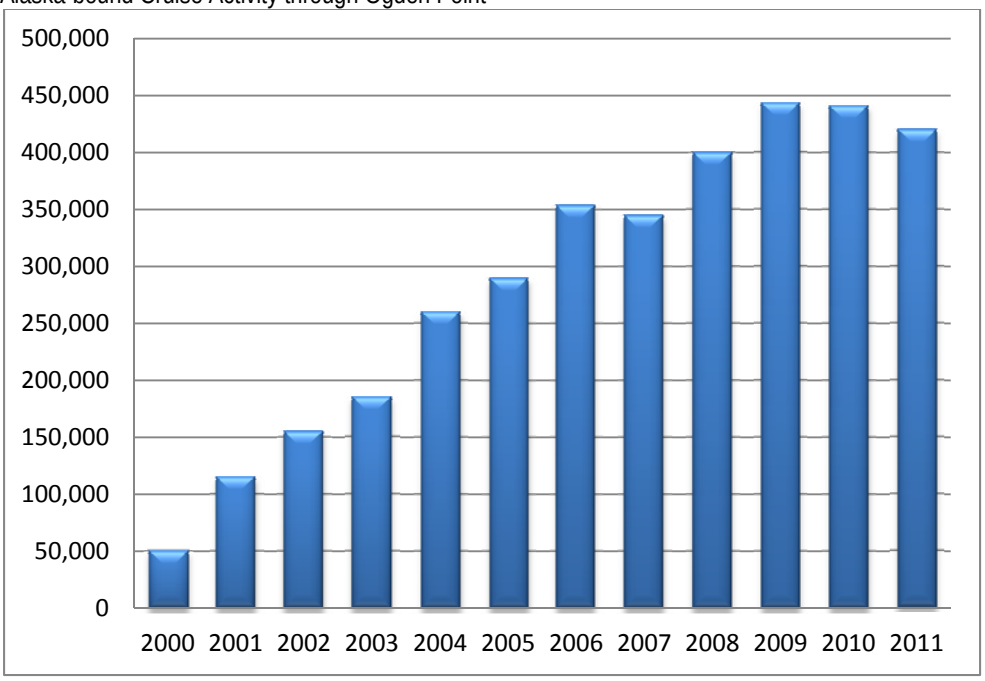
Description

As proven over the past several years, Ogden Point is a viable port of call destination for the Seattle-based Alaska cruise trade. In 2011, Ogden Point handled 206 vessel calls with over 449,000 passengers. As indicated in the financial overview contained in Section 3, this business represents over half of GVHA's revenues and contributes a substantial surplus to GVHA net income, enabling the continuance of other activities elsewhere in Victoria harbour, many of which operate at a deficit. The current operation frequently requires all three cruise berths, and these are heavily used during the cruise season on evenings of the year that are compatible with popular vessel itineraries. Minor opportunities for increasing the number of calls or passengers include adding additional calls to "shoulder" days in the week or the potential deployment of larger vessels, but these opportunities are limited. Over the longer term, improved air access to Victoria, Vancouver, and Seattle airports together with development of the specialty Asian cruise market may see home-porting opportunities for Ogden Point which could increase berth utilization and economic activity per call. As such, the project team presents this marine-based case study to document the implications of continuing the present passenger cruise business at or near present volumes, rather than growing significantly.

Background

As discussed in Section 3, Alaska-bound cruise activity through Ogden Point has grown dramatically over the past decade. This business is linked to Seattle-based vessels or the Alaska cruise market. Seattle-based Alaska cruise vessel voyages increased from less than 50 in 2000 to a present level in excess of 200 (GVHA, 2010b). Exhibit 6-4 summarizes this growth:

EXHIBIT 6-4
Alaska-bound Cruise Activity through Ogden Point



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Required Infrastructure

While originally employed as a multi-purpose deep-sea terminal, Ogden Point serves remarkably well as a cruise passenger port of call. It has two finger piers yielding four medium-draft deep-sea berths, of which three can be used simultaneously for berthing large cruise vessels. With the exception of routine maintenance and refurbishment, the present berth infrastructure serves well for the medium term to sustain the existing business. GVHA is also proactively investing to improve the attractiveness of the present terminal, most recently through the new mooring dolphin at the end of Pier B.

Land-side infrastructure to date generally functions adequately, although peak day disembarkations are now substantially in excess of reasonable passenger capacity for the customs facility and land-side transportation function. In turn, the land-side cruise passenger transportation function (motor coaches, caleches, and bicycle rickshaws) over-runs much of the terminal area and produces significant local traffic congestion on peak cruise days. GVHA could address this through selective investment in passenger processing facilities, passenger pick-up and drop-off facilities, and channelization and delineation of vehicle access routes on the terminal. This will enhance the passenger experience, reduce delays, and reduce the amount of terminal area necessary to support the cruise terminal operation, opening up portions of the terminal for potential dedication to other new businesses. GVHA will need to continue its efforts with the City to facilitate safe and efficient vehicle terminal access and egress on peak cruise days.

Revenue Projected

Cruise and cruise support revenue to GVHA exceeded $3 million in the financial year ending March 31, 2010 (GVHA, 2010c). Given the significant growth in passenger volume for 2011, revenues are anticipated to be approximately $3.1 million in the current year.

Impact on Other Land Uses

As noted above, the current passenger cruise terminal configuration and operations mode imposes significant limitations on the use of Ogden Point Terminal for other activities, particularly those uses that need continuous access to portions of the terminal surface and/or unimpeded vehicle access for their operations. As time and finances permit, GVHA could mitigate this and pursue other business opportunities through a planned program of terminal infrastructure enhancements to improve efficiency and contain the current operational sprawl.

Access Requirements and Neighbourhood Impacts

As discussed above, current operations models impose significant traffic congestion on the Dallas Road area. Detailed technical analyses may suggest mitigation measures for these issues, possibly including traffic channelization and/or intersection upgrades, dedicated nonmotorized vehicle routes, and signage or lighting improvements.

Cruise vessels also produce vessel air emissions while in port, another significant issue for nearby neighbourhoods. GVHA may wish to investigate the feasibility of alternate power sources (cleaner fuel or even shore power) as a potential mitigation opportunity.

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Discussion and Next Steps

GVHA's passenger cruise business forms the financial and operational backbone of GVHA's operations. Working to mitigate negative impacts, enhance visitor experience, and accommodate further ship calls will serve to cement the strong competitive position enjoyed by Victoria through a fortunate combination of geography and cultural history. The major threats to this success would appear to lie in potential changes to demand for cruising by the general public and/or changes in the US shipping legislation and regulations (Jones Act) which mandates a foreign port of call for foreign-flagged vessels transiting between United States ports. However, Alaska seems to be a very durable cruise destination for Americans, and the cruising demographic for this destination is still growing. If the Merchant Marine Act statute should change, GVHA will still benefit from the relative attractiveness of Victoria as a port of call, a unique attraction in its own right.

Another significant risk to GVHA's cruise business over the medium- to long term is the issue of capital reinvestment for legacy infrastructure. Based upon the age of the Ogden Point infrastructure (in particular the finger piers), GVHA can reasonably anticipate the need for significant structural rehabilitation in the future. The issue of seismic performance, criteria for which these structures would not have been designed, will further complicate this work when it becomes necessary. GVHA may wish to begin a systematic review of the condition of the current infrastructure inventory with a view to selective investments in enhanced preventative maintenance and to enable proactive planning for capital rehabilitation and ultimately replacement.

Synopsis

With the strong growth and performance of GVHA's passenger cruise business experienced over the past decade, it has become the financial cornerstone of GVHA's economic viability. The tremendous success of this business has produced a number of growing pains in terms of impacts to other GVHA operations, neighbourhood residents, and the City as a whole. Nonetheless, taken on balance, the tremendous infusion of associated economic activity, as well as the many GVHA services and benefits to the community which it engenders, are beneficial to residents of the Victoria area. As GVHA continues to explore opportunities to maximize the benefits and mitigate the impacts of this important international passenger business, they will also enhance the attractiveness of Victoria as a port of call and the durability of the passenger cruise business. The present situation presents growth opportunities (larger vessels, market growth, niche home-porting) for the future, as well as opportunities to improve efficiency of cruise operations to facilitate concurrent new business activity. Similarly, GVHA can address the longevity of the very significant legacy assets of the site to effectively manage infrastructure refurbishment and capital replacement challenges to ensure the continued viability of this important business line.

6.6.2 Case Study 2: Boat Yard/Boat Storage and Yacht Transfer

Description

Because of the significant number of pleasure craft based in the Victoria area, GVHA could develop boat storage and repair business activities at Ogden Point. This would cater to the seasonal needs of pleasure craft for dry-land storage and/or repairs, and would complement the passenger cruise business. This would also be a strong complement to the

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yacht transfer service currently operated by YachtPath, which in 2010 transported 126 yachts to and from Ogden Point and in the process generated more than $28,000 in revenue. GVHA could use approximately 2 hectares (5 acres) of the Ogden Point site for boat open storage, depending on the market response and the services offered, and could use part of the transit shed (warehouse) for covered storage. While initial activity could focus on storing boats, GVHA could improve the businesses of a number of current tenants and attract other supporting businesses to operate in proximity to the boat storage, in effect becoming a boat yard precinct.

Background

With its marina properties, GVHA's significant potential customer base could generate incremental revenue from boat yard services. The boat storage and repair activity fits with the GVHA mission of providing port-related activities at Ogden Point, and would complement the current use of the site by the cruise ship vessels. Additionally, the limited infrastructure required for a boat storage facility, and therefore the low cost of entry, would preserve the land should GVHA identify a better opportunity for the site in the future.

Boat yard activities that could occur at Ogden Point include, at a minimum:

- Lifting boats from the water using either a Travelift machine or other type of operation, or other type of operation, such as the boat launch ramp
- Transferring boats to the hydraulic trailer and transporting to open- or covered-storage positions
- Placing boats in position for storage, blocked for safe access
- Undertaking inspection, cleaning, and repairs
- Reversing the above process to relaunch the boats once repairs and/or storage are complete

An initial simplified process for lifting and relaunching boats could be developed without use of a Travelift by combining the use of the hydraulic trailer and the boat launch ramp. This would reduce initial capital costs significantly (Don Prittie, Pers. Comm., October 28, 2010).

Required Infrastructure

The boat storage operation would require a limited amount of new equipment and infrastructure. New equipment required would include:

- Marine Travelift machine and travelift dock (marine support structure) to lift boats from the water (see http://marinetravelift.com/)
- Hydraulic trailer for transporting boats once lifted to dry land
- Forklift for manipulating and loading/unloading stored boats
- Washdown water system, drainage collection, and water treatment system

Based upon recent similar projects on Vancouver Island, the project team anticipates that the total cost of the required infrastructure would be on the order of $1.5 million. GVHA could

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provide basic storage on the existing paved yard service, with a premium covered storage option in the transit shed on Pier A. The boat yard would require up to approximately 2 hectares (5 acres) of back-up land. The spatial organization of these facilities has significant flexibility, but would include the following considerations:

- Boat yard area:
  - The most convenient locations for open boat storage and marine services are in proximity to Travelift operations, but can potentially be at some distance.
  - Valuable waterside land does not need to be sacrificed to accommodate a boat yard/storage facility.
  - The ability to cordon and separate access, provide convenient electrical power, etc. is of value in supporting vessel repair activities.
  - Proximity to developable land for ancillary marine services (engine repair, sails, fiberglass and welding repairs, etc.) would be a highly valuable feature that would increase the attractiveness of Ogden Point as a boat storage/repair facility while enhancing GVHA revenues and adding activity and energy to the waterfront.
- Transit shed on Pier A for covered boat storage: Use of part of the existing transit shed for covered boat storage would be economic if access can be provided.
- Travelift location options – Two potential locations are:
  - Inshore of the Pilot boat station - This location features proximity to the transit shed and some potential for isolation from at least some of the cruise operations. However, it may conflict with other potential harbour activities at Pier A (although boat lift operations are typically infrequent and can be scheduled around other operations).
  - Vicinity of the Helijet terminal - The proximity of this location to the Helijet terminal may create operational conflicts with helicopters taking off and landing due to the height of the Travelift machine and the height of some sailboats. It is also some distance from the Pier A transit shed and would be in greater conflict with cruise operations (although these are generally seasonally offset).

The capital costs associated with establishing the boat storage operation could likely be reduced using an equipment leasing strategy for the mobile equipment. If a hydraulic trailer is used for boat lifting and relaunching, capital costs would be further reduced (deferring the need for a Travelift and corresponding support structure). This could potentially reduce capital costs by up to $500,000, but would require confirmation that the existing boat launch ramp was suitable for use with the hydraulic trailer. In addition, the use of the hydraulic trailer in the salt water environment would engender higher maintenance costs while shortening its life due to corrosion issues (Don Prittie, Pers. Comm., January 18, 2011).

Revenue Projected

Based upon discussions with GVHA staff and assessment of the potential scale of the boat storage location, the project team estimates gross revenue potential, from boat yard lift-out/ lift-in and storage activity, up to approximately $750,000 per year. GVHA should undertake

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further work to confirm this potential and identify ancillary revenue potential. GVHA could generate significant additional revenue by leasing lands used for marine service businesses.

Impact on Other Land Uses

The boat storage facility would have a fairly limited impact on the land, and would include a fenced area of approximately 2 hectares (5 acres), modest (and possibly temporary) buildings to serve the boat storage activities (mechanic/boat repair, specialized retail stores, such as sailing hardware equipments and clothing), and a Travelift located near the Pilot boat station or in the vicinity of the Helijet terminal. GVHA could use part of the existing transit shed located at Pier A for indoor boat storage.

To accommodate this new activity, GVHA would need to modify the site layout and internal circulation. GVHA would also need to rationalize the passenger flows and vehicle operations associated with the cruise operations to allow dedication of the space for this purpose.

Access Requirements and Neighbourhood Impacts

The boat storage activity would require limited and infrequent access requirements; the current site access would probably accommodate the needs. The project team anticipates a small increase in cars and light truck traffic. Unlike traffic related to cruise ships, the traffic generated by the boat storage activities would be fairly randomly distributed throughout the year and would most likely occur during daylight hours. The project team anticipates minimal impacts on the neighbourhood (noise, traffic congestion, pollution) as a result of the boat storage activity.

Discussion and Next Steps

The relatively modest infrastructure requirements of the boat yard/storage opportunity suggest the possibility of early implementation. To this end, GVHA may wish to proceed directly to project development activities, including:

- Preparation of a detailed market study
- Preparation of detailed capital cost and operating expenses analysis
- Preparation of a pro-forma income statement and cash-flow analysis
- Potential for operating or funding partnerships with third parties

Issues for particular consideration in this work would include:

- Mitigation of impacts with respect to adjacent residential area
- Potential First Nations involvement
- Improvements to onsite services, utilities, and road access
- Marine terminal security

Comparable Facility

The Shelter Island Marina and Boat Yard, located on the South Arm of the Fraser River in Richmond, BC, have been successfully operating since 1978. This boat yard has two Travelifts capable of accommodating vessels from 6 to 40 m (20 to 130 ft) in length, and provides short- and long-term storage for up to 300 vessels. In addition, approximately 30 marine businesses are established in the service component at the boat yard. Shelter

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Island Marina was awarded a two Anchor Eco-Rating to recognize its commitment to Marina Environmental Best Practices. This facility has become a significant destination for pleasure boat owners, both for boat storage and maintenance, as well as for the unique retail facilities it offers, including an onsite restaurant and pub. This demonstrates an excellent example of the potential scale of operation that can be achieved by a well-planned operation with good services offering and a large surrounding market.

Synopsis

The boat yard/storage land use presents a short-term opportunity for GVHA to diversify its business act Ogden Point without fundamentally compromising other existing activities. While the recreational boating fleet is large, facilities for small vessel storage in and around the Victoria area are limited, providing potential and significant competitive advantage for Ogden Point as a site for these activities. The opportunity could also offer value-added covered storage facilities to customers at relatively modest cost to GVHA. Furthermore, a well-designed facility for boat storage, inspection, and repair in combination with small parcels of developable land for specialty services and retail establishments can provide further attractiveness to customers while growing GVHA's revenues. In the longer term, if larger-scale opportunities that require large fixed commitments of land on the site present themselves, GVHA may have to sacrifice this business to pursue those opportunities. In that case, GVHA would need to assess the relative attractiveness of those opportunities, as compared to the (as then) established boat storage business.

6.6.3 Case Study 3: Coastal Shipping/Ro-Ro Cargoes/Vehicle Ferry

Description

Located at the southern tip of Vancouver Island in close proximity to major shipping lanes connecting to the international gateway ports of Vancouver, Seattle, and Tacoma, Ogden Point could be viable as a future small-scale transshipment position as part of an integrated coastal shipping/distribution logistics system. The principal characteristics of Ogden Point's infrastructure elements, including deep-sea medium-draft berths and a significant paved back-up land, are well-suited to this sort of operation. An alternative ro-ro activity with similar implications for infrastructure and revenue potential would be the potential development of a vehicle ferry terminal at Ogden Point, potentially serving emerging services between the US Puget Sound/Olympic Peninsula and Victoria.

Background

Coastal shipping generally refers to the waterborne movement of cargoes through inshore waters. A special case of coastal shipping has been under study on Canada's west coast for a number of years—particularly for containerized and ro-ro cargo. This is the use of smaller vessels to move deep-sea, TransPacific import cargo from coastal ports inland to smaller shallow-draft intermodal (typically rail) terminals that are remote from the congestion of large urban coastal centres (and the reverse movement for export cargo). Another special case of relevance to Vancouver Island is the Seaspan service linking Tilbury Island (Delta, BC) to Nanaimo and Swartz Bay on Vancouver Island. This is a ro-ro service principally engaged in delivery of consumer goods and industrial supplies to Vancouver Island. This corresponds to the regional distribution links referenced previously.

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In recent years, there has been interest in the use of coastal shipping operations to reduce congestion from the Highway 99/Interstate 5 (I5) corridor between San Francisco and Vancouver. Potential ports of call include San Francisco, Portland, Tacoma, Seattle, and Vancouver. In this model, Victoria could serve as a transshipment terminal, where vessels from one or more of these ports could transfer cargo to shore for short-term storage prior to being reloaded on another vessel for delivery to their final destination. Current industry comment suggests that establishing adequate demand for this service to be commercially viable is some years away (Menzies, 2005).

The geography of the Cascadia Region, and in particular the inland location of Portland, the I5 corridor, Seattle, and Tacoma, presents significant challenges to the competitiveness of this type of service under current economic conditions. Nonetheless, with growing movement of containerized freight in the TransPacific trade and corresponding increases in coastal movement of distribution freight flows, one option for moving this freight involves shifting more of it to water. This is particularly so as demographic change reduces the pool of available labour for truck driving (and may increase the cost of this option).

As an alternative ro-ro cargo, a potential new ferry service could elect to use Ogden Point as a terminal, likely connecting to destinations on the Olympic Peninsula of Washington State. While of a smaller scale than the typical BC Ferries Vancouver Island services, this could nonetheless grow to become a significant source of revenue to GVHA. The required infrastructure and revenue potential is, for the purposes of this study, essentially the same as for the coastal shipping activity.

Required Infrastructure

The project team anticipates that a minimal scale ro-ro coastal transshipment terminal would require the use of one of the Ogden Point finger piers, and approximately 4,000 to 5,000 lane-metres (requiring 2 hectares) of terminal holding compound space (plus access routes). GVHA would need to provide perimeter fencing around the holding compound for security purposes, a hydraulic ramp for vessel operations, and a fleet of yard tractors to move cargo to and from ships (fleet size would match to cargo volumes). Exhibit 6-5 indicates a schematic terminal layout based around Pier A South. The project team estimates the capital cost for fixed infrastructure at approximately $15 million.

Revenue Projected

Based on 100 vessel calls, 200,000 tonnes of cargo, and occupancy rent of 2 hectares, the project team estimates the annual revenue to GVHA to be in the range of $600,000 to $750,000.

Impact on Other Land Uses

The vessels used for coastal shipping are generally much smaller than those deployed in the deep-sea trade, both in terms of draft and length. Industry representatives propose vessels of around 180 m in length with a draft of 6 m. GVHA could readily handle this size of vessel at Ogden Point. Should this service be initiated, it would require dedication of one of the berths on a year-round basis. This would generally prevent its use by cruise vessels due to the need to allow a frequent, scheduled service.

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Initiation of a coastal shipping service would result in the loss of a third cruise berth—the largest adverse impact to the GVHA's current operating situation. This would serve to limit cruise revenues, and GVHA would need to look closely at the potential revenues, capital cost commitments, and risk associated with agreeing to host a coastal shipping service.

Access Requirements and Neighbourhood Impacts

For a true transshipment terminal, the majority of freight arrives and departs the terminal by water, with relatively little local-market interaction. While the project team anticipates this would be the case for the majority of the potential traffic to and from a coastal shipping transshipment terminal at Ogden Point, there will doubtless be some incidental use of the facility by local shippers and importers once the service became available.

Assuming a twice-weekly service using the notional design vessel described above and 5 percent of the ro-ro traffic departing the terminal from local origins or for local destinations, approximately 20 inbound and 20 outbound truck gate moves would be associated with this activity. They would be semi-trailer vehicles and arrivals would be distributed throughout the work day (with periods of greatest traffic activity immediately following each vessel call).

Discussion and Next Steps

The potential development of a transshipment terminal for coastal ro-ro traffic at Ogden Point is potentially a viable future business line for GVHA. While coastal shipping (including short-sea shipping) appears to show some growth in response to continuing centralization of the TransPacific trade, this has been slow with more discussion of the potential than demonstrated success thus far. At present, Vancouver Island domestic traffic is effectively and efficiently handled by the Seaspan Intermodal and BC Ferries terminals at Nanaimo and Swartz Bay. Success at Ogden Point would require a different model based on larger flows between major west coast gateways not directly connected to the Vancouver Island economy.

In a potential role as a transshipment position, GVHA should exercise caution: the proposed model is unproven and must be validated before any categorical statements as to its viability can be made. This may take a number of years as the freight industry evolves in response to changes in coastal movement of goods. In the meantime, GVHA should continue to monitor developments in this sector and work with potential proponents, but be cautious regarding commitments of any capital funds. Should a vessel operator be successful in initiating a service, there is presently limited precedent for predicting commercial success. Accommodating a scheduled coastal shipping service would of necessity limit GVHA's ability to host peak cruise vessel traffic, and it must be approached with caution.

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EXHIBIT 6-5
Coastal Shipping Transshipment Terminal

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The potential for realizing a new vehicle ferry terminal at Ogden Point is quite feasible and could be driven by growth in tourist traffic destined from Victoria to Washington State.

Comparable Facility

At present, the project team could not identify a comparable facility in the Pacific Northwest area operating as a hub transshipment port for ro-ro cargo. There are similarities with Seaspan Intermodal's operations in Swartz Bay and Nanaimo, though these are not transshipment terminals and hence have much higher gate traffic generation than a transshipment terminal would. Comparable vehicle ferry terminals can be found at a number of locations in BC and Washington State, including the Belleville Street Wharf in Victoria and at Port Angeles, WA.

Synopsis

Over the medium term, the evolution of the coastal shipping industry may provide opportunity for GVHA to work with the private sector to support a possible ro-ro transshipment terminal at Ogden Point. While the anticipated vessels can be readily accommodated using existing infrastructure, GVHA would need to expend significant capital to construct a loading ramp and secure compound in transit trailers. In addition, a regularly scheduled service of this nature would require dedication of one of the berths currently available for cruise vessel accommodation during the summer months, limiting GVHA's present activity in this sector. Since the commercial viability of the service model upon which this proposal is based is not proven at present in the Pacific Northwest, GVHA should approach this proposed land use with caution. On the other hand, vehicle ferry services linking Vancouver Island to the mainland of BC and Washington State are a proven service, and have grown with tourist traffic and the Island economy. Therefore, it is reasonable to anticipate that Victoria, as a major tourist destination, could host another such terminal at Ogden Point as market demand warrants.

6.6.4 Case Study 4: Berthage (including Cable Ships Berthage and Storage) and Marine Technology Research and Development Vessels and Support Facilities

Description

GVHA currently has (and can readily continue to develop and exploit) opportunities to provide non-working berthage services to deep-sea vessels calling at Victoria from time to time. Due to the general decline in the volume of marine trade to southern Vancouver Island, identifying and successfully pursuing opportunities for incremental business in this area will require a clear understanding of emerging trends in vessel deployment, as well as diligence in pursuing those for whom GVHA offers a competitive advantage. However, from time to time there is opportunity to host such vessels. Examples of potential berthage customers that have expressed interest in GVHA as a deep-water berth include marine cable ships (berthage and storage) as well as marine technology research and development vessels and related support facilities.

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Background

Because GVHA is well set up to accommodate moored vessels in the off season, the winter homeporting of a number of suitable sized vessels is a business development activity with a relatively low barrier to entry. Proximity to the services available in the Greater Victoria area provides competitive advantage for some of these customers. Of particular interest in light of the proposed site sub-zoning strategy described in this report will be identifying berthage opportunities with complementary need for shore facilities (operational bases, research labs, and equipment stores), and which can add value to the tenant while hopefully reducing the likelihood of base relocation. Specifically, the project team identified opportunities such as off-season homeporting for potential future Coast Guard arctic patrol vessels and homeport services for potential future oceanographic research vessels. Both of these options are predicated upon future anticipated but uncertain developments (for example, expansion of Canada's Coast Guard arctic patrol fleet in response to extended and expanded Arctic navigational opportunities, and expansion of oceanographic research activity from Canadian bases).

The project team also notes that, while increasing berthage and homeporting of suitably sized vessels to Ogden Point is readily available, the revenue potential from this activity is limited. Not only is the current tariff of charges for berthage relatively modest for non-working berthage of vessels, the GVHA's current tariff exempts vessels owned by Her Majesty the Queen and foreign governments from berthage charges. Thus, berthage charges would be exempted for vessels owned by the Federal Government with the potential that other associated activities could generate additional revenues for GVHA. Clearly this perspective requires careful strategy regarding the attraction of government-owned vessels, and GVHA must carefully consider the potential to limit Ogden Point's ability to accommodate other trade.

Required Infrastructure

Ogden Point's present configuration and infrastructure is well suited to accommodate vessels with draft up to 9 m, length up to 300 m, and beam up to 30 m. This would cover the range of research, patrol, and support vessels. Larger vessels (such as the container fleet, larger tankers, and bulk carriers) typically exceed one or more of the maximum berth dimensions described above, so would not be candidates for temporary or off-season berthage.

Revenue Projected

Schedule II of the Ogden Point Terminal Tariff calls for non-working berthage charges of $0.07 metre-hour on coastal vessels. Foreign-going vessels pay at four times the coastal rate. For illustrative purposes, the project team estimates that 50 days of coastal vessel (120 m length overall) and 50 days of foreign-going vessel (240 m length overall) would generate an estimated $50,000 in non-working berthage revenue.

Impact on Other Land Uses

The berths at Ogden Point Terminal are well suited for additional homeport and other non-working uses by various vessels. On the assumption that shore-side support is not particularly consumptive of the available terminal area, additional berthage could likely be

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accommodated without compromising other terminal operations. The single very important exception to this is the cruise industry. Committing primary berths to non-working berthage customers during the cruise season would effectively limit the cruise industry's use of the terminal to two vessels simultaneously—a 33 percent reduction from current peak days with the resulting significant reduction in cruise revenue. Thus, GVHA must consider very carefully the implications of opportunities such as this that require year-round facilities. Conversely, GVHA should preferentially pursue potential berthage customers with a clear seasonal occupancy pattern that complements that of the cruise industry. These customers may warrant consideration of special incentives to encourage this occupancy.

Access Requirements and Neighbourhood Impacts

Because of the very broad range of vessel types that could make use of Ogden Point Terminal for non-working berthage, the project team was not able to accurately predict vessel and terminal access requirements or emissions. However, the project team concluded the following regarding their likely nature and relative magnitude:

- Vessels seeking non-working berthage at Ogden Point will doubtless be physically smaller and present dramatically smaller crew and passenger size than the current cruise vessel trade.
- The anticipated berthage activities will likely correspond to relatively infrequent vessel arrivals and departures, with much less frequent terminal access requirements than the present passenger cruise trade.
- Other impacts associated with non-working berthage should also be smaller in scale, though potentially similar in nature to those associated with the current passenger cruise operations. These would include air emissions associated with on-board power generation.

Discussion and Next Steps

Given the relatively low cost to GVHA of accommodating additional non-working berthage for vessels seeking to be based in the area during the winter months, GVHA may wish to conduct some market research to support potential business development in this area. However, the potential market is likely small and specialized at present, while offering only modest revenue potential; GVHA must gear their business development effort to recognize this reality. Over time, however, this situation may change providing further opportunities in this business. GVHA may wish to consider modifying their tariff to provide incentives to vessels with off-season berthage needs that could enable GVHA to continue to offer three berths to the cruise industry during the cruise season.

Comparable Facility

The project team could not identify a significant port facility in coastal BC focused on non-working berthage for commercial navigation as a primary business activity. Nonetheless, most ports accommodate this business to some extent, at least on a seasonal or opportunistic basis. This is particularly the case for legacy port terminals, which are underutilized due to seasonality or industrial decline. Ogden Point accommodates some of this traffic now, as do comparable facilities in Nanaimo and Port Metro Vancouver.

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Synopsis

Selective accommodation of suitable vessels for off-season, non-working berthage (particularly those looking for homeport operations base facilities) is a viable, though financially modest, option for developing incremental revenue for GVHA. It presents few if any requirements for additional infrastructure investment to berth vessels to support their homeport operations. Some of these berthage users may also see opportunity in developing complementary shore-based facilities on the proposed transitional sub-zones at Ogden Point. Unfortunately, the Federal Government owns many of the potential target vessels for this business, so are presently exempted from berthage charges by the GVHA tariff. Business development outreach to potential client agencies outside of the Federal Government may identify useful opportunities; GVHA may wish to consider the use of incentives in its tariff for long-term, seasonal berthage to encourage potential tenants.

6.6.5 Case Study 5: Liquid Bulk Products Terminal

Description

While bulk materials storage generally requires land-side transportation access and/or resource production in the port hinterland, GVHA could consider inbound liquid bulk products (such as refined petroleum products) as a possible future land use for the Ogden Point facility. By extension, and recognizing that the nature and form of energy storage and consumption may change significantly over the next few decades, GVHA may wish to consider the potential for storage and handling of inbound energy-related cargoes for domestic market consumption (for simplicity assumed to be in a liquid bulk form).

Background

With the exception of the Canadian Armed Forces Colwood Terminal, liquid bulk fuels for southern Vancouver Island are accommodated by the Chevron Hatch Point Terminal at Cobble Hill and the Shell Bare Point Terminal at Chemainus. Thus, demand for supplementary petroleum liquid bulk storage (or equal) postulates either significant growth in demand for liquid fuels in southern Vancouver Island or the introduction of new technology for energy storage with different storage and/or distribution needs. The former (demand growth) seems relatively unlikely given the present emphasis on energy conservation and increasing efficiency of energy use. The latter may be feasible, but suggests that this potential land use may be a very long-term development. In either event, the project team presents this potential land use to capture its implications for land-use planning purposes, recognizing that it does not appear to offer much short-term potential for implementation.

Required Infrastructure

Exhibit 6-6 illustrates the potential scale of this land-use option with a conceptual sketch of a potential liquid bulk storage facility (tank farm) for the Ogden Point site with capacity comparable to that provided at either the Hatch Point or Bare Point terminals. This is very much an "upper-limit" indication of potential land requirements for this facility; total land requirement is approximately 2 hectares. The location shown is somewhat arbitrary and the configuration, size, and location could readily be adjusted to suit the actual future development.

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The project team assumes that a petroleum storage and distribution facility of this nature would require the provision of coastal tanker accommodation at berth at Ogden Point. The specialized vessels in coastal shipments are small (5,000 dead weight tonnes [DWT]). These would require significant modifications to existing moorage equipment, including quick-release bollards, petroleum-handling equipment, and piping linking the berth to the upland storage facility.

The project team estimates that the cost of constructing a new petroleum storage facility, complete with containment, truck loadout facility, piping, site preparation, etc., could be as high as $10 million to $15 million, excluding any required modifications at the berth to receive fuel barge or tanker traffic.

Revenue Projected

To illustrate the projected revenue of a liquid bulk products terminal, the project team assumed an annual throughput of 200,000 tonnes delivered by 40 coastal tankers of 5,000 DWT size, and a 2-hectare (5-acre) site. The project team estimates revenue to GVHA of $600,000 per year for berthage, wharfage, and occupancy rent with these assumptions.

Impact on Other Land Uses

With a significant fixed footprint necessary for tankage and containment, the development of liquid bulk storage and distribution at Ogden Point would require a significant long-term commitment by GVHA. GVHA would need to carefully identify and delineate an appropriate site for this development relative to existing operations. Certainly, the land area required could not be accommodated with today's level of other site activities without significant rationalization of present site operations, particularly for the cruise industry. To that end, GVHA would need to undertake a careful planning process in light of prevailing future terminal activity to confirm the availability of a suitable site.

Access Requirements and Neighbourhood Impacts

Since the viability of a liquid bulk terminal is predicated upon prospective changes in the technology of liquid fuels and their distribution, the specific access requirements for a facility of this type are somewhat uncertain. Nonetheless, if liquid fuel distribution for this new regime is comparable to present energy distribution methods, the project team anticipates that distribution will require significant tanker truck access to the terminal on a daily basis. The volume of distribution truck traffic could in fact be higher than for comparable present facilities since emerging alternate energy technologies may feature lower energy density than that of current petroleum-based fuels. We anticipate that this traffic will be randomly distributed throughout the business day, and would pose limited incremental congestion to the present cruise vessel peak periods (on the presumption that the liquid bulk terminal operator would schedule distribution activities to avoid those periods).

Discussion and Next Steps

The need for a new liquid bulk/refined petroleum terminal at Ogden Point can only be postulated based upon very significant changes in the nature and distribution of liquid fuels. While possible, these changes are not likely to occur for a number of years, potentially decades. Thus, the project team recommends that GVHA merely monitor this market for

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significant developments and ensure that site zoning can accommodate this sort of facility in the future should it be needed.

Comparable Facility

The refined liquid bulk products distribution terminals at Hatch Point (Chevron) or Bare Point (Shell) are comparable facilities. Bare Point typically accommodates four types of oil products—diesel fuel, regular gasoline, premium gasoline, and jet fuel—and has a combined storage capacity of 35,000 m^3. Typical storage cycles at terminals vary depending on market size and consumption and could range from 1 or 2 days to 1 week.

Synopsis

GVHA could accommodate a liquid bulk storage and distribution facility, likely related to inbound transport of liquid fuels, in the long term at Ogden Point. The economic viability of this facility depends on potential emergent changes in the nature of liquid fuels and their distribution, and GVHA should consider this a long-term possibility, with relatively small likelihood under current economic and technological conditions. Thus, GVHA should consider this as a potential future land use without taking any active steps forward at this point in time.

6.6.6 Case Study 6: Module Assembly Facility (including Ship-Building Support)

Description

With Ogden Point's location on the waterfront, local industry engaged in heavy equipment or module fabrication and/or assembly could use the site for their activities. These major, customized projects are infrequent, but often require an assembly facility on deep water to permit loadout to the ultimate customer. Similarly, construction of heavy infrastructure (e.g., major bridges) could use a large, level, well-serviced site for superstructure staging, erection, and loadout.

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EXHIBIT 6-6
Liquid Bulk Products Terminal

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Background

The Victoria area's history of shipbuilding, specialized equipment fabrication and supply, combined with its proximity to a trained labour force and global shipping lanes supports a significant niche industry in the engineering, fabrication, and erection of specialized heavy equipment and/or equipment modules. Examples include shiploaders, specialized mineral processing equipment, and process modules for the oil and gas industry. These are typically manufactured for delivery elsewhere, and require access to marine heavy lift capability to allow loadout by water. While relatively infrequent, this is a recurring activity in the Greater Victoria area, which could conceivably grow in importance in the decades ahead. A similar and complementary activity is the laydown and/or erection area for large civil/ infrastructure projects in the Greater Victoria area (for example, a bridge project). GVHA's Ogden Point facility is well situated to host these sorts of activities.

Required Infrastructure

Ogden Point's open paved surfaces and medium-draft water depth provide a feasible site to host module assembly operations. Necessary support facilities, such as water and power supply, are either available onsite or can be readily made available.

Revenue Projected

Based on an industrial land value of $600,000, the project team estimates that this activity would generate net revenue of approximately $123,000/ha/year ($50,000/acre/year) to GVHA.

Impact on Other Land Uses

The precise extent of surface area needed varies for each project, and cannot be predicted with certainty. However, in general, GVHA could provide sites with areas of 2 to 3 hectares with some restructuring of internal circulation, particularly in the non-cruise season. During the cruise season, this type of activity would likely impact cruise operations (and/or other occupancies), though GVHA could potentially mitigate these through the rationalization of cruise terminal operational and transportation patterns.

Access Requirements and Neighbourhood Impacts

Users of a heavy equipment or module erection site would require access for delivery of erection equipment and some heavy components (very large components would be delivered by water) and for workforce access, as well as for delivery of supplies and consumables. Thus, the intensity and frequency of vehicular access is not unlike that for a small shipyard—daily arrival and departure of workforce together with frequent but randomly distributed deliveries of material, punctuated by infrequent deliveries of large loads (major components and/or erection equipment such as cranes). Other neighbourhood impacts could include air emissions from onsite generators, air compressors, or welding machines. Subject to applicable bylaws, the site could be used for multi-shift activity.

Discussion and Next Steps

Use of Ogden Point for module assembly may provide periodic opportunity for incremental occupancy revenue to GVHA with little if any investment in additional infrastructure.

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Furthermore, it would strengthen the role of GVHA as a centre of economic vitality and employment. Module assembly is an activity that can typically only be achieved where there is good access to tidewater—a key Ogden Point attribute. Should GVHA wish to pursue this commercial opportunity further, the project team recommends that market research be carried out to identify the size and structure of the market for this activity, as well as to seek opportunities to service particular segments of this market, which may at present be under-served and could thus provide opportunity for differentiation.

Comparable Facility

Some 25 years ago, module assembly facilities supported the development of oil and gas production on the Alaska North Slope. Example locations included Astoria, Oregon and Tacoma, Washington. BC Development Corporation attempted to start a module assembly yard at Duke Point, Nanaimo, but this development was not successful. Today, major users of this fabrication approach and typical customers for this activity include the shipbuilding industry, the oil and gas industry, and the materials handling industry.

Some aspects of this market are currently served by Point Hope Shipyards, while some major heavy equipment erection is reported to have occurred on the Sydney Airport site. In Greater Vancouver, this type of activity has occurred in Burrard Inlet North Shore terminals (Washington Marine and Allied) and on the Fraser River (Vito Shipyard). None of these facilities have built an intentional or sustained business around this activity, but all have benefited from improved revenue and economic activity associated with these activities on an opportunistic basis.

Synopsis

The module assembly business may provide periodic opportunities for suitable off-season use of Ogden Point lands, while generating added capability to the cluster of Greater Victoria businesses active in this sector. GVHA can likely accommodate these activities without significant investment, although there are a number of other sites that could compete for this business. Some basic market research could assist GVHA in identifying the size of the market for this service, key competitors, and the potential for product or service differentiation strategies that could serve to enhance Ogden Point's competitiveness in this service offering.

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7. Implementation Strategy

7.1 Rezoning

Although the timing or occurrence of the developments described earlier at Ogden Point cannot be predicted with certainty, the project team believes that the case studies presented in this report capture the salient features of potential future marine-related development at Ogden Point. The vitality of Ogden Point is essential to meeting GVHA's governance mandate and its continuing role as an economic engine in the community. To the extent that land use constraints limit or prevent the future developments identified in this report, they threaten GVHA's success and continued role in the community. Clearly the proposed rezoning (Phase 3) of Ogden Point needs to retain flexibility in the Marine-based Zone to host these and other related activities. This flexibility would likely need to include the ability to host the following types of facilities and activities:

- Cruise vessels as Canada's busiest port of call
- Buildings to store and repair boats, as well as host boat repair activities
- Fenced storage compound (ro-ro or similar terminal)
- Ro-ro facility ramp (structure heights may exceed conventional building heights)
- Short-term module assembly activities, which could include the erection of structures significantly in excess of typical neighbourhood building heights, together with associated activities (such as shift work, welding, materials deliveries, large equipment components delivery, and craneage)
- Tank farm

During Phase 3 of the Master Plan process, it will be important for the project team to develop a comprehensive land-use and zoning model that can accommodate these requirements.

7.2 Ogden Point Redevelopment

The case studies in Section 6 describe a range of potential future land-use options for Ogden Point Terminal. Because the objective of identifying and assessing these options was to define a potential range of future uses for this site to inform the rezoning application process, the project team selected the options on an inclusive basis—i.e., options were generally included unless a fatal flaw was identified, which in the opinion of the project team, rendered the accommodation of a future marine land use infeasible. Examples of these fatal flaws include water depth (draft) at the berth, available site size, intermodal transportation opportunities, and availability of export cargoes in the Southern Vancouver Island hinterland. Because of the inclusive nature of this process, the project team did not attempt to identify a preferred singular strategy upon which GVHA should focus going

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forward. In this section, we present a qualitative assessment of the present viability of the case studies included in Section 6, and make suggestions that will enable GVHA to transform the envelope of development options included in Section 6 into a possible development strategy to pursue over the coming years.

As discussed previously, the project team did not consider current economic viability as a factor for inclusion in the options generation process. However, as part of their Implementation Strategy (Phase 4) for future development, GVHA must consider this when selecting items for early implementation. In addition, GVHA should consider capital investment requirements and impacts on existing businesses.

Beyond selecting candidate projects for early implementation, GVHA can assess other case studies presented in Section 6 for the potential timeframe for viability and possible implementation. This is because the viability of various business opportunities changes over time as technology and global supply chain/distribution networks evolve in response to other developments. In considering the possible timeframe for potential development, consideration of a hierarchy of enabling factors can be instructive:

- **Terminal Rationalization/Capital Investment:** Some business opportunities identified in this report require further terminal infrastructure investment to create space that could be committed to new business opportunities. While relatively low cost, these investments will require time to develop and finance.
- **Technology Change:** Some business opportunities identified in Section 6 require technology change before they become viable. An example is the liquid bulk terminal case study, which likely cannot be viable without fundamental technology change for liquid fuels.
- **Market Change:** Many business opportunities require the optimal combination of market conditions and or the right proponent to be viable. An example is the coastal shipping transshipment hub port case study; while changes in coastal- and short-sea shipping practices have been discussed for a number of years, there presently does not seem to be commercial validation for a transshipment hub port in Victoria.
- **Social License:** Some new businesses contemplated for Ogden Point will entail significant changes to traffic patterns or other impacts to the citizens of Victoria. Although none of the case studies presented entail impacts on the same scale as present peak cruise days, some of them would result in changes in traffic patterns and other impacts. For example, a transshipment hub port, while primarily handling ro-ro traffic not originating in or destined for Victoria, would doubtless produce some limited volume of truck traffic entering and leaving. In addition to good design to mitigate impacts, development proposals with impacts of this type will require strong community communications and consultation programs to familiarize stakeholders with the benefits and impacts associated with hosting these activities.

Exhibit 7-1 summarizes the readiness, present economic viability, and anticipated development timeframe for each of the case studies presented in Section 6.

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EXHIBIT 7-1
Summary of Marine-based Land-use Case Studies

Case Study	Readiness Comments	Present Economic Viability	Anticipated Development Timeframe
Passenger Cruise	Strong	Strong	Present/short term
Boat Yard	Good: Incremental infrastructure required	Appears potentially viable; requires market research	Short- to medium term
Coastal Shipping	Significant capital infrastructure required; would limit passenger cruise volume	Unproven economic model	Medium- to long term
Liquid Bulk Terminal	Large capital investment required	Does not appear viable at present (requires market or technology change to enable)	Long term
Berthage	Strong (potential fendering upgrades required)	Appears viable, if somewhat opportunistic; revenue potential limited	Short- to medium term
Module Assembly Area	Good	May be viable; requires market research; market appears limited/infrequent	Short- to medium term

7.3 Timeline of Potential Development

Exhibit 7-2 provides a visual representation of the potential development process by stage for each of the case studies examined in this report. The three phases of project development are:

1. **Passive Business Development (BD):** developing background knowledge to verify, calibrate, and update the work of this report
2. **Active Business Development:** with confirmation of economic viability and potential timing, developing a business plan and identifying potential developers/partners
3. **Project Development:** procurement process to select a developer/partner and securing funding/financing; leading to construction/implementation (as applicable) and operations

The project team provides the information in Exhibit 7-2 as a guideline only for future activities; GVHA should undertake business development activities to continually update the validity of the business initiatives and timing indications shown. Those items that appear viable for short-term implementation are shaded. For the purposes of this presentation, short term is considered to be from the present date to 10 years from the time of writing, medium term from 10 to 25 years from the present, and long term beyond 25 years.

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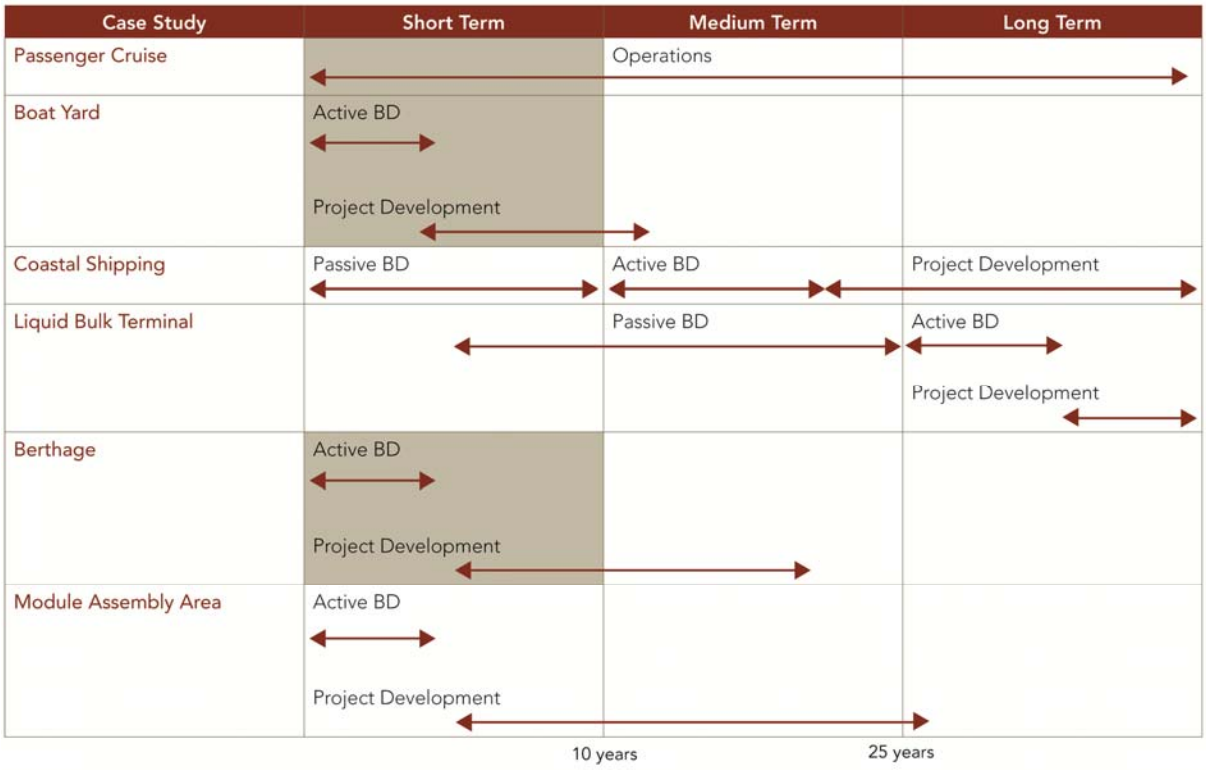
EXHIBIT 7-2
Potential Development Process for Marine-based Land-use Case Studies



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8. Site Access and Transportation Management

8.1 Transportation Management

GVHA has identified Transportation Management as a key success factor for day-to-day land-side operations and community interaction at Ogden Point. Stakeholders also identified Transportation Management as a main area to be addressed in future plans.

8.2 Current Access and Constraints

Ogden Point has two vehicular access points along Dallas Road (Exhibit 8-1). The south access is at the Dallas/Montreal intersection and the north access is located 250 m north. Given the diverse land uses at the site, a mix of vehicle types access Ogden Point, including passenger vehicles mainly associated with restaurant and seaport services, buses and taxis serving cruise ships, and trucks associated with light industrial and seaport uses.

The cruise season operation (May-Oct) generates the bulk of the traffic, transporting more than 500,000 people to various Victoria destinations via shuttle buses, shore excursion buses, taxes, limousines, pedicabs, and horse-drawn carriages. The required staging area to service the two cruise ship terminals on the site leave very little space for other activities and development during this high season. Therefore, the consolidation of the terminals, management of the staging area, and integration of the traffic with the adjacent neighbourhood is critical.

In order to address this issue proactively, GVHA has recently initiated the Ogden Point Cruise Transportation Strategy (OPCTS), which seeks solutions for efficient people movement to, from, and within Ogden Point. This initiative includes the Cruise Passenger Transport RFI. Details of this initiative can be found in Appendix F.

The first step of the OPCTS was the development of the cruise ship passenger RFI. The purpose of this RFI was to obtain information from suppliers for all or parts of potential solutions for the movement of cruise ship passengers from Ogden Point to downtown Victoria.

The information gathered from the RFI process, along with data gathered through other means (cruise ship passenger counts, cruise ship traffic volume count, cruise ship passenger survey, and cruise ship traffic noise measurements), will be used to develop the OPCTS.

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8.3 Transportation Management Principles for Future Development Considerations

In this section the project team provides a number of principles to guide discussions on transportation matters at Ogden Point. These principles have been categorized according to four main governing objectives—safety, efficiency, effectiveness, and equity.

8.3.1 Safety

Protecting users of the port from any hazardous situation at Ogden Point is paramount. As such, the project team suggests that future plans include the following safety principles:

- Clear safety regulations will provide guidance for vehicles to operate on the site roads in a safe manner.
- Traffic regulations should be clear for all users to understand and obey them.
- Parking regulations should clearly indicate parking and non-parking areas designated by GVHA or lessees.
- Queuing designated areas by GVHA or lessees should be clear.
- Onsite safety regulations should indicate the parties authorized to provide direction to users, such as GVHA, the City of Victoria, and the Royal Canadian Mounted Police.

8.3.2 Efficiency

Transportation Management should aim to achieve the greatest possible benefits for users and GVHA with the available resources. Efficiency principles include:

- Solutions to problems are to consider simple, inexpensive solutions first.
- Problem severity defines the priority of implementation solutions.
- Change in land use or new uses should not create new problems.
- Implementation of solutions will be packaged/grouped if cost savings could be achieved.

8.3.3 Effectiveness

Transportation Management should address problems effectively while minimizing or mitigating related secondary impacts. Effectiveness principles include:

- Problems are to be confirmed and justified objectively.
- Transportation conditions at site are to be monitored on an ongoing, regular basis through data collection, observation, and analysis.
- Risk assessment of potential issues from operational, infrastructure, or land-use changes based on demand forecasting and scenario analysis is key for effectively addressing these problems.

Proper communication channels should be in place for users and the community to raise concerns with site utilization.

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8.3.4 Equity

Transportation Management should ensure the equitable and consistent treatment of Ogden Point users, and mitigate impacts on the surrounding users. The participation of users and the community to address traffic challenges will help build a consensus around the ultimate solution and helps to ensure long-term success of initiatives. Equity principles include:

- Review of community initiatives to ensure conformity with approval, prioritization, and City requirements of Traffic Management initiatives.
- Ogden Point's facilities should consider the diversity of motorized and non-motorized site users through proper regulation of internal walkways and streets.
- Transportation Management initiatives should consider the access needs of business patrons, tenants, neighbourhood residents, employees, and visitors.
- Traffic management initiatives affecting surrounding areas will provide opportunities for community participation and partnerships.

These principles need to be incorporated throughout the master planning process while developing a flexible traffic plan to support the future development of Ogden Point.

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EXHIBIT 8-1
Ogden Point Access Layout

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9. Mitigation of Current Impacts

The Ogden Point terminal creates tension between the modern industrial activities associated with the current marine-based waterfront activity and the legitimate desire of residential property owners to quiet enjoyment of their homes. This land-use conflict, resulting from the gentrification of waterfronts across North America, has been an increasingly important theme for major port developments over the past two to three decades (reference: http://www.worldcargonews.com/htm/w20110302.587723.htm). Although present peak activity at Ogden Point is restricted to the cruise season, during the affected periods there are significant impacts to nearby residents. Future growth in the cruise business, as well as the development of new business lines at Ogden Point, has the potential to exacerbate these impacts.

Every development project imparts change to the community and the precinct within which it is located. These changes can be both positive and negative, and often the same changes are viewed very differently by the various stakeholders. The economic impact of Ogden Point, particularly the cruise operations, is clearly a significant benefit to Victoria residents. Nonetheless, James Bay residents have expressed concerns regarding traffic congestion and air emissions during cruise calls. Successful development at Ogden Point will be possible through sustained effort by all parties to balance competing interests in an effort to capture the community benefits, while mitigating unavoidable impacts.

Section 6 describes the range of potential development plans under consideration by GVHA. GVHA, the City, and interested stakeholder groups need to continue working together to identify issues associated with potential for short-term realization will yield the best returns to all involved; focusing on the potential impacts of future development options that may never be realized will not be in the interests of GVHA or its neighbours.

Existing Ogden Point operations (particularly cruise operations) have a number of impacts on the surrounding residents. This has been the subject of significant work to date by GVHA and stakeholders. From the work carried out on the Master Plan to date, it is apparent that these impacts will be significant as GVHA continues to develop Ogden Point in keeping with its mandate. For many of these issues, technology can offer relief, although it brings its own costs and impacts. In developing solutions to these challenges, collaboration between GVHA, its neighbours, and other agencies will be essential. Therefore, it is important to remain focused on supporting long-term partnerships to achieve success

The following section provides an overview of three of the current major issues of concern expressed by local stakeholders with respect to existing Ogden Point operations. For each, some insights into options for impact mitigation are offered:

- **Cruise Transportation Traffic Impacts:** Ogden Point internal traffic circulation functions as an extension of the surrounding James Bay road network, particularly during cruise vessel calls. As a result, the impact of the traffic originating from and destined for the terminal is felt throughout the James Bay neighbourhood. Addressing the off-site traffic and transportation challenges will require an integrated approach with

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GVHA and the City working together to develop effective and integrated solutions. Even though GVHA has been making incremental improvements to traffic circulation within Ogden Point during cruise ship calls, these cannot in isolation significantly address the congestion observed on nearby streets. The main concerns identified by the residents have been in relation to noise and volume of traffic traveling through the community. Because peak cruise days are relatively infrequent when considered on an annual basis, addressing traffic congestion at Ogden Point will likely require a combination of operational and capital infrastructure elements. Developing a detailed plan is beyond the scope of this assignment, but initial observations by the project team suggest that it should consider:

- Modal separation for departing and arriving traffic: If an alternative route was provided for non-motorized traffic (bicycle rickshaws and horse-drawn vehicles), the operating speed of motorized vehicles would increase somewhat, reducing travel times, congestion, and vehicle emissions. This could be achieved through changes to the existing designated corridor(s), or by routing, for example, non-motorized traffic along one of the streets currently off-limits to cruise terminal traffic.
- Channelization of traffic within the terminal: In concert with modal separation, continuing GVHA's recent moves to improve traffic channelization within the terminal will further reduce traffic turbulence and congestion. The effectiveness of this strategy will be constrained by the ability to achieve capacity and/or modal separation strategies for the municipal streets serving the terminal.
- Further structuring of cruise passenger movements for customs and ground transportation pickup areas: As part of the overall terminal traffic channelization strategy, the use of structured and facilitated facilities for pedestrian movements will reduce turbulence and enhance general traffic operations. This could include measures such as enhanced signage, moving sidewalks, and expanded and enhanced terminal facilities.
- In the context of the case studies examined for this, all of the future land uses considered are anticipated to produce less peak traffic volumes than those currently realized for a peak cruise vessel day. In general terms, therefore, overall traffic concerns will be effectively addressed by resolving the traffic issues associated with cruise port of call operations.

- **Air Emissions:** Air quality is influenced by a number of additional factors, including but not limited to vehicle congestion, vehicle fleet composition, and weather conditions. Various options are available for addressing air emissions concerns, but they will each have differing capital costs and effectiveness. In general, because of the relatively short and intermittent nature of the cruise business, capital-intensive solutions (for example, shore power) may be less cost-effective than operations-based solutions. In general, it is likely that careful air quality monitoring and operations planning, possibly combined with clean fuel requirements for vessels in port, will be the most cost-effective means of mitigating air emissions associated with power generation for berthed vessels. GVHA has retained consultants to conduct a feasibility study for the possibility of installing a shore power system at Ogden Point. This system allows cruise vessels to connect to the domestic power grid using special transformers and connecting cables instead of

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burning fuel while at berth. This option could prove particularly attractive if GVHA is successful in developing any of the renewable energy options outlined in the recent *Renewable Power Generation Conceptual Plan for Ogden Point* (Jordan Fisher & Associates, May 12, 2011) commissioned by GVHA (Appendix I).

- **Light Emissions:** GVHA will need to provide night lighting at the Ogden Point Terminal to facilitate operations for a number of the land uses described in the case studies in Section 6. Presently, site lighting is required only for peak cruise vessel days, so the potential for light emission concerns is restricted to the latter months of the cruise season (when days are shorter). While light emissions can create concerns for surrounding residents, good lighting design, together with a well-developed operating regime, can mitigate these effects. GVHA may wish to consider working with tenants and stakeholders to establish Design Guidelines for terminal lighting, which could include such elements as lighting design levels, use of hooded fixtures, use of subarea lighting, and bi-level designs with lower-level security lighting.

Design Guidelines are a critical component of a City rezoning application. As the vision of Ogden Point matures in Phase 3 of the master planning process, these design guidelines may be expanded to ensure mitigation of future impacts.

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10. Conclusions and Recommendations

GVHA's Ogden Point facility is critical to Victoria's continued role as a regional port. To guide GVHA's business strategy and to inform their site rezoning application, the project team applied a systematic approach to identify potential site sub-zoning and corresponding land use. Within the marine-based sub-zone, the project team carried out a case-study analysis of potential future marine-based business activities, and developed a proposed time scale for potential project development. The team also suggested approaches to site transportation management strategy development and mitigation of project impacts.

In the context of GVHA's two objectives for this work, it is important to recall that this document is the first part of the overall project Master Plan, and is primarily intended to feed the Phase 3 of the work from the perspective of future economic activity and related development in the Marine-Based Sub-Zone. In Phase 3, the project team will draft Design Guidelines to shape the built form of future development at Ogden Point and serve as the basis of a site rezoning application.

The project team proposed a site land-use scheme, based upon extensive consultation with stakeholders, which includes the following sub-zones:

- Flexible Marine-based Zone
- Enhanced Semi-public Marine Zone
- Helicopter/Air Transport & Flexible Marine Zone
- Transitional Mixed-use Zone
- Semi-public Community-oriented Zone

In keeping with the mandate of the GVHA and the role of this Part A document, the focus of this document was on land-use and development opportunities in the Flexible Marine-Based Zone. The project team identified a short list of six case studies for potential business activity in this zone, as follows:

1. Passenger Cruise Vessel Port of Call/Niche Homeport
2. Boat Yard/Boat Storage and Yacht Transfer
3. Coastal Shipping/Ro-Ro Cargoes/Vehicle Ferry
4. Berthage (including Cable Ships Berthage and Storage) and Marine Technology Research and Development Vessels and Support Facilities
5. Liquid Bulk Products Terminal
6. Module Assembly Facility (including Ship-Building Support)

The project team characterized these opportunities in terms of their capital cost, potential revenue, land use implications, transportation access requirements, and outlook for future development. The range of timeframes corresponding to these case studies is broad, ranging from the present passenger cruise activity through to the very long-term potential for a

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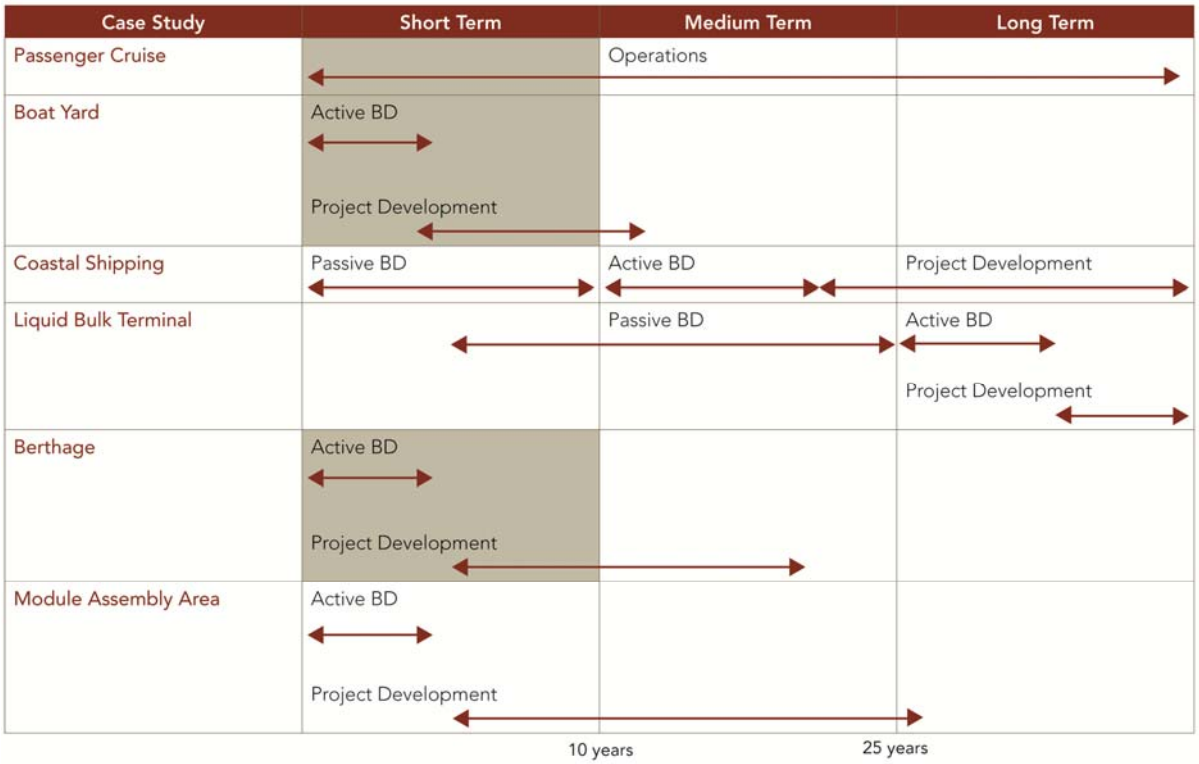
liquid bulk products terminal. In between, a range of other opportunities offer potential for business development for GVHA, with significant uncertainty as to timing of their feasibility. The potential range of timeframes for realization of these opportunities is described in Exhibit 10-1.

EXHIBIT 10-1
Potential Development Process for Marine-based Land-use Case Studies



For planning purposes, short term is considered to be from the present date to 10 years from the time of writing, medium term from 10 to 25 years from the present, and long term beyond 25 years.

The vitality of Ogden Point is essential to meeting GVHA's governance mandate and their continued role as an economic engine in the community. The proposed rezoning of Ogden Point needs to retain flexibility in the Marine-Based Zone to host these and other related activities. This flexibility would likely need to include the ability to host the following types of facilities and activities:

- Cruise vessels as Canada's largest West Coast port of call
- Buildings to store and repair boats, as well as host boat repair activities
- Fenced storage compound (ro-ro or similar terminal)
- Ro-ro facility ramp (structure heights may exceed conventional building heights)
- Short-term module assembly activities, which could include the erection of structures significantly in excess of typical neighbourhood building heights, together with

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associated activities (e.g., shift work, welding, materials deliveries, large equipment components delivery, craneage, etc.)

- Tank farm

The future development of Ogden Point will also need to consider the transportation implications of specific proposed land uses. The case studies considered each have implications for the existing surface transportation regime within the terminal and for the adjacent street network. Although these implications vary widely, none of the case studies analyzed pose a traffic impact that approaches one generated by the present cruise passenger business. The project team anticipates that significant resources will be required to manage this interface in the future. It should be noted that of all the case studies considered for this assessment, the Passenger Cruise Terminal function—essentially the present land use—generates the highest level of traffic, with other potential activities generally generating lower and more randomly distributed traffic impacts to the local street network.

The mitigation of environmental impacts associated with infrastructure projects is now firmly established as an integral part of capital project development. Section 9 presents an overview of a potential approach to mitigating impacts to the environment, which may result from implementation of one or more of the development case studies described in this report.

Taken together, the findings of this document provide a basis for future strategic development and planning by GVHA for the Ogden Point facility. This includes developing an appropriate rezoning application to facilitate anticipated development, as well as a progressive program of strategic business development to capture new business for GVHA.

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APPENDIX A

SUMMARY OF PUBLIC SURVEY RESPONSES

Ogden Point Master Plan: Tabulation of Issues derived from Informal Public Survey & Stakeholder Committee Workshop #1

Compiled by Merrick Architecture January 8, 2010; Issued to Stakeholder's Committee Workshop for Discussion January 12, 2010

Topic of Interest/Concern	Number of Times Referenced within 89 Survey Responses							Comments / Notes	Topic-Relevant Stakeholder Input January 12, 2010 Workshop #1
	5 or less	5 to 10	10 to 15	15 to 20	20 to 25	25 to 30	30 plus		
Beautification of Site Make the site a destination and a nicely landscaped 'people place' as an 'iconic' gateway to the City; Attractive well-designed 'curb appeal' for visitors and residents alike.							*	Large majority (at least 75%) of respondents express a desire for beautification or some manner of site enhancement, and/or noted the site is very under-utilized. Many requests for increased landscaping.	~public access through site ~pedestrian link to downtown
Maintain & Enhance a Working Port Create solutions that maintain appropriate existing uses while creating improvements that will balance economic return with respect for the environment and the mental and physical health of an integrated community.						*		General support of existing port activities from those that even acknowledge them (which many respondents do not). A few responses (less than 5) stated there should be nothing done that would reduce Heavy Marine opportunities. Many suggest seeking balance offered by a live/work/play model while maintaining port activities.	~public viewing of site acitivities, but public access must not hinder industrial activity ~uses recommended include cruise industry support, marine recreation industries, small ship repair and support services, transportation hub, offices, artisans sudios, education facitilities, parkade and cafes ~incorporate water lot
Sustainable Solutions Whatever is done, it must respond to 'Green Design' criteria to demonstrate responsible stewardship of the site, the environment and the community as a whole.						*		A major and consistently expressed 'hot button' issue. Implication that any form of development must incorporate sustainability initiatives.	~redevelopment should have a 'green technology' focus
Responsible Cruise Ship Management The future requirments/projections of the Cruise Ship industry should be reviewed comprehensively, to guide overall planning and development, especially the provision of all manner of cruise ship servicing needs.					*			Outright opposition to the Cruise Ship industry not directly expressed, but many comments request better resource stewardship and environmental respect from the cruise ship industry. Several responses recommend developing on-site cruise ship infrastructure services, such as wind power, on-shore power (10 responses) and sewage handling.	~cruise industry facilities to address vessel, terminal, passenger, crew and security needs
Transportation and Traffic Develop an effective traffic management framework/plan to address ALL offsite traffic concerns, of which there are many.					*			Noted that some suggested ideas conflict with local community desire to reduce traffic. One response recomends increased site development/ improvements, yet also requests complete elimination of non-resident traffic in James Bay. Wide range of traffic/transportation concerns referenced.	~notion of transportation consolidation, to consider bus, helijet, float plane, Coho, Clipper, other options ~possible decking to address transportation management?

Topic of Interest/Concern	Number of Times Referenced within 89 Survey Responses							Comments / Notes	Topic-Relevant Stakeholder Input January 11, 2009 Workshop
	5 or less	5 to 10	10 to 15	15 to 20	20 to 25	25 to 30	30 plus		
Improve/Strengthen GVHA Relationship with Community The GVHA should use the Master Plan as an opportunity to enhance their reputation by demonstrating responsible community leadership.				*				Concern that the process must be transparent and that the GVHA needs to respect the needs and concerns of the surrounding community. A few comments expressed mistrust of the GVHA.	
Noise Abatement Look at ways to reduce or mitigate noise both on and off-site.			*					Very few references were made to on-site noise (helijets), but many references to traffic noises off-site, especially from buses.	
Air Pollution Abatement Look at ways to reduce emissions from all sources on and off site.			*					Concerns about all sources of air pollution noted, but strong references to air pollution caused by cruise ships and buses, with many suggestions for land-based power for the ships and consistent demands for low-emission buses and other road vehicles.	
No Housing or Hotels!	*							Suggestion from the few that raised this is that housing will compromise or isn't able to co-exist with marine uses.	~GVHA Board does not wish to consider any residential use on the site ~some stakeholders suggest/recommend consideration of responsible/appropriate residential use along eastern/Dallas Road edge ~added residential density may support other uses? ~residential along Dallas could improve urban design and provide buffer? ~convention centre/hotel as potential uses?
Acknowledge First Nations	*							A few respondents noted potential compensation for displacement of First Nations, but comments suggest shared interest in financial opportunities. Significantly more interest to acknowledge First Nations is evident in Ideas for Site, versus it being expressed as an issue of concern.	
Other	*							Singular concerns (one comment only) may be reviewed directly in the survey comments compiled by the GVHA.	~several recommendations to explore marine education, high tech marine research/development and other potential academic alliance possibilities ~solutions for site should integrate with harbour-wide planning, beyond GVHA properties

APPENDIX B

ENVIRONMENTAL REVIEW

Appendix B – Errata Sheet

Ogden Point Environmental Review

Page 2: Section "Stage 1 Preliminary Site Investigation" – 3rd Para. commencing "Pier B" needs to be re-ordered chronologically due to the following corrections

- End of Line 8: "Pier A was raised and a concrete warehouse built in 1978."
- End of Line 9: "Passenger ferry service to the piers started in 1995." This statement should be added in line 7 after "In 1995, Pier B was lowered and repaved."
- Line 10 needs to delete "and more recently," and should read "The property has operated as a cruise terminal since 1968."

Page 2: Last Para.:

- 4th Line: Spelling correction: "Juan de Fuca Strait".
- 5th Line: Spelling correction: "Helijet".
- 6th Line: "Westcan" should be changed to "Western Office Building".

Page 7: Section "Conclusion" – 2nd Para. – 2nd Line: This sentence indicates there is a "Figure 1" in error, there is no longer a Figure 1 in this section.

Ogden Point Environmental Review

TO: Robert Cheng

FROM: Meggen Janes, CH2M HILL

DATE: March 1, 2010

PROJECT NUMBER: 396153

Ogden Point is located at the southwest end of James Bay, and serves as a marine port for cruise ships and other large vessels, marine related businesses and a heliport. It is in an industrial area of Victoria Outer Harbour and for the purposes of this review, includes a waterlot and breakwater, two piers (Piers A and B) and the upland portion bounded on the east by Dallas Road. The property was defined as (UMA Engineering Ltd., 2006a):

1) Uplands – PID #017-797-438 referred to as "That part of Section 31, Beckley Farm, Victoria District, Plan 4 shown coloured red on Plan 799 O.S. Except parts in plans 1845R, 26729 and VIP 73680"

2) Water-lot – PID #025-434-047 referred to as "Lot A of part of the bed of Victoria Harbour, Victoria District, Plan VIP73883"

The following documents were reviewed to gain a general understanding of the environmental conditions of the property:

1. External Review of Reports for Ogden Point, Victoria, BC, (Site 5432), Ministry of the Environment, July 7, 2008.

2. Ogden Point Certificate of Compliance (CoC), Deficiency Fulfillment: Preliminary Site Investigation, Addendum Report for Lot 1 and Water Lot, UMA Engineering Ltd., October 2006.

3. Ogden Point Certificate of Compliance (CoC), Deficiency Fulfillment: Detailed Site Investigation, Lot 1 and Water Lot, Dallas Road, Victoria, BC, UMA Engineering Ltd., November 2006.

4. Updates to the UMA (2006) Detailed Site Investigation Addendum report for Ogden Point Public Port Facility, Victoria, British Columbia, UMA Engineering Ltd., May 30, 2007.

5. Ogden Point Certificate of Compliance (CoC), Deficiency Fulfillment: Ecological and Human Health Risk Assessment/Risk Management Addendum Report for Lot 1 and Water Lot, UMA Engineering Ltd., June 2007.

Many of the aforementioned reports reference earlier environmental reports which were unavailable for review at this time. Other documents such as aerial photographs and photographs were reviewed to provide site context and usage information. The environmental condition of the property is presented through summary of the Stage I

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Preliminary Site Investigation, Stage II Preliminary Site Investigation/Detailed Site Investigation, Remediation and Ecological and Human Health Risk Assessment/Risk Management.

Stage 1 Preliminary Site Investigation:

Two Stage I PSIs have been completed on the property; the most recent in October 2006 as a Deficiency Fulfillment to satisfy the Ministry of the Environment (MoE's) external reviewer comments in 2005. A Stage I PSI is an initial environmental evaluation of a property to determine potential and actual environmental concerns based on historical and current site usage and adjacent site usage. The following reports were available for review:

1. External Review of Reports for Ogden Point, Victoria, BC, (Site 5432), Ministry of the Environment, July 7, 2008.
2. Ogden Point Certificate of Compliance (CoC), Deficiency Fulfillment: Preliminary Site Investigation, Addendum Report for Lot 1 and Water Lot, UMA Engineering Ltd., October 2006.
3. History of Ogden Point, Gerry Lutz, President, Ogden Point Enhancement Society, date unknown.

The majority of the property was built and leveled from 1913 to 1916. The breakwater was completed with granite and rock from Hardy Island and concrete. The two piers and portions of the upland area included fifty three concrete caissons and over on million cubic yards of dredged sediment from Victoria Inner Harbour. Additional infilling occurred in the 1970s/1980s with the filling of the Camel Point foreshore with inorganic material from City of Victoria utility construction.

Pier B was used as a grain terminal until 1978 when the last grain elevator was dismantled. Pier A was deployed as a CN railway freight shed, a CN railway freight slip projected north from Pier B and several rail lines were present across the Uplands area connecting to the Piers and the freight slip. The freight shed burnt down in 1977, CNR discontinued rail service to Ogden Point and removed the remaining rail tracks in 1987 and the rail barge ramp in 1994. Lumber shipments were also received at Ogden Point until 1984. A fish cold storage plant operated from 1925 to 1990 in a five-storey concrete building on the Uplands portion which was later dismantled in 1993. In 1995, Pier B was lowered and repaved. Pier A was raised and a concrete warehouse built. Passenger ferry service to the Piers started in 1985 and more recently, the property has operated as a cruise terminal. Historical environmental concerns are related to historical operations, infilling practices, bulk storage, treated wood storage, wood treatment and petroleum storage.

Currently the uplands area is paved and generally flat topography. There are some unpaved areas around the heliport terminal (noise abatement soil berm) and along the south shore of the site. To the east of the site beyond Dallas Road is residential, to the north is industrial, to the south is Juan de Fuca Straight and to the west is Victoria Harbour. The following facilities are present on the property: helijet area, Mercury Marine area, Trotac Marine area, James Bay Anglers area, horse drawn carriage area, Westcan Office Building, Ogden Point

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Café area, Pacific Pilotage area, Warehouse, Passenger Terminal, Crew/Lounge License area and various parking lots.

A site visit was completed by UMA Engineering Ltd. in February 2006 and the significant findings included:

- Poor housekeeping, oil staining at 89 Dallas Road (Mercury Service Station)
- On-site helicopter refueling using pump and underground storage tank at 79 Dallas Road (Pacific Heliport Ltd.)
- Underground storage tanks and aboveground storage tanks at 189 Dallas Road (Westcan Terminals Ltd.)
- Workshop with lube and oil products for servicing small repairs at 189 Dallas Road (Pacific Pilotage Authority Canada Workshop)

The Stage 1 deficiency report (UMA, 2006) concluded that "the site has been potentially contaminated by industrial activities that have been ongoing since the early 1900s. Activities related to marine and rail transportation, wood treatment, lumber storage, petroleum products storage and refueling/maintenance of vehicles, ships, rail cars and industrial machinery have all occurred on the site through the years. Substance left behind from these operations may include a variety of petroleum hydrocarbons, chlorinated phenols, heavy metals, PAHs and PCBs."

Upon review of the Stage 1 PSI Deficiency report the MoE reviewer, SLR (MoE, 2008), concluded that the deficiencies had been filled.

Stage II Preliminary Site Investigation/Detailed Site Investigation

To evaluate the potential or actual environmental concerns identified in the Stage I PSI, a Stage II PSI/DSI is completed to conduct sampling and analytical testing of site samples for determination of level of contamination. Four site investigations have been completed on the Ogden Point property since 1997. This section presents an overview of the findings based on a review of the following reports:

1. Ogden Point Certificate of Compliance (CoC), Deficiency Fulfillment: Detailed Site Investigation, Lot 1 and Water Lot, Dallas Road, Victoria, BC, UMA Engineering Ltd., November 2006.
2. Updates to the UMA (2006) Detailed Site Investigation Addendum report for Ogden, Point Public Port Facility, Victoria, British Columbia, UMA Engineering Ltd., May 30, 2007.
3. External Review of Reports for Ogden Point, Victoria, BC, (Site 5432), Ministry of the Environment, July 7, 2008.

UMA reviewed and compiled all data from previous reports and screened the results against current 2006 BC Contaminated Sites Regulation (CSR) standards. The findings of the various investigations are summarized as follows:

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A) Soil contaminants of concern are present in three general areas of the property: northern portion (James Bay Anglers Boat Launch) in both shallow (up to 1.2 m bgs) and deep (greater than 1.2 m bgs) soil; north-central portion (Ogden Point Public Port Facility) of the property in both shallow and deep soil; and southeastern portion (South Shore Greenway) of the property in both shallow and deep soil. The general area of contamination is approximately 75 m by 40 m; 25 m by 25 m and 25 m by 25 m, respectively. The soil contamination is believe to be associated with the historical use of poor quality fill.

   a. Copper and lead concentrations exceeding 5 to 10 times and over 10 times, respectively, the CSR standards in fill associated with the northern portion of the property in both shallow (to 1.2 m bgs) and deeper (greater than 1.2 m bgs) depths.

   b. Cadmium concentrations exceeding 2 to 5 times the CSR standards associated with the northern portion of the property in deeper (greater than 1.2 m bgs) soil and in soil on the southeastern part of the Uplands Area.

   c. Chromium concentrations exceeding 2 to 5 times the CSR standards associated with the northern portion of the property in deeper (greater than 1.2 m bgs) soil, in deeper soil on the southeastern part of the Uplands Area and in shallow soil in the north-central part of the Uplands Area.

   d. Zinc concentrations exceeding over 10 times the CSR standards associated with the northern portion of the property in deeper (greater than 1.2 m bgs) soil, in deeper soil on the southeastern part of the Uplands Area and in shallow and deeper soil in the north-central part of the Uplands Area.

   e. Arsenic concentrations exceeding up to 5 to 10 times the CSR standards associated with the northern portion of the property in both shallow (up to 1.2 m bgs) and deeper (greater than 1.2 m bgs) soil and in shallow soil on the northcentral part of the Uplands Area.

B) In addition to the soil contamination noted above, the MoE review (2008) concluded that sodium exceeded the Vancouver Island regional background value in the northeastern portion of the property (just south of the James Bay Anglers Boat Launch). The reviewers also noted that at two locations the polybrominated biphenyls concentrations in soil exceeded the CSR standard in the northeastern portion of the property (James Bay Anglers Boat Launch area)

C) Groundwater concentrations exceed the CSR standards for arsenic, cadmium, zinc, benzo(a)pyrene or pyrene at five locations across the property. UMA/AECOM (2006) assessed the groundwater concentrations against BC Technical Guidance 2: Statistical Criteria for Evaluating a Volume of Material and concluded that cadmium and zinc were the only statistically relevant exceedances. The MoE external reviewer has commented (MoE, 2008) that the rationale for use of BC Technical Guidance 2 has not been demonstrated. Furthermore, the MoE does not accept the application of Technical Guidance 2 to groundwater except in specific circumstances.

D) Several sediment surface samples exceeded the CSR sediment standards for lead, PCBs and several individual PAHs. Of note, surface sediment samples collected from one

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location between Piers A and the breakwater, were found to exceed CSR sediment standards for several PAHs and PCBs at varying depth intervals. Another area on the east side of the waterlot between Piers A and B, also had numerous exceedances of the CSR sediment standards in surface sediment and the core sample (sediment core Ogden-1) had several PAHs and PCBs at varying depth intervals exceeding the CSR sediment standards.

E) None of the surface water samples submitted exceeded provincial standards or guidelines.

Upon review of the Stage 2 DSI Deficiency report the MoE reviewer, SLR (MoE, 2008), concluded that many deficiencies had been filled however some remained. Most notably, the MoE reviewer identified discrepancies in concentrations in tables; identification of contaminants of concern; sediment figure presentation; use of CSR sediment standards for typical sites despite potential presence of eelgrass beds which require use of sensitive site standards; and use of BC Technical Guidance 2.

Remediation

Several remedial excavations have been completed in the past on the property. The following document was reviewed to gain a general understanding of the remedial efforts:

1. Ogden Point Certificate of Compliance (CoC), Deficiency Fulfillment: Ecological and Human Health Risk Assessment/Risk Management Addendum Report for Lot 1 and Water Lot, UMA Engineering Ltd., June 2007.

Remediation activities have been directed at removal of underground storage tanks (USTs) and above ground storage tanks (ASTs) and excavation and removal of metal impacted soil. Ten USTs and four ASTs have been reportedly removed and one UST has been either removed or abandoned. Limited documentation was available on the removal activities but the following has been ascertained:

1) Two USTs (one diesel and one furnace oil) were removed from Pier B by Stevens Management in 1994. No details on the removal were available for review however subsequent soil and groundwater testing was completed in the vicinity and confirmed that the USTs did not impact soil or groundwater at levels of concern.

2) Two USTs were removed in 1998 east of Pier A along southern shore and overseen by CP/WTI. The wall, floor and fuel line confirmatory soil samples had concentrations meeting the CSR standards for hydrocarbons and metals with the exception of one sample with a zinc concentration greater than the standard.

3) One UST was removed in 1998 in the Westcan area by CP/WTI. The concentrations of organic compounds in soil samples did not exceed the regulatory standards with the exception of Heavy Extractable Petroleum Hydrocarbons (HEPH) and zinc in the initial floor sample after the removal of a UST. Additional soil was excavated and the confirmatory soil sample satisfied the regulatory standards for organic compounds. No additional metal analysis was completed.

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4) The presence of two additional USTs was evaluated by CP/WTI in 1998 using testpits but neither UST was found. CP/WTI concluded that the USTs had been removed.

5) Three ASTs and two USTs were reportedly removed by CP/WTI in 2000. No details on the removal were available for review.

6) One ASTs was reportedly removed by Morrow in 2002 and one USTs was reportedly removed by Morrow in 2000. No details on the removal were available for review.

7) In the Ogden Point Public Port Facility (north-central portion of the uplands area), concentrations of metals in fill soils exceeded regulatory standards for arsenic, antimony, chromium, copper and zinc in several samples. In 2002, Morrow Environmental Consultants excavated 47 m3 of soil and disposes of the material off-site. Confirmatory samples and step-out borehole sample analytical results indicate that metal concentrations in exceedance of standards remain in the area.

Ecological and Human Health Risk Assessment/Risk Management

Contaminants of Concern at Ogden Point that had concentrations in excess of CSR Standards were addressed using a risk-based approach. The following documents were reviewed to gain a general understanding of the EHHRA completed for the property:

1. External Review of Reports for Ogden Point, Victoria, BC, (Site 5432), Ministry of the Environment, July 7, 2008.

2. Ogden Point Certificate of Compliance (CoC), Deficiency Fulfillment: **Ecological and Human Health Risk Assessment/Risk Management Addendum Report for** Lot 1 and Water Lot, UMA Engineering Ltd., June 2007.

The Deficiency Fulfillment report (UMA, 2007) was prepared to address deficiencies in KeyStone Environmental's EHHRA (Keystone, 2002) identified by the MoE External Reviewer in 2005.

Risks were evaluated for a variety of human receptors including: recreational users, construction, maintenance and utility workers. Specifically for the boat ramp, human receptors included: James Bay Anglers Association members, adult and child recreational users, construction and utility workers. Risks were also evaluated for terrestrial and aquatic ecological receptors. A risk assessment is a scientific process of conducting contaminant pathway analysis to determine qualitatively or quantitatively the contaminant uptake by the receptors. The contaminant uptake is evaluated and the potential risk to the receptor is calculated. A risk exposure is considered minimal or negligible if the estimated potential is less than 1 in 100000 incremental lifetime cancer risks and a risk quotient less than 1.0.

The EHHRA (UMA, 2007) provided the following conclusions: "Based on the results of the human health risk assessment, no contaminant-related hazards have been identified in the uplands of the Ogden Point Site." Risks from human receptor exposures to lead in soil were calculated to be acceptably low. Non-cancer risks to adults or children from seafood

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consumption were also estimated to be acceptably low. Unacceptable cancer risk was possible if a person consumed one meal of mussels, crab or shrimp per week from waterlot over a lifetime. However UMA concluded that the consumption of one meal from the water lot per week is highly unlikely and therefore concluded to be acceptably low. Similarly, in the ecological risk assessment, all ecological risks were concluded to be minimal to negligible.

As a result of the risk assessment, no additional risk management requirements were identified for the terrestrial area and no additional risk management requirements were identified for the aquatic areas of the property.

Upon review of the EHHRA Deficiency report the MoE reviewer, SLR (MoE, 2008), concluded that many deficiencies had been filled however some remained. Most notably, the MoE reviewer indicated that risks to commercial workers needed to be addressed, exposure due to dermal contact and inhalation need to be addressed or exclusion supported, arsenic and potentially other groundwater contaminants need to be evaluated in the risk assessment, risks need to be modeled for consumption of fish, and sediment toxicity tested is necessary. The MoE External Reviewer was satisfied with the UMA conclusion on conservatism in ingestion of waterlot seafood however noted that the uncertainty discussion in the EHHRA should present alternate less conservative calculations.

Conclusion

The property contains soil, groundwater and sediment contaminants of concern in a variety of areas exceeding the CSR standards. Considerable investigation has been completed on the site and in most cases, the extent of the contamination is well understood. The risk assessment concluded that no significant risk management requirements were needed in order to protect receptors under the current land use scenario. Future construction workers were considered in the risk assessment as a potential receptor.

In evaluating future development scenarios, consideration should be given to the presence of subsurface contamination. Figure 1 illustrates general areas of soil and groundwater contamination. Redevelopment of these areas is possible but potentially more problematic than areas without contamination. Redevelopment of areas without identified contamination can proceed without special environmental controls.

The risk assessment completed for the site was completed for the current development condition with much of the property covered with asphalt surfacing. Future development should also consider maintaining this type of barrier to exposure with contaminated material. Barriers are typically considered temporary and need to be inspected in the long-term for potential failure (e.g. cracks, etc.). The following examples of barriers all serve to block the direct contact pathway from site users:

- Ornamental gardens or grassed areas (incorporating a clean fill base)
- Paving stones
- Asphalt covers (e.g. parking lots)
- Concrete
- Driveways/roadways

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- Sidewalks
- Building foundations

Additional cost to develop the contaminated areas includes additional worker protection and administrative controls, dust control during excavations, construction of barriers to soil and groundwater, disposal and management of contaminated soil and groundwater and possible ongoing monitoring of barriers.

Construction or maintenance/landscape workers may encounter impacted soil or groundwater during excavations; therefore, measures to mitigate direct contact with soil or groundwater require the use of personal protective equipment (PPE). Inhalation of dust generated during construction activities in these areas may also present a concern. Dust control can be implemented during construction activities in response to changing site conditions (e.g. dry weather or high wind) and often includes watering, tarping, securing or covering of stockpiled soil, and/or restricting or ceasing work when wind or weather conditions are unfavourable.

In order to proceed with redevelopment of the property or any part thereof, the City of Victoria requires a MoE Certificate of Compliance in accordance with the *British Columbia Contaminated Sites Regulation* (BC CSR), which is enabled under the *Environmental Management Act*. Specifically, a Certificate of Compliance is needed when a local government receives an application for subdivision, zoning, development, demolition of a structure or soil removal. In order to obtain a Certificate of Compliance, the client will need to satisfy the deficiency list identified by the MoE in 2008 by additional environmental investigation, risk assessment and reporting and submit again an application to the MoE for a Certificate of Compliance. On behalf of Greater Victoria Harbour Authority, UMA Engineering Ltd. submitted supplemental PSI, DSI and EHHRA reports in 2007 to fulfill the deficiencies noted in an initial 2005 Ministry of the Environment (MoE) review of a Certificate of Compliance (CoC) application. The MoE in July 2008, using the external reviewer, SLR Consulting, recommended that the CoC be withheld until further deficiencies in the reports are addressed. During the deficiency fulfillment, consideration should be given in the risk assessment to potential redevelopment and new receptors that may encounter contamination at the Site.

Within the overall development schedule, time for the MoE review and approval process needs to be included. Review times can be up to a year or more given the complexity of the site issues. Additional environmental work is also needed to prepare the MoE application.

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Ogden Point Environmental Review

TO: Robert Cheng

FROM: Tom Kestner, CH2M HILL

DATE: April 23, 2010

PROJECT NUMBER: 396153

Introduction

Ogden Point is located at the southwest end of James Bay, and serves as a marine port for cruise ships and other large vessels, marine related businesses and a heliport. It is in an industrial area of Victoria Outer Harbour and for the purposes of this review, includes a waterlot and breakwater, two piers (Piers A and B) and the upland portion bounded on the east by Dallas Road.

Ogden Point is along the coastline and is adjacent to the Victoria Harbor Bird Sanctuary (VHBS). The (VHBS) commences at the high-water mark on Cadboro Point (commonly called Ten-mile Point), near the City of Victoria, British Columbia; thence, in a southwesterly direction to the most southerly point of Trial Island; thence, westerly to Brotchie Ledge; thence, to high-water mark on Macauley Point; thence, along high-water mark on the shores of Vancouver Island to point of commencement; including all areas below high-water mark in Victoria Harbor, Selkirk Water, Victoria Arm and Portage Inlet.

Although impacts from past and present human activities are evident in Victoria Harbour, some areas still provide valuable wildlife habitat and feeding areas. Several shoreline properties in Victoria Harbour are currently undergoing, or slated for, redevelopment. This will provide opportunities for enhancing wildlife habitat and the overall condition of the harbor (Hooper, 1988). Currently the Ogden Point area is previously disturbed with existing utilities buildings, a ferry terminal, helicopter landing pads, and other industrial facilities.

Ecological Issues

The VHBS is a federally protected bird sanctuary protected through the Migratory Birds Convention Act (MBCA) and the Migratory Birds Sanctuary Regulations (MBSR). It has been documented that Glaucous-winged Gulls (*Larus glaucescens*) occur throughout the bird sanctuary and are well known for nesting within urban developments on building rooftops (Hooper, 1988). There have been reports of Glaucous-winged Gulls nesting on a building rooftop within the Ogden Point area on Pier 'A'.

The MBSR states in Section 3(1) (b) that:

"it is an offence, in a migratory bird sanctuary, to (a) hunt migratory birds, or (b) disturb, destroy or take the nests of migratory birds. However, Section 10(1) reads: "No person shall,

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in a migratory bird sanctuary, carry on any activity that is harmful to migratory birds or the eggs, nests or habitat of migratory birds, except under authority of a permit".

The MBCA states under the Migratory Birds Regulations in 24 (1) that:

"Any person may, without a permit, use equipment, other than an aircraft or firearms, to scare migratory birds that are causing or are likely to cause damage to crops or other property".

As stated above no, nest, bird, or its habitat can be touched, altered or harmed in any way or form. The site does not occur within the sanctuary, and the buildings are not natural nesting habitat, however, the Glaucous-winged Gulls and nests still cannot be harmed in any way. In saying this it would be recommended that any buildings being used as nesting sites for these birds be torn down prior to or after the nesting season to ensure no nests or birds are damaged. Thus, fall through winter would be an ideal time to remove any buildings if necessary.

In addition, the Canadian Wildlife Service notified the Greater Victoria Harbour Authority (GVHA) in 2008 that the electronic sound device installed by the GVHA to scare gulls off the Ogden Point Pier 'A' warehouse was not appropriate near the sanctuary because other birds would be disturbed (Ringuette, 2008). However, if a permit is acquired through the Canadian Wildlife Service the use of the sound device would be permitted to scare off the gulls.

Ecological Constraints

If significant work along the shorelines is required such as the removal of the retaining wall along or piers or if any other in-water works are to occur in the future then the Department of Fisheries and Oceans (DFO) would need to be contacted. DFO would review the detailed works as there may be potential issues such as contaminants being released from the seabed when the piers and wall are pulled out. DFO is a federal governing body and would likely need to review detailed construction plans, and also have documentation of the environmental setting within and around the project area.

Depending on the type of future works to be conducted in-water work may also have impacts on subtidal biological and physical features in the harbor (GWI, 2008). Impacts could also include effects on wave patterns and currents (GWI, 2008). Extent of the work and current conditions would need to be studied to accurately determine if any potential effects could occur to these features from further development. It should be noted that future works could also be used as an opportunity to enhance the shoreline habitat in that area.

The biggest ecological restraints would likely come from any developments that pertain to works being conducted in-water or along the shoreline concerning the potential impacts stated above, and potential impacts to birds within the bird sanctuary. Potential impacts to birds and nesting within the bird sanctuary would likely be caused by increased noise levels and/or boat traffic, again depending on the type of development. As the shoreline currently consists of a concrete retaining wall no natural shoreline habitat would be removed or altered during any re-development of the site.

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APPENDIX C

GEOTECHNICAL REVIEW

Appendix C – Errata Sheet

Planning-Level Geotechnical Assessment (Preliminary)

Ogden Point Master Plan Project

Page 2: Section Project Site History/Configuration – Para. 4 – The following sentence should be deleted:

"The seaward end of Pier B settled approximately 1.5 m in the 1990's, apparently as a result of undermining by prop-wash scouring from the larger ships which started calling at the port at that time."

And replaced with the following:

"The seaward end of Pier B settled approximately 1.5 m many years ago, probably as a result of consolidation of the wedge of unconsolidated Holocene marine mud upon which it was constructed. In 2003, a repair was carried out involving grouting of a void which had developed beneath the caissons along the southeast perimeter of the pier. This void was apparently caused by sidethrusters used to berth larger ships which had recently started calling at the port."

Planning-Level Geotechnical Assessment (Preliminary) Ogden Point Master Plan Project

PREPARED FOR: Greater Victoria Harbour Authority

PREPARED BY: Howard Thomas, P.Eng.

COPIES: Don Anderson/SEA
Robert Cheng/VIC

DATE: April 3, 2010

Introduction

The following technical memorandum summarizes results of a desktop review of the Ogden Point Lands based on existing available geotechnical information. This desktop review is part of the Ogden Point Master Plan Project (Project) being carried out by CH2M HILL for the Greater Victoria Harbour Authority (GVHA). The geotechnical work performed for this Project is in general accordance with a project service Agreement dated November 2009.

Objectives and Scope

The objective of this review was to identify geotechnical conditions that could affect the design and construction of different proposed components of the Master Plan, currently in preliminary concept development. These components include a variety of development scenarios, such as single and multi-storey (max 10-storey) structures, parks and landscaping, and other amenities

Important geotechnical considerations for design and construction include

- Bearing support and settlement potential of existing soils within the project area
- Performance of the existing soils during seismic loading
- Suitable types of foundations for supporting project components given the existing soil conditions and the requirements for seismic design
- Methods of mitigating unacceptable geotechnical conditions, and
- Special construction conditions that could influence the development of the site.

The scope of work for this evaluation was generally limited to review of geotechnical information collected by the GVHA. The GVHA searched available archives to locate geotechnical reports, geologic maps, old photographs, and construction records for the general Project area. The volume of information

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reviewed was substantial, but only a fraction of it was subsurface information. A list of the relevant references is included at the end of this memorandum.

Project Site History/Configuration

The project area was developed by filling Victoria Harbour seaward up to 400 m west of Dallas Road, starting over a century ago. Before the filling, the shoreline was irregular and apparently rocky. The location of this shoreline appears on several older maps and is shown in Figure 1.

A major engineering project, the 760-m-long Ogden Point Breakwater, was constructed in the period 1914-1917. Work on Piers A and B proceeded simultaneously. "Rock" was barged to the site from Esquimalt and placed as a foundation mattress for 53 precast concrete caissons that were to form the outline of the dock. These were hollow, reinforced concrete boxes 26-m long, 11-m wide and 15-m deep, each weighing 30 MN. Each was floated and sunk in position to a base elevation of 10.6-m below mean sea level (MSL), then filled with rock. As can be seen on Figure 1, the caissons bound only a portion of the terrestrial site shoreline.

The upland portion of the site was blasted level, and over one million cubic metres of dredged fill were placed behind the caissons by a large suction dredge. This material (also placed between the old shoreline and the piers) was dredged from the Victoria Inner Harbour and apparently contained silt, sand, and gravel particles and shell fragments. The work was completed in 1917. In addition to railway tracks with a rail barge ramp, a 13,000-square-metre cargo warehouse was constructed on Pier A the following year. The oldest aerial photograph of the site is from 1932. Ogden Point had undergone significant infilling by this date.

In 1977 the Canadian National Railway's Pier A warehouse was destroyed by fire. The replacement facility was constructed on the concrete slab for the original structure. Reference 16 indicates that this floor slab is extensively cracked. This may be a result of many years of heavy traffic rather than of soil settlement. The seaward end of Pier B settled approximately 1.5 m in the 1990's, apparently as a result of undermining by prop-wash scouring from the larger ships which started calling at the port at that time. Stabilizing this required an emergency repair consisting of grouting scour voids and constructing an external concrete retaining wall.

At present, the terrestrial site is about 14.3 ha in size. Over half of this area is an outward extension of the land base from the original high water mark, as a result of fill placed in the harbour and Pier A and B caissons. The vast majority of the uplands area is presently paved with concrete or asphalt, and the site topography is generally flat. Water depth between the existing piers shown in Figure 1 varies but is typically at least 15 m within 20 m of the western portion of the north and south sides of the two piers. We understand that this depth is maintained by periodic dredging.

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Geology

The Quaternary Geological Map of Greater Victoria (Ref. 3) shows the thickness and distribution of the Quaternary stratigraphic units in Greater Victoria. It provides the geological basis for the assessment of the earthquake hazards shown on companion maps which depict anticipated liquefaction and amplification of ground motion in Greater Victoria.

Quaternary deposits in Greater Victoria overlie an irregular, glacially-scoured bedrock surface. C. N. Ryzuk & Associates (Ref. 19) state that the local bedrock generally consists of competent metamorphic intrusives. The depth to bedrock can vary from zero to as much as 30 m within the space of a city block. Vashon till directly overlies bedrock in much of the Greater Victoria area. The till is a discontinuous unit and is generally less than a few metres thick. The till is overlain by the Capilano sediments.

The principal units of the Capilano sediments in the Victoria area are the Victoria clay and the Colwood sand and gravel. The Victoria clay is a unit of the glaiciomarine clayey silt that forms an irregular blanket-like deposit, generally below an elevation of 60 m. The brown clay facies of the Victoria clay is at the surface in most of the Victoria area.

In shoreline and nearshore sediments, the brown clay facies extend below modern sea level, because relative sea level fell below its modern position in the latest Pleistocene stage and earliest Holocene stage. In these settings, the brown clay facies is overlain by Holocene marine mud deposited during the Holocene rise in sea level. Holocene muds are locally overlain by prograding shoreline sands.

Subsurface Geotechnical Conditions

Only limited geotechnical information was found for the Project area by the GVHA. The following discussions summarize this information and provide an interpretation of subsurface conditions relative to the master planning effort.

Thurber (Ref. 13) reports that some as-built information is available from original construction of the piers. The available information indicates that bedrock removal was required along the east ends of the piers but the bedrock surface generally falls steeply towards the west. A boring drilled by Thurber in 1968 through one of the caissons at the outboard end of Pier B showed 5 m of clean, gravelly sand, over 8.5 m of sandy silt to silty sand, over 26 m of a medium stiff silty clay, over dense till and bedrock. The upper sand was apparently the “rock mattress” upon which the caisson was placed. The deeper sand apparently belongs to the shoreline sands. The silty clay is apparently the “Holocene marine mud.” And the till apparently belongs to the Vashon till unit.

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In 2009, a boring was drilled for a proposed tie-up dolphin in the water lot about 70 m west of Pier B (see Ref. 19). Water depth at the boring location was about 15.6 m below sea level. Consistent with the earlier Thurber boring, the top 13.7 m below the mudline was found to consist of loose fine sand and below that to 37.6 m was a soft to firm silty clay. Beneath the clay was 4.4 m of dense glacial till overlying apparent bedrock.

Figure A8 in Ref. 15 shows two cross sections through the site based on limited boring and groundwater monitoring well information. These cross sections typically show 3-4 m of sand and gravel fill overlying sand fill, and a water table affected by the tides but typically 2-3 m below the ground surface. However, several of the borings toward Dallas Road encountered a native silt beneath the upper fill, and one (MW 01-34) encountered 2 m of wood waste beneath the upper fill. Reliability of these cross-sections is questionable: Based on Thurber's boring, the elevation of the bedrock beneath the west end of Pier B is El -38 and not -7 as is shown on Section BB'. And, depiction of native material over fill in Section AA' cannot be a correct interpretation of the local subsurface conditions.

A water well was drilled to a depth of 60 m in 1968 in the vicinity of the old shoreline. This log showed bedrock encountered at a depth of 57 m. This information casts doubt on the notion that the original shoreline was bedrock.

Fill and overburden soils within the terrestrial lot appear to be primarily granular. No boring information was found for Pier A. However, it is presumed that, like beneath Pier B, a wedge of Holocene mud thickening to the west is also present there. Fine-grained soils remaining beneath the piers have been subjected to more than 90 years of surcharge loading. Even so, raising the grade on the piers could cause settlement.

Engineering Properties of Soil and Bedrock

Although the general characteristics of foundation soil and rock are known within the Project area, quantitative subsurface information has not been found by GVHA in their search of various archives. Shoreward of the piers toward Dallas Road, bedrock covered by up to 4 m of the native "Victoria clay"(actually a silt)appears to be present. West of the original shoreline appears to be granular hydraulic fill over bedrock.

Static Support and Settlement

The fill located below mean sea level apparently was placed hydraulically in the early 1900s. Such methods of placement often result in a loose soil density, making the hydraulic fill susceptible to settlement and bearing failures when new loads are applied. Fill above the water table is likely to be more competent, providing better bearing and being less susceptible to settlement under new building loads.

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The potential for future settlement will increase as the relative thickness of the hydraulic fill and fine-grained soils increase. Since the thickness of these deposits is limited near Dallas Road, settlement is expected to be small. On the other hand at the pier-head line, the thickness of fine-grained soils could potentially lead to significant settlement if new loads exceed those applied in the past. This would include loads from filling (raising the grade), not only from new structures.

Seismic Performance

One of the most significant considerations for the Project site is soil performance during seismic loading. As discussed in the next section of this technical memorandum, levels of ground shaking during the design seismic event are expected to be very high because of the proximity of the Cascadia seismic source zone. This high level of ground shaking in combination with the likely loose, cohesionless nature of the dredged fill and the high groundwater conditions makes the fill deposits susceptible to liquefaction.

Liquefaction refers to the condition where saturated, loose cohesionless soil loses strength as soil grains tend to densify during ground shaking. When the soil liquefies, the soil becomes fluid-like in consistency and can exhibit very low strength. The potential consequence of liquefaction could be

- Loss in soil bearing support for foundations supported on or close to liquefiable soils.
- Post-earthquake settlement of liquefiable soils
- Potential for slope movement at the pier-head line.

The potential for slope movement at the pier head-line warrants special note, as slope movement could be the highest risk for the Project area during a large seismic event. As evidenced in recent and past earthquakes, especially because of nearby dredging to maintain channel depths, areas along harbours are particularly vulnerable to slumping. Most often the slumping is the consequence of loose, saturated soils at the shoreline undergoing liquefaction, and the liquefied soil no longer being able to resist the gravity loads caused by the slope. Large slumps have occurred, and these have caused major damage to structures located on the shoreline. The limits of significant ground displacement can extend a 100 m or more from the shoreline, though most movement occurs within 25 to 30 m of the shoreline.

Seismicity and Preliminary Earthquake Design Criteria

The 2005 Canadian National Building Code (CNBC) stipulates that new construction be designed for an earthquake with a 2% probability of exceedance in 50 years. The Natural Resources Canada (NRC) seismic hazard website summarizes seismic

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design parameters applicable to the Ogden Point site (latitude 48.41, longitude -123.39). The website recommends a peak ground acceleration (PGA) of approximately 0.60 g. The source of this ground motion is mainly associated with the Cascadia subduction zone, where the Juan de Fuca plate is subducting beneath continental plates.

Levels of Ground Shaking

The NRC seismic hazard website also provides spectral acceleration at other periods for use in building design. The spectral accelerations at other periods for the Ogden Point site are summarized below.

Table 1. Spectral Accelerations from NRC Seismic Hazard Website (Dense Soil/Soft Rock)

Spectral Acceleration	Period (Seconds)			
	0.2	0.5	1.0	2.0
S_a	1.21	0.81	0.38	0.18

The spectral accelerations, as well as the PGA value, cited above are for dense soil/soft rock conditions. This site condition is referred to as Site Class C. The values in Table 1 need to be modified by a site amplification/deamplification factor if other site classes occur. The occurrence of other site classes is determined on the basis of soil and rock conditions within the upper 30 m of geologic profile. For the Ogden Point site, conditions range from relatively-competent bedrock near Dallas Road (Site Classes B and C) to deep overburden at the pier-head (Site Class D or E).

Liquefaction Potential

In Ref. 13, Thurber states that the potential for liquefaction of the native sandy silt/silty sand seabed deposits and the backfill behind the caissons is high. This is consistent with Ref. 21 which shows land west of the original shoreline as having "Moderate to High" liquefaction hazard.

Specific evaluations of the liquefaction potential have not been conducted because of lack of quantitative geotechnical information for the Project site. To be conservative for this master planning study, a reasonable assumption is that the hydraulic fill in the upper 10 to 15 m of soil behind the caissons and west of the original shoreline will liquefy during the design seismic event.

The extent of liquefaction would likely be widespread unless ground improvement methods are used to reduce the potential for liquefaction. Methods for reducing liquefaction potential are discussed later in this technical memorandum. The manifestation of liquefaction for those areas that do liquefy will include sand boils, settlement, and loss in soil strength. On the piers and within 25 to 30 m of the

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present shoreline, large lateral movements, ground fractures, and grabens might be expected to develop.

Planning-Level Geotechnical Recommendations

Incomplete geotechnical information obtained from the review of existing geologic maps and geotechnical reports suggests that site conditions comprise heterogeneous granular fill over either native soil or possible bedrock. In the area near Dallas Road the fill is thin and is located directly over the bedrock. West of Dallas Road, the fill becomes thicker and overlies sequences of native sands and silts. Where the fills extend below Mean Sea Level, they are typically "loose."Though compressed since the piers' construction, a substantial thickness of fine-grained soil remains beneath the two piers. Based on these conditions, the following guidance can be used for master-planning-level foundation design and site mitigation.

Suitable Building Foundation Types

We understand that, while steel pipe piles were driven to support column loads for the reconstructed warehouse on Pier A (its walls are tiltup walls), other lighter structures (primarily single-storey) east of the piers are typically supported by slabs on grade and shallow foundations. Provided appropriate setbacks are observed and ground improvement is done as described below, it appears that spread foundations and slab-on-grade construction may be suitable for supporting single-storey and low-rise buildings.

Ground improvement may not be required east of the former shoreline. On the other hand, pile foundations will likely be needed out on the piers to support heavy loads, multi-storey or settlement-sensitive structures.

Special Requirement for Seismic Loading

Hydraulic fills are particularly vulnerable to liquefaction during strong ground shaking, because of the general loose consistency of the soils and because of the high groundwater elevation in this type of environment. The occurrence of liquefaction could damage buildings supported on the liquefied soil, as discussed below. Because of the potential severity of liquefaction at the Ogden Point site, special consideration will have to be given to the potential need for mitigating the liquefaction risk.

Mitigation of Liquefaction Potential

As noted previously, the instability of the shoreline could result in large lateral soil movements within 25 to 30 m of the water's edge. The caisson retaining wall defines the water's edge for much of the property. Some other shoreline segments have a riprapped slope. The potential for this movement will depend on the level and

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duration of earthquake shaking, as well as on the original construction methods used for site preparation.

Existing information indicates that the caissons were placed on a gravel/rock mattress. If soils below the caissons were to liquefy, the caissons could slide seaward from the effects of inertial loads and earth pressures imposed by the liquefied hydraulic fill behind the caisson. As the caisson and slope move seaward, the ground in the current paved areas would settle. The risk of liquefaction in the backlands area appears to be less serious than at the shoreline. However, additional geotechnical explorations and design evaluations will be required to quantify the types and likely response of soils below and behind the shoreline in the areas of hydraulic fill. If these studies determine that a risk of movement exists, then the ground along the shoreline will require some level of improvement to reduce the liquefaction potential. Various types of ground improvement could be considered, including

- *Vibro-densification*. If the hydraulic fill is relatively free of fines, vibro-densification methods can be used. This ground improvement method involves densifying the soil by application of vibrations using a vibratory probe system. As the ground settles under the vibrations, more fill is place to maintain the ground surface.
- *Stone Columns*. With this method columns of gravel and rock are densified at spacings of 2 to 3 m. The diameter of the column typically varies from 0.75 to 1 m. The densified columns provide a series of stabilized columns that reduce ground motions and provide additional soil strength.

Selection of the most appropriate ground improvement method will depend on types of soil at the site, the area to be improved, environmental factors, construction time, and construction costs. Reference 22 describes a successful very recent application of vibro-replacement and dynamic compaction at the Deltaport marine Container Terminal off the coast of Greater Vancouver, BC. Including a verification test program, 486,000 cubic meters of granular materials were densified there in less than 20 weeks. The author participated in a waterfront project in Southcentral Alaska several years ago in which nearly 200,000 cubic meters of saturated granular soils were successfully densified in place on a grid pattern (on 3 to 5 m spacing) using a vibratory hammer to drive a section of heavy H-pile up to 20 m long with cleats welded to the web. (Several cubic meters of pea gravel were added at each grid location as the pile was successively inserted and retracted.)

Other Site Development Considerations

A number of other geotechnical issues will be considered during the master planning efforts. These include road and walkways for access, parks and landscaping, as well as other amenities. None of these development considerations

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presents a particularly significant design or construction requirement relative to other developments in the shoreline area around Greater Victoria Harbour.

Construction Considerations

The primary issues related to construction east of the piers will be the high groundwater elevation and the loose consistency of hydraulic fills present at the site. This will limit excavations to a depth of 2 to 3 m, unless dewatering methods are used to control groundwater inflow.

While there are construction risks and challenges, the present lack of development for much of the area provides good access to various construction methods, making development relatively easy in this urban environment. Further, the proximity of the harbour provides a method of bringing in and removing material that will have limited effects to areas surrounding Ogden Point.

Data Gaps

Locations of numerous test pits, borings, and monitoring wells appear on the various site plans for Ogden Point. However, many of these appear to have been shallow explorations made for environmental purposes. Logs of previous explorations were not generally found during this limited review. Detailed geotechnical explorations are needed to define geotechnical conditions that will affect design and construction of future developments at the Project site.

Deeper borings extending to bedrock and including sampler blowcounts will be required to define subsurface conditions beneath Lot 1 and confirm preliminary conclusions and resolve discrepancies noted above. These explorations should be performed throughout the development area, including at the shoreline to quantify the risk of lateral flow and spreading during a design seismic event.

A multi-phase exploration program appears to be the most suitable for the development. The initial phase should include only a limited number of explorations to define the characteristics of the hydraulic fill and the conditions of soils in the vicinity of the caissons. A combination of drilling and sampling, as well as cone penetrometer test (CPT) soundings, would be the preferred approach for this initial phase. Based on results of these initial explorations and evaluation of shoreline stability, a site grading plan can be developed and the layout and type of single and multi-story buildings, and other project amenities could be defined. Once defined, development-specific borings and associated laboratory testing and geotechnical analyses could then be carried out.

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Conclusions and Recommendations

The Ogden Point Project area appears to be suitable for development from a geotechnical standpoint; however, a number of critical geotechnical issues will have to be considered during master planning and future studies. These issues are summarized below:

- Hydraulic fill that was used to construct the uplands will generally serve as a suitable foundation material for single-story structures. A potential exists for unacceptable settlements, particularly towards the piers. This potential will need to be quantified.
- Under seismic loading, the hydraulic fill is expected to liquefy. If liquefaction occurs, the bearing capacity of shallow footings located above or close to the liquefiable soils could decrease significantly and post-earthquake settlement could exceed several tens of millimeters. These consequences could be mitigated by use of ground improvement on a general or local basis.
- Larger, multi-story buildings will likely need to be constructed on pile foundations. The exception is along Dallas Road where the depth to bedrock may be relatively shallow. In this area, the existing fill soils above the bedrock would likely have to be removed, to allow the structures to be constructed directly on rock.
- Out on the piers, raising the site grade should be avoided and deep pile foundations will probably be required for support of structures. High-rise structures (more than two storeys, say) should probably be avoided in these areas.
- The shoreline appears to be vulnerable to liquefaction-induced slumping, based on the types of soils making up the shoreline and experience from other similar locations during large earthquakes. Additional geotechnical explorations and evaluations will be required to quantify the potential risk from liquefaction. In the event that these studies show that the site is vulnerable, various ground improvement methods can be used to stabilize the site.

The search of archives for geotechnical information at the site was of limited success. This absence of information led to significant questions about the characteristics and likely performance of the soil, particularly towards the pier-head line. An important next step in the development of the site is to conduct a limited geotechnical exploration program to characterize soils and establish likely performance under gravity and seismic loads. With this information, master planning can proceed with more confidence. Once development plans are known, final exploration work and design studies will be required.

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Limitations

This technical memorandum was prepared exclusively for the Greater Victoria Harbour Authority's Ogden Point Master Planning Project in accordance with generally accepted geotechnical engineering practice. Conclusions and recommendations provided in this memorandum are based on the project descriptions as of late February 2010 and site conditions developed from existing reports and maps.

The subsurface conditions were interpreted from limited available information. Simplifying assumptions have been made when making these interpretations. These assumptions are inappropriate for final design for foundations or selection of construction means and methods. Users of this technical memorandum should verify that project development plans discussed in this document have not been changed.

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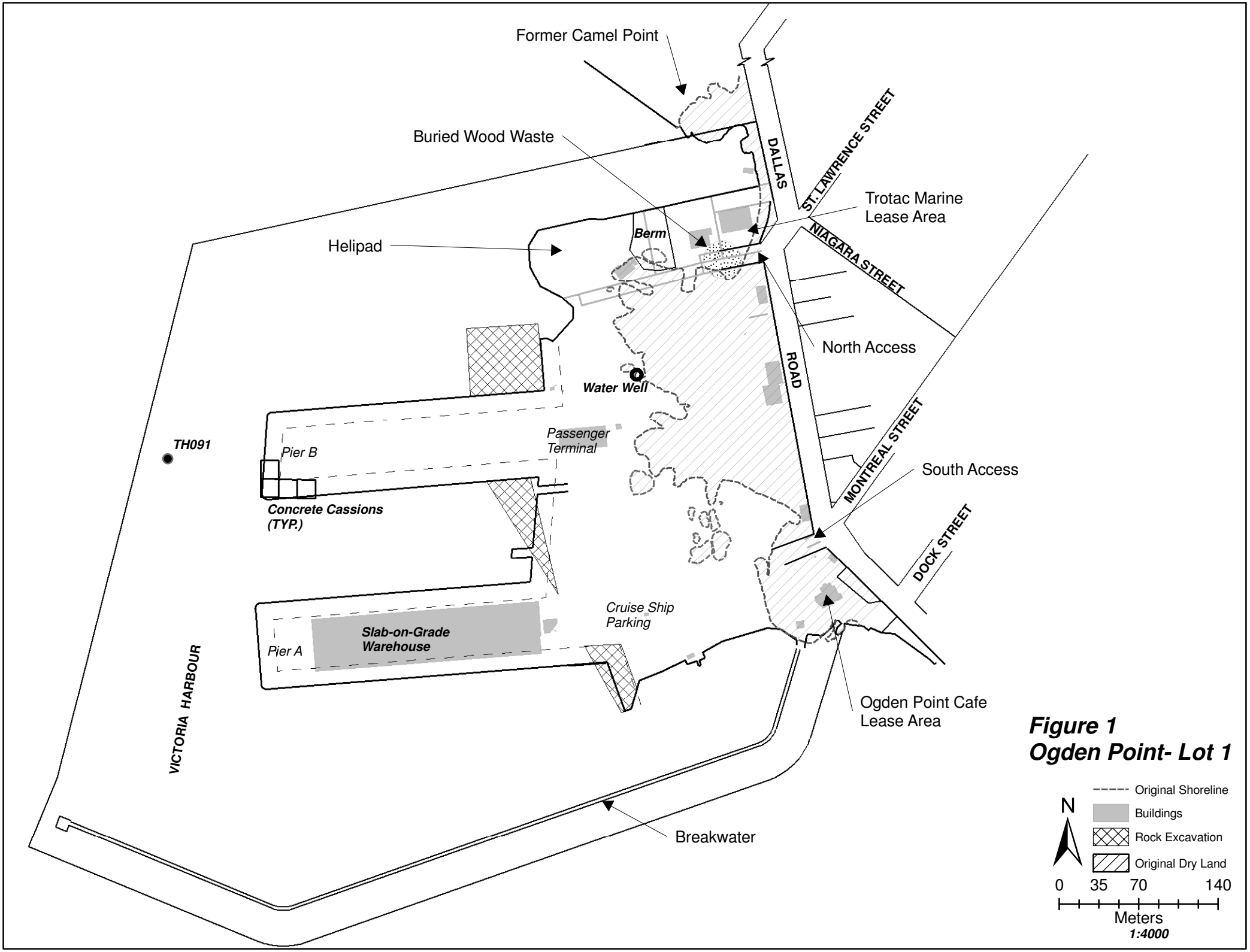

Figure 1
Ogden Point- Lot 1

APPENDIX D

LONG LIST OF POTENTIAL PORT MARINE-BASED ACTIVITIES

APPENDIX D

Potential Port Marine-based Activities

To establish a long list of potential marine-based activities to be considered for Ogden Point, the project team conducted extensive research on activities in ports in Canada and around the World. The research primarily focused on ports that were perceived as sharing similar characteristics with Ogden Point (such as, size of surrounding population and geographical location). Other major world-economic-scale ports were also considered. The project team analyzed the following ports (among others):

- Port of Everett, Washington
- Port of Juneau/Skagway, Alaska
- Port of Belledune, New Brunswick
- Port of St John's, Newfoundland
- Port of Prince Rupert, British Columbia
- Port of Capetown, South Africa
- Port of Freemantle, Perth, Australia
- Port of Singapore
- Port of Honolulu, Hawaii
- Port of Long Beach, California
- Port of Bergen, Norway
- Saint Thomas, Caribbean

Comparisons of cruise ship calls and cargo handling at some of the above ports in 2009 are provided in Exhibits D-1 and D-2, respectively. As shown, Ogden Point receives a similar number of cruise ships each year when compared to ports such as Vancouver, Seattle, Belledune, and Bergen. However, Ogden Point is lacking in terms of cargo-handling volumes and significant changes may be required to make it comparable to other major ports.

Once the long list of potential marine-based activities was established, the project team developed a list of screening criteria to determine the feasibility of these activities at Ogden Point. Each activity was tested against these criteria and only the activities that successfully passed the screening and did not contain a fatal flaw were considered for further analysis in the main document (the short list). The project team used the following screening criteria for the analysis:

- Land-side transportation access, including:
  - Rail
  - Road
  - Pipeline
- Site Size
- Marine conditions, including:
  - Draft
  - Berth length
  - Tidal
  - Wind/wave

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- Hinterland characteristics, including
  - Consumption (GDP)
  - Resources (Export)
- Urban Interface

A "fatal flaw" is defined in this case as a missing or economically unachievable must-have characteristic for the activity to happen at Ogden Point.

The results of the screening analysis are presented in Exhibit D-3.

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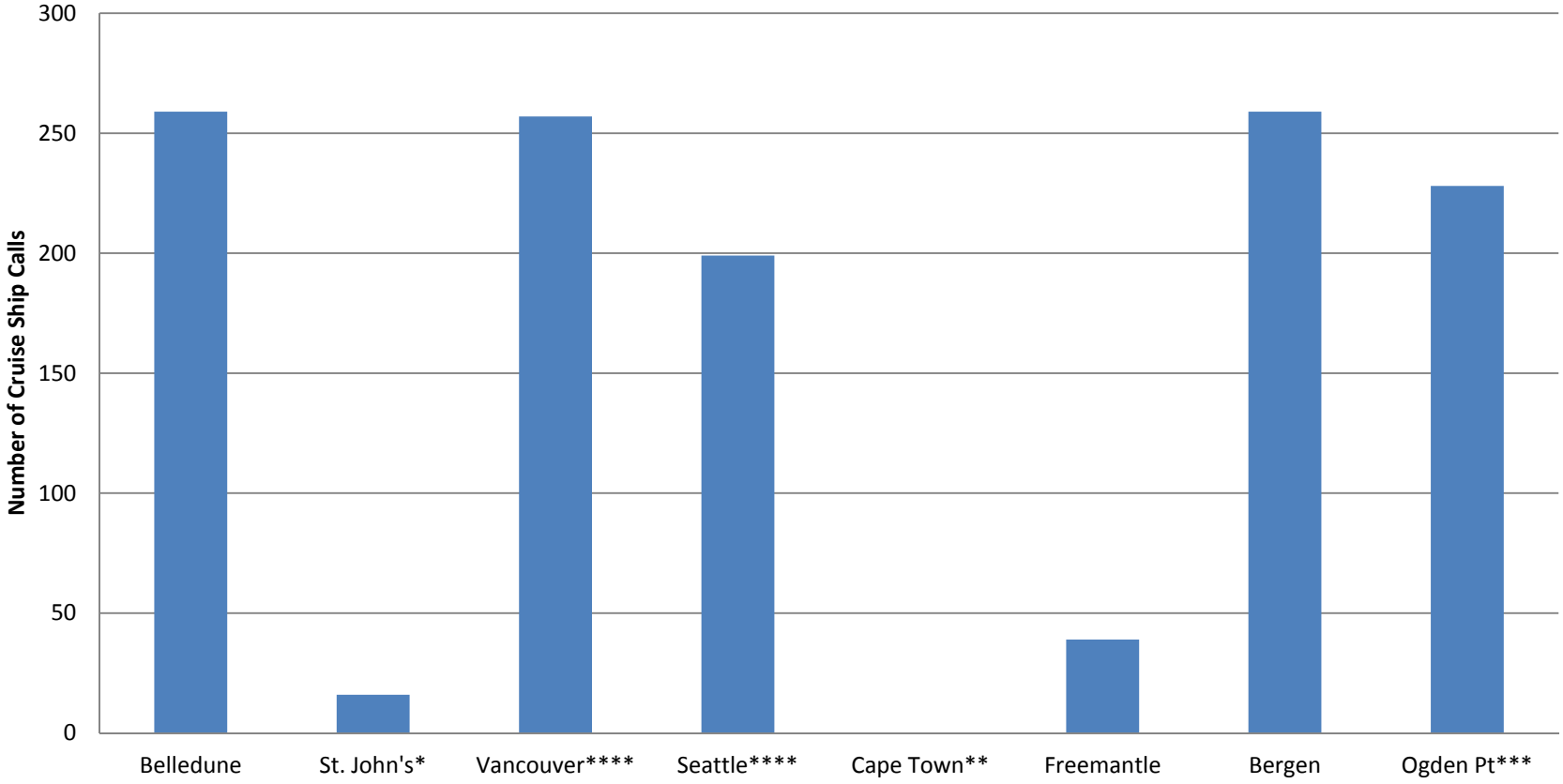
EXHIBIT D-1
Comparison of Cruise Ship Calls at Select Ports in 2009



*St. John's Data is from 2004
**Information not available for Cape Town
***Ogden Point's data is from 2010
****Vancouver and Seattle are home ports

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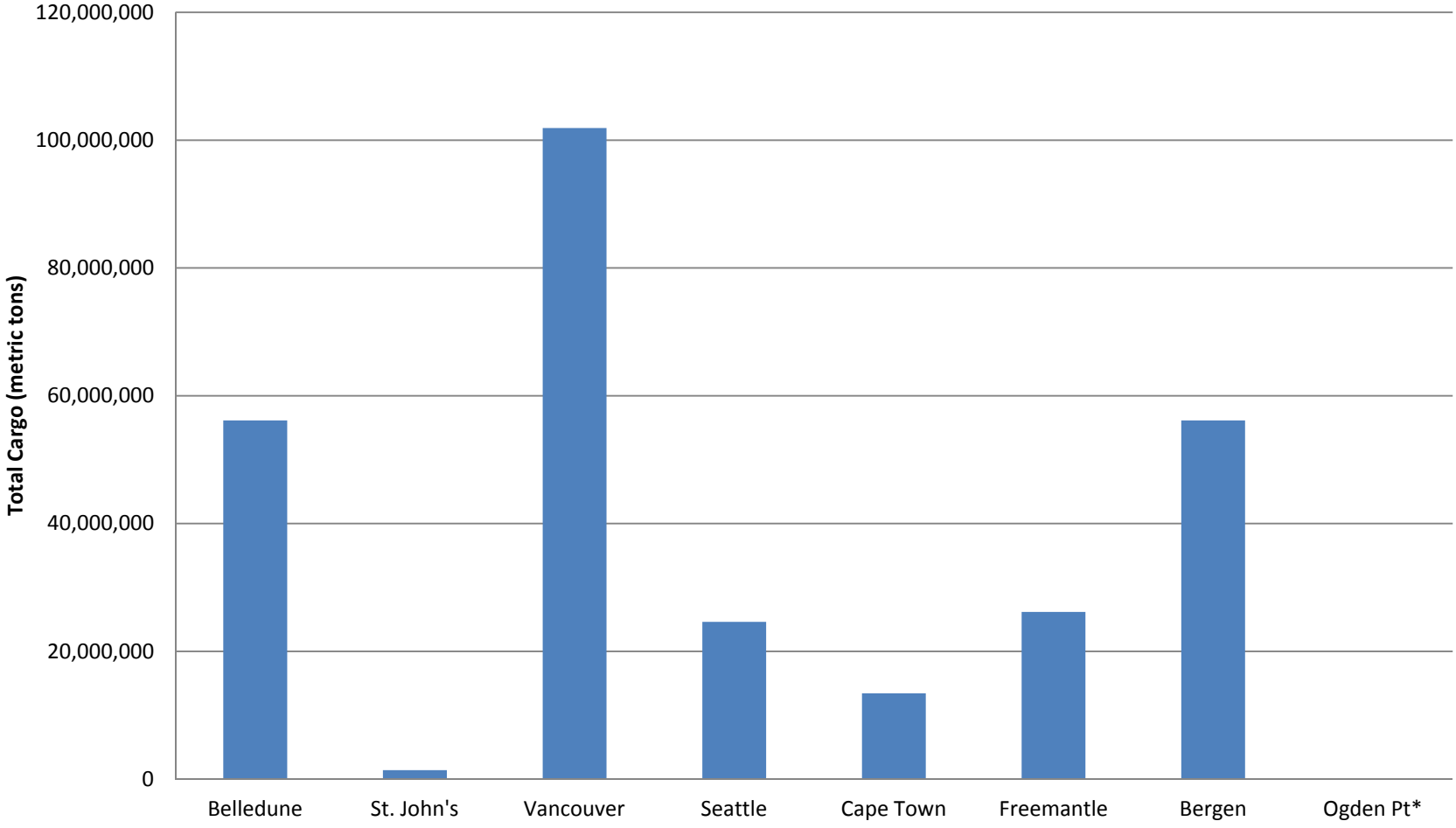
EXHIBIT D-2
Comparison of Cargo Handling at Select Ports in 2009



*Information not available for Ogden Point

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EXHIBIT D-3
Results of Screening Analysis of Potential Marine-based Activities at Ogden Point

Port Activity			Screening Criteria				Retained in Short List
			Land-side Transportation Access	**Site Size**	**Marine Conditions**	**Hinterland**	
Passenger Traffic	Domestic	Car	High-volume road access problematic due to nature of streets accessing terminal, proximity to residences, and stated position of neighbourhood association; important investment required to build access ramp	Ogden Point site large enough	GVHA experience suggests wave conditions at Ogden Point frequently exceed acceptable levels for ferry operations despite breakwater;	BC Ferries already servicing Victoria; limited potential due to limited population on Vancouver Island	No
		Passenger Only	No dedicated year-round high traffic transit access (i.e., bus, light rail transit [LRT]) from downtown	Ogden Point site large enough	GVHA experience suggests wave conditions at Ogden Point frequently exceed acceptable levels for ferry operations despite breakwater;	BC Ferries already servicing Victoria; limited potential due to limited population on Vancouver Island	No
	International	Cruise	Dedicated seasonal bus transit from Ogden Point to downtown	Ogden Point site large enough	Cruise ships fairly insensitive to weather conditions; Ogden Point breakwater sufficient	Victoria is a top touristic destination on Canada's West Coast	Yes

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EXHIBIT D-3
Results of Screening Analysis of Potential Marine-based Activities at Ogden Point

Port Activity			Screening Criteria				Retained in Short List
			Land-side Transportation Access	**Site Size**	**Marine Conditions**	**Hinterland**	
		Ferry	High-volume road access problematic due to nature of streets accessing terminal, proximity to residences, and stated position of neighbourhood association; need for ro-ro loading ramp	Ogden Point site large enough	Ferries fairly insensitive to weather conditions; Ogden Point breakwater sufficient	Victoria is a top touristic destination on Canada's West Coast; potential for specialty service(s) linking with US.	Yes
		Air Traffic	No dedicated year-round high traffic transit access (i.e., bus, LRT) from downtown	Ogden Point site large enough	Depending on equipment, somewhat sensitive to weather conditions; rough seas at Ogden Point challenge some fixed wing operations.	Victoria is a top tourist destination on Canada's West Coast	No
General Cargo	Roll on, Roll off (ro-ro)		Generates irregular truck traffic to and from Ogden Point	Ogden Point site likely large enough	Marine conditions sufficient to support ro-ro activity	Local market size potentially sufficient	Yes
	Containerized		Potential for high level of truck traffic in and out of Ogden Point site; no rail access likely a fatal flaw	Area required for container handling not enough at Ogden Point (100 acres minimum for a container terminal)	Sensitive to weather conditions; huge investments required to make it feasible; likely too shallow for most vessels (fatal flaw)	Vancouver Island market already served by Port of Vancouver	No
	Break Bulk		Potential for high level of truck traffic in and out of Ogden Point site	Ogden Point site likely large enough	Marine conditions sufficient to support activity	Local market size not sufficient	Yes

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EXHIBIT D-3
Results of Screening Analysis of Potential Marine-based Activities at Ogden Point

Port Activity			Screening Criteria				Retained in Short List
			Land-side Transportation Access	Site Size	Marine Conditions	Hinterland	
	Coastal & Short-sea Shipping	Short-sea shipping	Generates irregular truck traffic to and from Ogden Point	Ogden Point site likely large enough	Marine conditions sufficient to support activity	Local market size potentially sufficient	Yes
		Coast-wise deep sea	Generates irregular truck traffic to and from Ogden Point	Ogden Point site likely large enough	Marine conditions sufficient to support activity; limitations on size of vessels	Vancouver Island market likely not sufficient to support activity	Yes
Liquid Bulk Storage	Crude Oil		Does not generate traffic; crude oil shipped by tanker	Ogden Point not likely large enough	Marine conditions insufficient to support activity; crude oil in AfraMax tankers	Vancouver Island market not sufficient to support activity; crude oil market is U.S. west coast	No
	Refined Petroleum Products		Generates irregular traffic for product distribution	Ogden Point site likely large enough; similar to other terminals	Marine conditions adequate for product tanker	Competition from established product terminals	Yes
	Non-Petroleum Products		No rail is a fatal flaw	Ogden Point site likely large enough; similar to other terminals	Marine conditions adequate for product tanker	No local market	No
Dry Bulk Storage			No rail is a fatal flaw	Ogden Point not large enough for dry bulk storage	Marine conditions sufficient to support activity; limitations on size of vessels	No local market (resource exporters) in Vancouver Island to support activity	No
Boat Yard	Storage		Does not generate high traffic volume; no special infrastructure required	Site large enough to handle boat yard and supporting activities	Protected launch area feasible	Local market need for boat storage & repair facilities as well as international yacht transfer.	Yes
	Supporting Services						
	Yacht Transfer						

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EXHIBIT D-3
Results of Screening Analysis of Potential Marine-based Activities at Ogden Point

Port Activity	Screening Criteria				Retained in Short List
	Land-side Transportation Access	Site Size	Marine Conditions	Hinterland	
Ship Repair	Does not generate high traffic volume; no special infrastructure required	Site large enough to handle ship repair activities	Investment required to lift boats out of water	Competition from local ship repair facilities; limited market opportunity	Yes*
Fish Handling	High traffic volume of dedicated trucks highly problematic; infrastructure investment required for unloading vessels	Required land sufficient	Fish handling fairly insensitive to weather conditions; breakwater sufficient	Fish handling used to be an activity carried at Ogden Point; lack of economic feasibility	No
Heavy Equipment Assembly	May generate periodic disruptive traffic along Dallas Road	Extensive use of land; Ogden Point large enough to accommodate needs	Heavy equipment assembly insensitive to weather conditions	Dependent on major construction projects on the Island; fairly limited potential	Yes
Non-working Berthage	Does not generate high traffic volume; no special infrastructure required	Limited need for land	Non-working berthage insensitive to weather conditions	Potential with winter Arctic Coast Guard vessels, research vessels, Navy vessels, ferries, vessel refit, specialty eco-tourism, special purpose/educational cruise ships, mega yachts	Yes
Research Institute	Does not generate high traffic volume; no special infrastructure required	Site large enough to handle activity	Research institute fairly insensitive to weather conditions	Two large universities in BC and research labs interested in development.	Defer further consideration to Part B

* Ogden Point can sustain small ship repair and a lay-down/module assembly area for larger ship repair.

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APPENDIX E

ECONOMIC EVALUATION

Output Measures:		
Average Ratio of Net Income to Net Assets	**1.5%**	
Present Value of Ogden Point Operating Cash	**$18,497,551**	
Present Value of Ogden Point Sustaining Capital	**-$8,661,465**	
Present Value of Ogden Point Net Cash Flow	**$9,836,087**	
Present Value of Other Properties Cash Shortfall	**-$9,352,441**	
Present Value of Combined Cash Net Cash Flow	**$483,646**	
Input Values:		
Discount Rate	**6%**	
Planning Period	**20**	**years**
Cruise Passenger vessel traffic:		
Year 2010		
Bundled Vessel arrivals	**218**	
Non Bundled Vessel Arrivals	**10**	
Year 2011 and after		
Bundled Vessel arrivals	**200**	
Non Bundled Vessel Arrivals	**10**	
Adjustment to Vessel Arrival Level after 2015	**95%**	
Passengers per bundled vessel (2010 budget estimate)	**1,925**	
Passengers per non bundled vessel (2010 budget estimate)	**370**	
"Lost Vessel" factor	**5%**	**vessels not arriving**
Differential Escalation	**1.5%**	**on Property Tax**
Revenue Accounts:		
GVHA share of Cruise Operations Revenue	**74%**	
Passenger Charge shared with Western Stevedoring	**$6.40**	
Bundling Charge shared with Western Stevedoring	**$1.60**	
Passenger Charge not shared with Western	**$0.70**	
Berthage and Service & Facilities / non bundled vessel	**$2,750**	
Cruise Support Revenue / unbundled vessel	**$1,855**	
Non Cruise Vessel & Warehouse Revenue	**$64,500**	
Property Services Revenue	**$400,000**	
Marine Transportation Revenue	**$200,000**	
GVHA Operating Expense Accounts:		
General Operating Expenses	**$250,000**	
Repairs and Maintenance	**$325,000**	
Insurance	**$125,000**	
Property Taxes	**$550,000**	
Administrative Expenses	**$550,000**	
Estimated Cost of Berthing Dolphin in 2910	**$3,500,000**	
Estimated Annual Sustaining Capital	**$450,000**	
Estimated Annual Cash Shortfall at Other GVHA Properties	**$750,000**	
Allocations:	**Yard**	
Useful Life for Asset Depreciation (years)	**10**	**years**
Proportion of Sustaining Capital	**25%**	
	Construction	
Useful Life for Asset Depreciation (years)	**20**	**years**
Proportion of Sustaining Capital	**25%**	
	Piers / Breakwater	
Useful Life for Asset Depreciation (years)	**50**	**years**
Proportion of Sustaining Capital	**50%**	

Ogden Point Master Plan | **GVHA Cash Flow Evaluation** | **Passenger Traffic**

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Estimated Number of Cruise Vessels per Season:																					
Bundled Vessels adjusted by "Lost Vessel allowance"	207.1	190.0	190.0	190.0	190.0	190.0	180.5	180.5	180.5	180.5	180.5	180.5	180.5	180.5	180.5	180.5	180.5	180.5	180.5	180.5	180.5
Non Bundled Vessels	9.5	9.5	9.5	9.5	9.5	9.5	9.025	9.025	9.025	9.025	9.025	9.025	9.025	9.025	9.025	9.025	9.025	9.025	9.025	9.025	9.025
Total Passenger Cruise Vessel Traffic	**216.6**	**199.5**	**199.5**	**199.5**	**199.5**	**199.5**	**189.5**	**189.5**	**189.5**	**189.5**	**189.5**	**189.5**	**189.5**	**189.5**	**189.5**	**189.5**	**189.5**	**189.5**	**189.5**	**189.5**	**189.5**
Estimated Number of Cruise Passengers per Season:																					
Bundled Vessels	**398,730**	**365,807**	**365,807**	**365,807**	**365,807**	**365,807**	**347,517**	**347,517**	**347,517**	**347,517**	**347,517**	**347,517**	**347,517**	**347,517**	**347,517**	**347,517**	**347,517**	**347,517**	**347,517**	**347,517**	**347,517**
Non Bundled Vessels	**3,515**	**3,515**	**3,515**	**3,515**	**3,515**	**3,515**	**3,339**	**3,339**	**3,339**	**3,339**	**3,339**	**3,339**	**3,339**	**3,339**	**3,339**	**3,339**	**3,339**	**3,339**	**3,339**	**3,339**	**3,339**
Total Cruise Passengers Per season	**402,245**	**369,322**	**369,322**	**369,322**	**369,322**	**369,322**	**350,856**	**350,856**	**350,856**	**350,856**	**350,856**	**350,856**	**350,856**	**350,856**	**350,856**	**350,856**	**350,856**	**350,856**	**350,856**	**350,856**	**350,856**

Draft

values in $000 units	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Schedule of Depreciable Assets																					
Book Values at Start																					
Yard	$733	$660	$701	$738	$771	$801	$827	$851	$873	$893	$910	$926	$940	$953	$965	$975	$985	$993	$1,001	$1,007	$1,014
Construction	$2,878	$2,734	$2,707	$2,681	$2,657	$2,634	$2,612	$2,591	$2,571	$2,552	$2,534	$2,517	$2,501	$2,486	$2,471	$2,457	$2,444	$2,431	$2,420	$2,408	$2,398
Piers / Breakwater	$27,548	$30,462	$30,076	$29,697	$29,326	$28,962	$28,606	$28,256	$27,914	$27,578	$27,249	$26,927	$26,611	$26,302	$25,999	$25,701	$25,410	$25,125	$24,845	$24,571	$24,302
Total	$31,159	$33,856	$33,483	$33,116	$32,753	$32,396	$32,045	$31,698	$31,358	$31,023	$30,694	$30,371	$30,053	$29,741	$29,434	$29,134	$28,839	$28,549	$28,265	$27,986	$27,713
Additions in Period																					
Yard	$0	$113	$113	$113	$113	$113	$113	$113	$113	$113	$113	$113	$113	$113	$113	$113	$113	$113	$113	$113	$113
Construction	$0	$113	$113	$113	$113	$113	$113	$113	$113	$113	$113	$113	$113	$113	$113	$113	$113	$113	$113	$113	$113
Piers / Breakwater	$3,500	$225	$225	$225	$225	$225	$225	$225	$225	$225	$225	$225	$225	$225	$225	$225	$225	$225	$225	$225	$225
Total	$3,500	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450
Depreciation in Period																					
Yard	$73	$72	$76	$79	$83	$86	$88	$91	$93	$95	$97	$98	$100	$101	$102	$103	$104	$105	$106	$106	$107
Construction	$144	$140	$138	$137	$136	$134	$133	$132	$131	$130	$130	$129	$128	$127	$126	$126	$125	$124	$124	$123	$123
Piers / Breakwater	$586	$611	$604	$596	$589	$581	$574	$567	$561	$554	$547	$541	$534	$528	$522	$516	$510	$505	$499	$494	$488
Total Depreciation	$803	$823	$818	$812	$807	$802	$796	$790	$785	$779	$773	$768	$762	$756	$751	$745	$740	$734	$729	$723	$718
Book Valeus at End																					
Yard	$660	$701	$738	$771	$801	$827	$851	$873	$893	$910	$926	$940	$953	$965	$975	$985	$993	$1,001	$1,007	$1,014	$1,019
Construction	$2,734	$2,707	$2,681	$2,657	$2,634	$2,612	$2,591	$2,571	$2,552	$2,534	$2,517	$2,501	$2,486	$2,471	$2,457	$2,444	$2,431	$2,420	$2,408	$2,398	$2,387
Piers / Breakwater	$30,462	$30,076	$29,697	$29,326	$28,962	$28,606	$28,256	$27,914	$27,578	$27,249	$26,927	$26,611	$26,302	$25,999	$25,701	$25,410	$25,125	$24,845	$24,571	$24,302	$24,039
Total Depreciable Book Value at End	$33,856	$33,483	$33,116	$32,753	$32,396	$32,045	$31,698	$31,358	$31,023	$30,694	$30,371	$30,053	$29,741	$29,434	$29,134	$28,839	$28,549	$28,265	$27,986	$27,713	$27,445
Book Value of Land	$14,807	$14,807	$14,807	$14,807	$14,807	$14,807	$14,807	$14,807	$14,807	$14,807	$14,807	$14,807	$14,807	$14,807	$14,807	$14,807	$14,807	$14,807	$14,807	$14,807	$14,807
Total Net Asset Value	$48,663	$48,290	$47,923	$47,560	$47,203	$46,852	$46,505	$46,165	$45,830	$45,501	$45,178	$44,860	$44,548	$44,241	$43,941	$43,646	$43,356	$43,072	$42,793	$42,520	$42,252

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Pro Forma Income Statement																					
GVHA Shipping Revenue:																					
Cruise Passenger Operations Revenue																					
Pax @ $6.40	$1,905	$1,749	$1,749	$1,749	$1,749	$1,749	$1,662	$1,662	$1,662	$1,662	$1,662	$1,662	$1,662	$1,662	$1,662	$1,662	$1,662	$1,662	$1,662	$1,662	$1,662
Pax @ $0.70	$282	$259	$259	$259	$259	$259	$246	$246	$246	$246	$246	$246	$246	$246	$246	$246	$246	$246	$246	$246	$246
Bundling @$1.60	$472	$433	$433	$433	$433	$433	$411	$411	$411	$411	$411	$411	$411	$411	$411	$411	$411	$411	$411	$411	$411
Berthage & Service & Facilities	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20
sub total	$2,679	$2,461	$2,461	$2,461	$2,461	$2,461	$2,339	$2,339	$2,339	$2,339	$2,339	$2,339	$2,339	$2,339	$2,339	$2,339	$2,339	$2,339	$2,339	$2,339	$2,339
Cruise Passenger Support	$299	$299	$299	$299	$299	$299	$299	$299	$299	$299	$299	$299	$299	$299	$299	$299	$299	$299	$299	$299	$299
Total Cruise Passenger Revenue	$2,978	$2,760	$2,760	$2,760	$2,760	$2,760	$2,638	$2,638	$2,638	$2,638	$2,638	$2,638	$2,638	$2,638	$2,638	$2,638	$2,638	$2,638	$2,638	$2,638	$2,638
Non Cruise Vessel & Warehouse Revenues	$48	$48	$48	$48	$48	$48	$48	$48	$48	$48	$48	$48	$48	$48	$48	$48	$48	$48	$48	$48	$48
Total Shipping Revenue	$3,026	$2,808	$2,808	$2,808	$2,808	$2,808	$2,686	$2,686	$2,686	$2,686	$2,686	$2,686	$2,686	$2,686	$2,686	$2,686	$2,686	$2,686	$2,686	$2,686	$2,686
Property Services Revenue	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400
Marine Transportation Revenue	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	$200
Total Ogden Point Revenue	$3,626	$3,408	$3,408	$3,408	$3,408	$3,408	$3,286	$3,286	$3,286	$3,286	$3,286	$3,286	$3,286	$3,286	$3,286	$3,286	$3,286	$3,286	$3,286	$3,286	$3,286
GVHA Operating Expenses:																					
General Operating Expenses	$250	$250	$250	$250	$250	$250	$250	$250	$250	$250	$250	$250	$250	$250	$250	$250	$250	$250	$250	$250	$250
Repairs and Maintenance	$325	$325	$325	$325	$325	$325	$325	$325	$325	$325	$325	$325	$325	$325	$325	$325	$325	$325	$325	$325	$325
Insurance	$125	$125	$125	$125	$125	$125	$125	$125	$125	$125	$125	$125	$125	$125	$125	$125	$125	$125	$125	$125	$125
Property Taxes	$550	$558	$567	$575	$584	$593	$601	$610	$620	$629	$638	$648	$658	$667	$677	$688	$698	$708	$719	$730	$741
Administrative Expenses	$550	$550	$550	$550	$550	$550	$550	$550	$550	$550	$550	$550	$550	$550	$550	$550	$550	$550	$550	$550	$550
Total Operating Expenses	$1,800	$1,808	$1,817	$1,825	$1,834	$1,843	$1,851	$1,860	$1,870	$1,879	$1,888	$1,898	$1,908	$1,917	$1,927	$1,938	$1,948	$1,958	$1,969	$1,980	$1,991
Excess of Revenues over Operating Expenses	$1,826	$1,600	$1,591	$1,583	$1,574	$1,566	$1,435	$1,426	$1,416	$1,407	$1,398	$1,388	$1,378	$1,369	$1,359	$1,348	$1,338	$1,328	$1,317	$1,306	$1,295
Depreciation Allowance	-$803	-$823	-$818	-$812	-$807	-$802	-$796	-$790	-$785	-$779	-$773	-$768	-$762	-$756	-$751	-$745	-$740	-$734	-$729	-$723	-$718
GVHA Net Income	$1,023	$777	$774	$771	$767	$764	$639	$635	$632	$628	$624	$620	$616	$612	$608	$603	$599	$594	$588	$583	$577
Pro Forma Cash Flow Statement																					
Cash Fom Operations																					
Net Income	$1,023	$777	$774	$771	$767	$764	$639	$635	$632	$628	$624	$620	$616	$612	$608	$603	$599	$594	$588	$583	$577
Add back Depreciation	$803	$823	$818	$812	$807	$802	$796	$790	$785	$779	$773	$768	$762	$756	$751	$745	$740	$734	$729	$723	$718
Total Operating Cash	$1,826	$1,600	$1,591	$1,583	$1,574	$1,566	$1,435	$1,426	$1,416	$1,407	$1,398	$1,388	$1,378	$1,369	$1,359	$1,348	$1,338	$1,328	$1,317	$1,306	$1,295
Cash to Investments																					
Sustaining Capital Cost	-$3,500	-$450	-$450	-$450	-$450	-$450	-$450	-$450	-$450	-$450	-$450	-$450	-$450	-$450	-$450	-$450	-$450	-$450	-$450	-$450	-$450
Total Cash to Investments	-$3,500	-$450	-$450	-$450	-$450	-$450	-$450	-$450	-$450	-$450	-$450	-$450	-$450	-$450	-$450	-$450	-$450	-$450	-$450	-$450	-$450
GVHA Net Cash Flow	-$1,674	$1,150	$1,141	$1,133	$1,124	$1,116	$985	$976	$966	$957	$948	$938	$928	$919	$909	$898	$888	$878	$867	$856	$845
Cash Flow other GVHA Properties	-$750	-$750	-$750	-$750	-$750	-$750	-$750	-$750	-$750	-$750	-$750	-$750	-$750	-$750	-$750	-$750	-$750	-$750	-$750	-$750	-$750
Combined GVHA Net Cash Flow	-$2,424	$400	$391	$383	$374	$366	$235	$226	$216	$207	$198	$188	$178	$169	$159	$148	$138	$128	$117	$106	$95

APPENDIX F

CRUISE SHIP PASSENGER REQUEST FOR INFORMATION

APPENDIX F

Cruise Ship Passenger Request for Information (RFI)

The cruise ship passenger RFI is a facet of the Ogden Point Cruise Transportation Strategy (OPCTS). The OPCTS seeks solutions for efficient people movement. Key considerations for the strategy include:

1. High quality service to cruise passengers
2. Mitigation of impacts from transportation through the local neighbourhood
3. Environmental leadership
4. Impact to and from other capital plans and projects:
    a. Consolidated terminal building
    b. Master Plan
    c. Traffic and pedestrian flow reconfiguration
    d. Infrastructure requirements
5. Impact to shore excursion operations
6. Impact to existing cruise tourism transportation providers
7. Impact to GVHA revenues

The first step of the OPCTS was the development of the cruise ship passenger RFI. The purpose of this RFI was to obtain information from suppliers for all or parts of potential solutions for the movement of cruise ship passengers from OP to downtown Victoria.

The information gathered from the RFI process, along with data gathered through other means (i.e., Cruise ship passenger counts, Cruise ship traffic volume count, cruise ship passenger survey, and cruise ship traffic sound measurement), will be used to develop the OPCTS.

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APPENDIX G

OGDEN POINT CONTAMINANTS OF CONCERN SITE SUMMARY FOR MASTER PLAN

Summary of OP Site August 17, 2011

Excerpts from AECOM reports/emails

The Preliminary and Detailed Site Investigation Reports, and Environmental Risk Assessment for the Ogden Point Site were completed assuming a future set of land uses that is consistent with "commercial" and/or "industrial" land use as formally defined under the BC *Environmental Management Act.* Any proposals to change the current land use (commercial/industrial) to a more sensitive land use such as residential or urban parkland could invalidate some of the assumptions and conclusions from the earlier site assessment and risk assessment work.

A review of site development and the historical and current land uses that have occurred on the property are provided in the UMA (2006) PSI Addendum report. Based on the findings of that report, the Areas of Potential Environmental Concern (APECs) and Potential Contaminants of Concern (PCOCs) were identified and are presented in the table below.

Location	APEC	Activity	PCOCs
Area A	A1: Helijet Airways, northwest portion of Lot 1.	Storage of Jet A1 fuel in UST and refuelling activities. Infilling of the harbour-front beneath this area occurred at a later date than the major portion of Area A (1970s).	Hydrocarbons, metals or other contaminants from unclean fill.
	A2: Mercury Marine maintenance shop, north potion o Lot 1, east of Helijet Airways.	Servicing of marine engines, storage of small craft and sale of parts. Waste solvent and used engine oil collection. Fill of unknown origin is present in this area.	Hydrocarbons, metals, solvents. Other contaminants from unclean fill.
	A3: Trotac Marine located east of Mercury Marine, north portion of Lot 1.	Trotac Marine periodically handles and/or stores fuel on the north end of their property and fill of unknown origin is present in this area.	Hydrocarbons, metals. Other contaminants from unclean fill.
	A4: Westcan Terminals freight and storage shed located on Pier A.	Loading and off loading of cargo ships mainly for pulp and paper products and maintenance of machinery including forklifts, trucks and hydraulic equipment.	Hydrocarbons, metals, solvents.
	A5: Pier B, including former grain elevator silos, boiler house, freight and coal shed.	Panama Pacific Grain Terminals (Victoria Elevator Co., Alberta Wheat Pool) stored and shipped grain. Two USTs, one diesel and one furnace oil was identified and removed by Stevens Management, no soil or groundwater samples had been collected.	Hydrocarbons, PCBs (from demolition of electrical equipment).
	A6: Former lumber dip tank built east of east end of Pier B.	Built in 1952 by Western Lumber Carriers and used to treat lumber before export. Tank was filled in after a few years of use.	Wood preservatives, suspected to be Creosote by CP/WTI (1999). May also include chlorinated phenolics.
	A7: Upland area between Pier A and B, former location of cold storage plant and utilities building.	Victoria Cold Storage and Terminal Warehouse Co. and BC Packers Ltd. operated a fish packing plant complete with fish oil tanks.	Metals, refrigerants, PCBs (from demolition of electrical equipment).
	A8: West end of Pier B.	Scrap metal storage by Capital Iron.	Metals
	A9: Former CN rail line which ran northwest to southeast across Lot 1 and former branch lines.	CN Rail line ran across property connecting Piers A and B to a CNR ferry slip formerly located north of Pier B.	Hydrocarbons, metals.
	A10: Uplands of Ogden Point Public Port Facility, Piers A and B.	Ogden Point PPF and piers were reported to have been constructed using fill material dredged from Victoria Inner Harbour and "may be contaminated to some degree with heavy metals and PAHs". Uplands area was also used as lumber storage.	Metals, PAHs, other hydrocarbons.

Area B	James Bay Anglers Boat Ramp, northern portion of Lot 1.	Possible use of poor quality fills during the infilling activities of Victoria Harbour.	Metals, PAHs, other hydrocarbons.
Area C	C1: South Shore Greenway, west of Pacific Pilotage Wharf and east of Pier A along the southern shore of Lot 1.	Former location of Western Lumber Carriers vehicle maintenance building and Island Jetfoil. 5 USTs were located at this site. 4 USTs were removed by CP/WTI in 1998. Whether the 5th UST was abandoned or removed is unknown.	Metals, PAHs, other hydrocarbons.
	C2: Former CN Rail locomotive shed.	Historically located just west of the Ogden Point entrance off Dallas Road at Montreal Street.	Metals, PAHs, other hydrocarbons.
Area D	Westcan Terminals former repair shop and maintenance yard located on the east side of Lot 1 next to Dallas Road.	Currently the building is now used for storage. 4 USTs and 3 ASTs were located in this area by CP/WTI. An additional AST was located at the Westcan Terminals Office building south of the storage building.	Possible metals and hydrocarbon contamination around USTs, ASTs and possible contamination from fuelling/servicing vehicles.
Area E	Water Lot.	Possible contamination of surface water and sediments due to historical shipping activities, infilling of Victoria Harbour, surface and groundwater flow from upland areas and subsurface soils.	Metals, hydrocarbons, PCBs, PAHs.

OP Water lot

Three areas of the water lot appear to have the greatest number of and concentrations of chemical contaminates. These areas are:

1. Adjacent to the north side of Pier B
2. Area between Piers A & B
3. South side of Pier A west of Pacific Pilotage wharf & south shore greenway

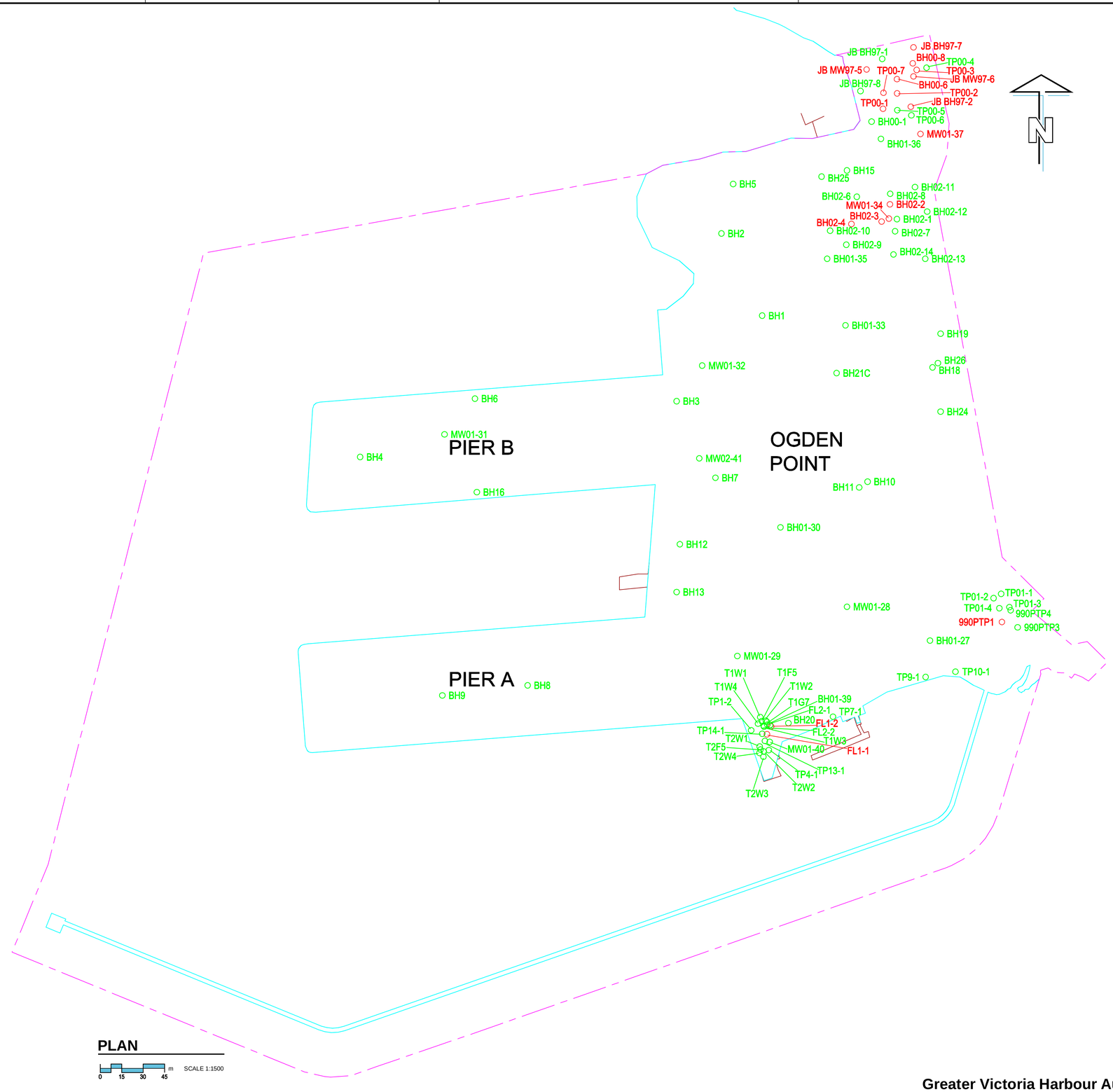
Contaminates of concern associated with these areas include –

- Arsenic, copper, lead, zinc
- Total PCBs
- Naphthalene, acenaphthylene, acenaphthene, fluorine, phenanthrene, anthracene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(a)pyrene, dibenz(a)anthracene, 2-methylnaphthalene and Total PAHs.

Subsequent to the technical work of this assignment, GVHA commissioned further environmental site characterization work by others in order to further delineate specific site contamination issues. A graphical summary of this work is incorporated here for completeness and to provide the reader with further insight into the nature of the issues.

AEC 1 - Ogden Point Public Port Facility					
Sample ID	Depth (cm)	Parameter	Result (µg/g)	BC CSR CL Standard (µg/g)	BC CSR Schedule, Exposure Scenario
FL1-1	Not available	Zinc	2110	300*	Sch. 5, Eco AW
FL1-1	Not available	Zinc	1940	600*	Sch. 5, Eco TSIP
FL1-1	Not available	Zinc	1590	600*	Sch. 5, Eco TSIP
99OPTP1	Not available	Zinc	1270	300*	Sch. 5, Eco AW
99OPTP1	Not available	Cadmium	2.3	2*	Sch. 5, Eco AW
99OPTP1	Not available	Chromium	96.3	60	Sch. 5, Eco AW
T3F6	Not available	Zinc	203	150*	Sch. 5, Eco AW
MW01-34	0.46	Antimony	71	40	Sch. 4
MW01-34	0.46	Arsenic	142	25	Sch. 5, Eco AW
MW01-34	0.46	Chromium	77	60	Sch. 5, Eco AW
MW01-34	0.76	Arsenic	186	25	Sch. 5, Eco AW
MW01-37	2.44	Sodium	1290	1000	Sch. 5, Eco TSIP
BH02-2-2	1.1	Zinc	663	600*	Sch. 5, Eco TSIP
BH02-2-3	1.9	Zinc	606	600*	Sch. 5, Eco TSIP
BH02-2-4	2.7	Zinc	705	600*	Sch. 5, Eco TSIP
BH02-3-2	1	Zinc	567	300*	Sch. 5, Eco AW
BH02-3-4	1.9	Sodium	1510	1000	Sch. 5, Eco TSIP
BH02-3-5	2.5	Sodium	1770	1000	Sch. 5, Eco TSIP
BH02-4-1	0.5	Chromium	81	60	Sch. 5, Eco AW
EX02-4-3	0.5	Arsenic	40	25	Sch. 5, Eco AW
EX02-4-3	0.5	Beryllium	20	8	Sch. 4
EX02-4-3	0.5	Chromium	204	60	Sch. 5, Eco AW
EX02-4-3	0.5	Copper	254	250*	Sch. 5, Eco TSIP
EX02-4-3	0.5	Silver	59	40	Sch. 4
EX02-4-3	0.5	Sodium	1290	1000	Sch. 5, Eco TSIP
EX02-4-12	1.2	Lead	3930	1000*	Sch. 5, HH
EX02-4-12	1.2	Zinc	690	600*	Sch. 5, Eco TSIP
EX02-4-13	1.2	Zinc	668	600*	Sch. 5, Eco TSIP
EX02-4-16	1.2	Copper	575	250*	Sch. 5, Eco TSIP
EX02-5-4	1.4	Copper	524	250*	Sch. 5, Eco TSIP

AEC 2 - James Bay Boat Launch					
Sample ID	Depth (cm)	Parameter	Result (µg/g)	BC CSR CL Standard (µg/g)	BC CSR Schedule, Exposure Scenario
BH00-8	0.4	Arsenic	29	25	Sch. 5, Eco AW
		Chromium	249	60	Sch. 5, Eco AW
		Copper	1020	250*	Sch. 5, Eco TSIP
		Lead	1110	1000*	Sch. 5, HH
		Zinc	1470	300*	Sch. 5, Eco AW
BH00-8	2.3	Arsenic	46	25	Sch. 5, Eco AW
		Cadmium	3.8	2*	Sch. 5, Eco AW
		Chromium	93	60	Sch. 5, Eco AW
		Copper	1510	250*	Sch. 5, Eco TSIP
		Lead	11800	1000*	Sch. 5, HH
		Zinc	18300	150*	Sch. 5, Eco AW
		Sodium	1070	1000	Sch. 5, Eco TSIP
BH00-6	0.4	Sodium	1890	1000	Sch. 5, Eco TSIP
BH00-6	2.3	Copper	317	250*	Sch. 5, Eco TSIP
		Lead	1090	1000*	Sch. 5, HH
		Sodium	2860	1000	Sch. 5, Eco TSIP
TP00-1	2.3	Sodium	1830	1000	Sch. 5, Eco TSIP
TP00-2	2.4	Sodium	1280	1000	Sch. 5, Eco TSIP
TP00-3	0.8	Sodium	1400	1000	Sch. 5, Eco TSIP
TP00-3	2.5	Sodium	2700	1000	Sch. 5, Eco TSIP
TP00-5	2.5	Sodium	3660	1000	Sch. 5, Eco TSIP
TP00-7	2.4	Sodium	1830	1000	Sch. 5, Eco TSIP
JB BH97-1	1.5	Arsenic	98.2	25	Sch. 5, Eco AW
		Cadmium	4.6	2*	Sch. 5, Eco AW
		Chromium	149	60	Sch. 5, Eco AW
		Copper	1480	250*	Sch. 5, Eco TSIP
		Lead	1970	1000*	Sch. 5, HH
		Zinc	1920	600*	Sch. 5, Eco TSIP
JB BH97-2	2	Zinc	1940	600*	Sch. 5, Eco TSIP
JB MW97-5	2	Chromium	61.1	60	Sch. 5, Eco TSIP
		Copper	1040	250*	Sch. 5, Eco TSIP
		Lead	1140	1000*	Sch. 5, HH
		Zinc	2100	600*	Sch. 5, Eco TSIP
JB MW97-6	2.1	Chromium	266	60	Sch. 5, Eco AW
		Copper	616	250*	Sch. 5, Eco TSIP
		Lead	2070	1000*	Sch. 5, HH
		Zinc	2090	600*	Sch. 5, Eco TSIP
JB BH97-7	0.9	Copper	531	250*	Sch. 5, Eco TSIP
		Lead	5420	1000*	Sch. 5, HH
		Zinc	1870	600*	Sch. 5, Eco TSIP
AW - aquatic life					
TSIP - toxicity to soil invertebrates and plants					
HH - Human Health					
UTM Coordinates not available for EX02 series or T3F6. These soil samples were remediated by excavation and are no longer present on site.					



LEGEND

- SHORELINE
- SITE BOUNDARY
- BH02-2 > BC CSR SOIL CRITERIA FOR TYPICAL SITES
- BH9 < BC CSR SOIL CRITERIA FOR TYPICAL SITES

PLAN

0 15 30 45 m SCALE 1:1500

Greater Victoria Harbour Authority
Ogden Point Soil Quality
Ogden Point - Victoria Harbour

AECOM

Figure A-1

A1 SIZE 23.39" x 33.11" (594mm x 841mm)

PLOT: 11/07/12 9:55:41 AM

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A1 SIZE 23.39" x 33.11" (594mm x 841mm)

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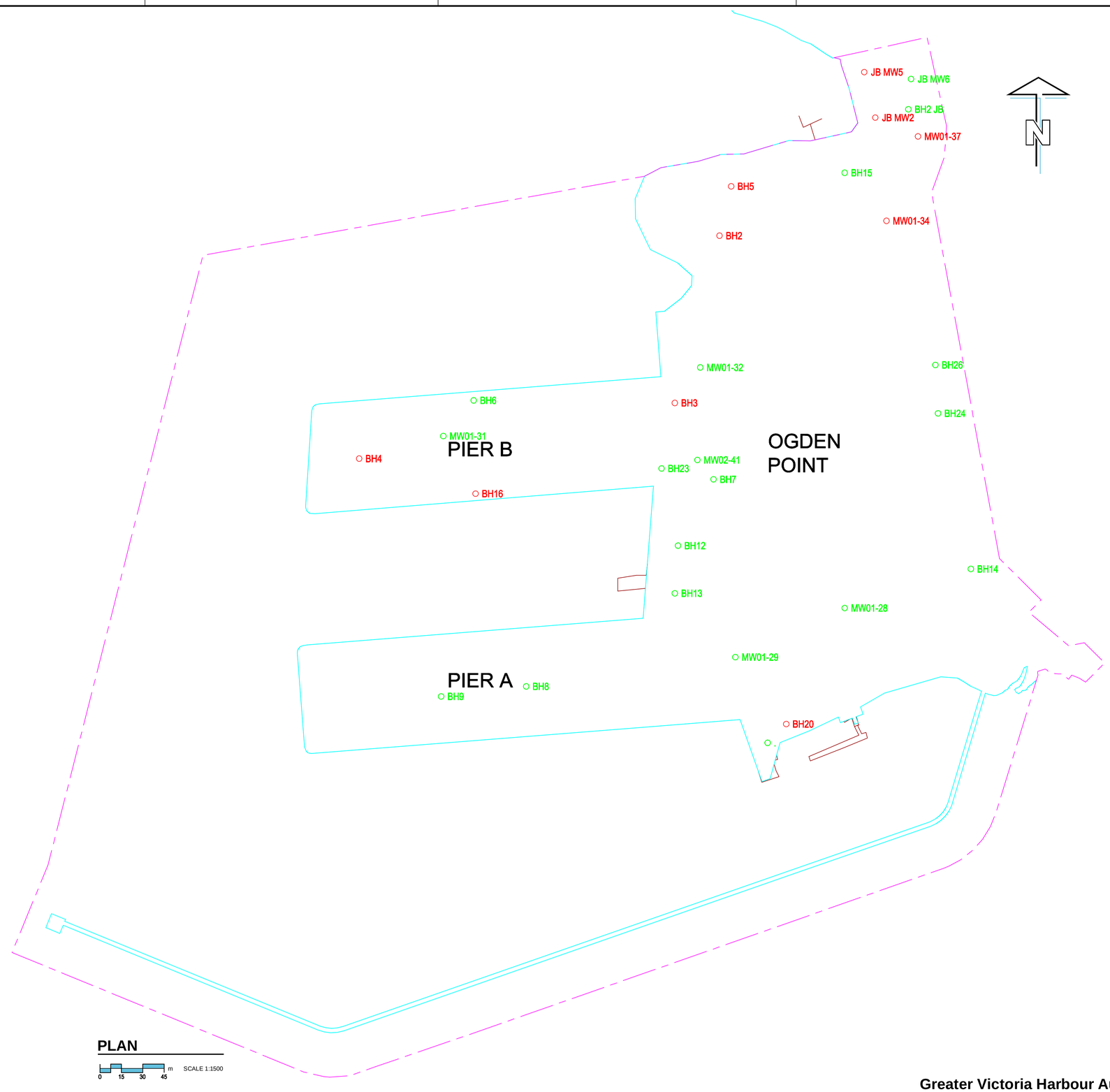
AECOM FILE NAME: 60157484-00-H-F03-R0X.dwg Saved By: tangyx

AEC 1 - Ogden Point Public Port Facility					
Sample ID	Sample Year	Parameter	Result (µg/L)	BC CSR CL AW-m Standard (µg/L)	BC CSR CL DW Standard (µg/L)
BH2	1997	Cadmium	2	1	5
BH2	1997	Zinc	110	100	5000
BH2	1997	Benzo(a)pyrene	0.03	0.1	0.01
BH2	2001	Arsenic	14	125	10
BH4	1997	Cadmium	1.2	1	5
BH20	1997	Cadmium	4	1	5
BH3	1999	Arsenic	60	125	10
BH5	1999	Arsenic	80	125	10
BH5	1997	Benzo(a)pyrene	0.04	0.1	0.01
BH16	1997	Benzo(a)pyrene	0.11	0.1	0.01
BH16	1997	Pyrene	0.23	0.2	-
MW01-34	2001	Cadmium	1.7	1	5
MW01-34	2001	Zinc	310	100	5000
MW01-37	2001	Zinc	160	100	5000

AEC 2 - James Bay Boat Launch					
Sample ID	Sample Year	Parameter	Result (µg/L)	BC CSR CL AW-m Standard (µg/L)	BC CSR CL DW Standard (µg/L)
JB MW2	1999	Arsenic	170	125	10
JB MW5	1999	Arsenic	110	125	10
BC CSR - BC Contaminated Sites Regulation					
CL - Commercial Landuse					
AW-m - Aquatic Life Marine					
DW - Drinking Water					



PLAN

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LEGEND

- SHORELINE
- SITE BOUNDARY
- BH20 > BC CSR GROUNDWATER CRITERIA FOR TYPICAL SITES
- BH9 < BC CSR GROUNDWATER CRITERIA FOR TYPICAL SITES

Greater Victoria Harbour Authority
Ogden Point Groundwater Quality
Ogden Point - Victoria Harbour

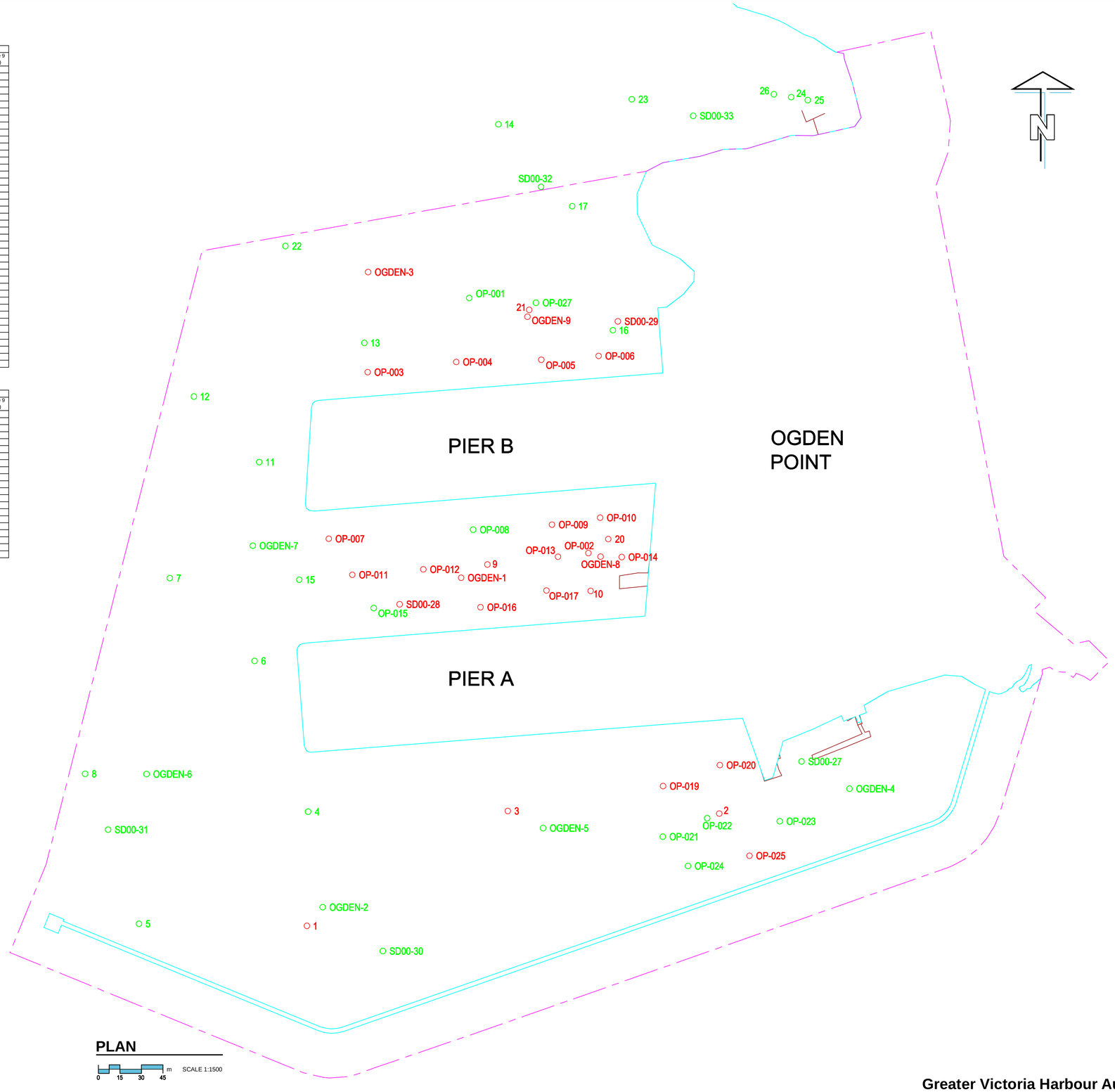
AECOM

Figure B-1

Between Piers A and B					
Sample ID	Depth (cm)	Parameter	Result (µg/g)	BC CSR Schedule 9 SedQCTS (µg/g)	BC CSR Schedule 9 SedQCSS (µg/g)
9,10,20	0-10	Lead	140	130	69
9,10,20	0-10	Total PCBs	0.27	0.23	0.12
9,10,20	0-10	Benz(a)anthracene	0.9	0.83	0.43
9,10,20	0-10	Chrysene	1	1	0.52
9,10,20	0-10	Pyrene	1.94	1.7	0.87
9,10,20	0-10	Benzo(a)pyrene	0.92	0.92	0.47
9,10,20	0-10	Acenaphthene	0.26	0.11	0.055
9,10,20	0-10	Anthracene	0.7	0.29	0.15
9,10,20	0-10	Fluoranthene	1.84	1.8	0.93
9,10,20	0-10	Fluorene	0.3	0.17	0.089
9,10,20	0-10	Phenanthrene	1.74	0.65	0.34
20	0-10	Lead	163	130	69
20	0-10	Benz(a)anthracene	1.06	0.83	0.43
20	0-10	Chrysene	1.24	1	0.52
20	0-10	Pyrene	2.87	1.7	0.87
20	0-10	Benzo(a)pyrene	1.08	0.92	0.47
20	0-10	Acenaphthene	0.26	0.11	0.055
20	0-10	Anthracene	0.62	0.29	0.15
20	0-10	Fluoranthene	2.3	1.8	0.93
20	0-10	Fluorene	0.3	0.17	0.089
20	0-10	Phenanthrene	2.11	0.65	0.34
SD00-28	0-10	Chrysene	1.2	1	0.52
SD00-28	0-10	Acenaphthene	0.2	0.11	0.055
SD00-28	0-10	Anthracene	0.49	0.29	0.15
SD00-28	0-10	Fluorene	0.22	0.17	0.089
Ogden-1	0-10	Acenaphthene	0.221	0.11	0.055
Ogden-1	0-10	Anthracene	0.454	0.29	0.15
Ogden-1	0-10	Benz(a)anthracene	0.954	0.83	0.43
Ogden-1	0-10	Fluoranthene	2.56	1.8	0.93
Ogden-1	0-10	Fluorene	0.285	0.17	0.089
Ogden-1	0-10	Phenanthrene	2.37	0.65	0.34
Ogden-1	0-10	Pyrene	2.77	1.7	0.87
Ogden-1	10-20	Acenaphthene	0.14	0.11	0.055
Ogden-1	10-20	Anthracene	0.43	0.15	0.079
Ogden-1	10-20	Fluorene	0.18	0.17	0.089
Ogden-1	10-20	Phenanthrene	1.35	0.65	0.34
Ogden-1	10-20	Pyrene	1.82	1.7	0.87
Ogden-1	30-40	Lead	205	130	69
Ogden-1	30-40	Mercury	1.41	0.84	0.43
Ogden-1	30-40	Phenanthrene	0.907	0.65	0.34
Ogden-1	30-40	Total PCBs	0.41	0.23	0.12
Ogden-1	50-60	Acenaphthene	0.28	0.11	0.055
Ogden-1	50-60	Anthracene	0.67	0.29	0.15
Ogden-1	50-60	Fluoranthene	1.81	1.8	0.93
Ogden-1	50-60	Fluorene	0.27	0.17	0.089
Ogden-1	50-60	Phenanthrene	1.89	0.65	0.34
Ogden-1	50-60	Pyrene	2	1.7	0.87
Ogden-1	90-100	Acenaphthene	0.27	0.11	0.055
Ogden-1	90-100	Anthracene	0.562	0.29	0.15
Ogden-1	90-100	Fluorene	0.268	0.17	0.089
Ogden-1	90-100	Phenanthrene	1.81	0.65	0.34
Ogden-8	0-10	Lead	168	130	69
Ogden-8	0-10	Mercury	1.01	0.84	0.43
Ogden-8	0-10	Acenaphthylene	0.277	0.15	0.079
Ogden-8	0-10	Acenaphthene	0.159	0.11	0.055
Ogden-8	0-10	Fluorene	0.194	0.17	0.089
Ogden-8	0-10	Phenanthrene	1.45	0.65	0.34
Ogden-8	0-10	Anthracene	1.22	0.29	0.15
Ogden-8	0-10	Fluoranthene	5.19	1.8	0.93
Ogden-8	0-10	Pyrene	11.6	1.7	0.87
Ogden-8	0-10	Benzo(a)anthracene	4.21	0.83	0.43
Ogden-8	0-10	Chrysene	4.26	1	0.52
Ogden-8	0-10	Dibenz(a,h)anthracene	0.305	0.16	0.084
Ogden-8	0-10	Benzo(a)pyrene	3.67	0.92	0.47
Ogden-8	0-10	Total PCBs	1.17	0.23	0.12
OP-002	0-10	Total PCBs	1.1	0.23	0.12
OP-002	0-10	Lead	332	130	69
OP-002	0-10	Zinc	700	330	170
OP-002	0-10	Acenaphthylene	0.49	0.15	0.079
OP-002	0-10	Acenaphthene	0.12	0.11	0.055
OP-002	0-10	Fluorene	0.19	0.17	0.089
OP-002	0-10	Phenanthrene	1.1	0.65	0.34
OP-002	0-10	Anthracene	0.67	0.29	0.15
OP-002	0-10	Fluoranthene	4.6	1.8	0.93
OP-002	0-10	Pyrene	5.7	1.7	0.87
OP-002	0-10	Benzo(a)anthracene	2.4	0.83	0.43
OP-002	0-10	Chrysene	2.5	1	0.52
OP-002	0-10	Benzo(a)pyrene	2.7	0.92	0.47
OP-002	0-10	Dibenz(a,h)anthracene	0.37	0.16	0.084
OP-002	0-10	Total PAH	29	20	10
OP-003	0-10	Arsenic	361	50	26
OP-003	0-10	Copper	307	130	67
OP-003	0-10	Lead	259	130	69
OP-003	0-10	Zinc	564	330	170
OP-007	0-10	Acenaphthylene	0.17	0.15	0.079
OP-007	0-10	Acenaphthene	0.81	0.11	0.055
OP-007	0-10	Fluorene	1.2	0.17	0.089
OP-007	0-10	Phenanthrene	6.6	0.65	0.34
OP-007	0-10	Anthracene	0.65	0.29	0.15
OP-007	0-10	Fluoranthene	5.8	1.8	0.93
OP-007	0-10	Pyrene	4.3	1.7	0.87
OP-007	0-10	Chrysene	1.4	1	0.52
OP-007	0-10	Total PAH	25	20	10
OP-009	0-10	Copper	1470	130	67
OP-009	0-10	Lead	152	130	69
OP-009	0-10	Acenaphthylene	0.74	0.15	0.079
OP-009	0-10	Anthracene	0.66	0.29	0.15
OP-009	0-10	Pyrene	5.2	1.7	0.87
OP-009	0-10	Benzo(a)anthracene	2.6	0.83	0.43
OP-009	0-10	Chrysene	2.4	1	0.52
OP-009	0-10	Benzo(a)pyrene	2.1	0.92	0.47
OP-009	0-10	Dibenz(a,h)anthracene	0.28	0.16	0.084
OP-009	0-10	Total PAH	22	20	10
OP-010	0-10	Copper	179	130	67
OP-010	0-10	Lead	483	130	69
OP-010	0-10	Acenaphthene	0.31	0.11	0.055
OP-010	0-10	Fluorene	0.57	0.17	0.089
OP-010	0-10	Phenanthrene	3.9	0.65	0.34
OP-010	0-10	Anthracene	1.1	0.29	0.15
OP-010	0-10	Fluoranthene	3.7	1.8	0.93
OP-010	0-10	Pyrene	3.5	1.7	0.87
OP-010	0-10	Benzo(a)anthracene	1.3	0.83	0.43
OP-010	0-10	Chrysene	1.3	1	0.52
OP-010	0-10	Benzo(a)pyrene	1.2	0.92	0.47
OP-010	0-10	Total PAH	21	20	10
OP-011	0-10	Total PCBs	0.4	0.23	0.12
OP-012	0-10	Lead	140	130	69
OP-012	0-10	Phenanthrene	0.83	0.65	0.34
OP-013	0-10	Total PCBs	0.6	0.23	0.12
OP-013	0-10	Lead	146	130	69
OP-013	0-10	Acenaphthene	0.14	0.11	0.055
OP-013	0-10	Fluorene	0.23	0.17	0.089
OP-013	0-10	Phenanthrene	1.3	0.65	0.34
OP-013	0-10	Anthracene	0.41	0.29	0.15
OP-013	0-10	Pyrene	2.1	1.7	0.87
OP-014	0-10	Total PCBs	1.8	0.23	0.12
OP-014	0-10	Lead	441	130	69
OP-014	0-10	Acenaphthene	0.16	0.11	0.055
OP-014	0-10	Fluorene	0.2	0.17	0.089
OP-014	0-10	Phenanthrene	1.3	0.65	0.34
OP-014	0-10	Anthracene	0.46	0.29	0.15
OP-014	0-10	Pyrene	2.3	1.7	0.87
OP-016	0-10	Lead	133	130	69
OP-017	0-10	Lead	961	130	69
OP-017	0-10	Fluorene	0.42	0.17	0.089
OP-017	0-10	Phenanthrene	1.1	0.65	0.34
OP-017	0-10	Anthracene	1.6	0.29	0.15
OP-017	0-10	Benzo(a)anthracene	0.88	0.83	0.43
OP-017	0-10	Chrysene	1.1	1	0.52

South of Pier A					
Sample ID	Depth (cm)	Parameter	Result (µg/g)	BC CSR Schedule 9 SedQCTS (µg/g)	BC CSR Schedule 9 SedQCSS (µg/g)
1,2,3	0-10	Total PCBs	0.34	0.23	0.12
OP-019	0-10	Acenaphthene	0.16	0.11	0.055
OP-019	0-10	Phenanthrene	1.2	0.65	0.34
OP-019	0-10	Anthracene	0.33	0.29	0.15
OP-019D	0-10	Acenaphthene	0.7	0.11	0.055
OP-019D	0-10	Fluorene	0.54	0.17	0.089
OP-019D	0-10	Phenanthrene	3.9	0.65	0.34
OP-019D	0-10	Anthracene	1.2	0.29	0.15
OP-019D	0-10	Fluoranthene	3.8	1.8	0.93
OP-019D	0-10	Pyrene	4	1.7	0.87
OP-019D	0-10	Benzo(a)anthracene	1.4	0.83	0.43
OP-019D	0-10	Chrysene	1.5	1	0.52
OP-019D	0-10	Benzo(a)pyrene	1.5	0.92	0.47
OP-019D	0-10	DiBenz(a,h)anthracene	0.17	0.16	0.084
OP-019D	0-10	Total PAH	23	20	10
OP-020	0-10	Acenaphthylene	2.7	0.15	0.079
OP-020	0-10	Acenaphthene	0.42	0.11	0.055
OP-020	0-10	Fluorene	0.54	0.17	0.089
OP-020	0-10	Phenanthrene	9.1	0.65	0.34
OP-020	0-10	Anthracene	4.4	0.29	0.15
OP-020	0-10	Fluoranthene	87	1.8	0.93
OP-020	0-10	Pyrene	62	1.7	0.87
OP-020	0-10	Benzo(a)anthracene	6	0.83	0.43
OP-020	0-10	Chrysene	11	1	0.52
OP-020	0-10	Benzo(a)pyrene	3.2	0.92	0.47
OP-020	0-10	DiBenz(a,h)anthracene	0.45	0.16	0.084
OP-020	0-10	Total PAH	200	20	10
OP-025	0-10	Naphthalene	0.9	0.47	0.24
OP-025	0-10	Acenaphthylene	0.35	0.15	0.079
OP-025	0-10	Acenaphthene	3.9	0.11	0.055
OP-025	0-10	Fluorene	3.4	0.17	0.089
OP-025	0-10	Phenanthrene	22	0.65	0.34
OP-025	0-10	Anthracene	5.7	0.29	0.15
OP-025	0-10	Fluoranthene	18	1.8	0.93
OP-025	0-10	Pyrene	18	1.7	0.87
OP-025	0-10	Benzo(a)anthracene	7.3	0.83	0.43
OP-025	0-10	Chrysene	7.2	1	0.52
OP-025	0-10	Benzo(a)pyrene	6.5	0.92	0.47
OP-025	0-10	DiBenz(a,h)anthracene	0.92	0.16	0.084
OP-025	0-10	Total PAH	110	20	10
BC CSR - BC Contaminated Sites Regulation					
SedQCTS - Sediment Quality Criteria for Typical Sites					
SedQCTSS - Sediment Quality Criteria for Sensitive Sites					

North of Pier B					
Sample ID	Depth (cm)	Parameter	Result (µg/g)	BC CSR Schedule 9 SedQCTS (µg/g)	BC CSR Schedule 9 SedQCSS (µg/g)
21	0-10	Acenaphthene	0.12	0.11	0.055
21	0-10	Anthracene	0.32	0.29	0.15
21	0-10	Phenanthrene	1.04	0.65	0.34
SD00-29	0-10	Lead	153	130	69
SD00-29	0-10	Phenanthrene	0.76	0.65	0.34
Ogden-9	0-10	Total PCBs	0.453	0.23	0.12
Ogden-3	0-10	Phenanthrene	0.72	0.65	0.34
OP-004	0-10	Arsenic	144	50	26
OP-004	0-10	Lead	131	130	69
OP-004	0-10	Phenanthrene	1.1	0.65	0.34
OP-004	0-10	Anthracene	0.3	0.29	0.15
OP-004	0-10	Fluoranthene	4.4	1.8	0.93
OP-004	0-10	Pyrene	3.6	1.7	0.87
OP-004	0-10	Benzo(a)anthracene	1.1	0.83	0.43
OP-004	0-10	Chrysene	2.5	1	0.52
OP-005	0-10	Total PCBs	3.3	0.23	0.12
OP-005	0-10	Lead	485	130	69
OP-006	0-10	Lead	258	130	69
BC CSR - BC Contaminated Sites Regulation					
SedQCTS - Sediment Quality Criteria for Typical Sites					
SedQCTSS - Sediment Quality Criteria for Sensitive Sites					



PLAN

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LEGEND

SHORELINE

SITE BOUNDARY

OP-025 > BC CSR SEDIMENT CRITERIA FOR TYPICAL SITES

OGDEN-2 < BC CSR SEDIMENT CRITERIA FOR TYPICAL SITES

Greater Victoria Harbour Authority
Ogden Point Sediment Quality
Ogden Point - Victoria Harbour

AECOM

Figure C-1

A1 SIZE 23.39" x 33.11" (594mm x 841mm)

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APPENDIX H

VICTORIA HARBOUR MIGRATORY BIRD SANCTUARY

APPENDIX H

Victoria Harbour Migratory Bird Sanctuary

Victoria Harbour is part of a federally designated Migratory Bird Sanctuary. Although the boat and plane traffic in the inner harbour discourages most birds from feeding there, many different types can be seen in the outer areas and more sheltered coves in the harbour.

- Some of the most diverse populations of *diving ducks, mergansers and coots* in the local area occur in Victoria Harbour. These birds are present from late fall through to early spring, and include: Red-breasted Merganser; Common Goldeneye; Bufflehead; Hooded Merganser; Greater Scaup; American Coot; Oldsquaw Duck; and Surf Scoter.
- Large numbers of gulls can be seen year-round. The Glaucous-winged Gull is a resident species, while the Mew Gull is most common during the winter months.
- Among the *swans, geese and dabbling ducks*, the American Wigeon is among the most commonly observed species in Victoria Harbour, along with Mallards and Canada Geese.
- Loons and grebes are most numerous during the winter months in this area, including the Red-necked Grebe, Pacific Loon and Horned Grebe.
- Shorebirds are not seen in large numbers in Victoria Harbour, although this may be due partly to the difficulties in accessing the remaining fragments of natural shoreline. Nevertheless, species such as Western Sandpiper, Black-bellied Plover and Black Oystercatcher have been sighted.

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APPENDIX I

RENEWABLE POWER GENERATION CONCEPTUAL PLAN FOR OGDEN POINT, VICTORIA

Subsequent to the technical work of this assignment, GVHA commissioned further work by others to investigate opportunities for renewable power generation at the Ogden Point site. The resulting report is incorporated here to provide the reader with further insight into the nature of the opportunities and issues that may exist in this sector.

JORDAN FISHER & ASSOCIATES

Renewable Power Generation
Conceptual Plan for Ogden Point, Victoria

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Synopsis

This report examines, with a 5, 10, and 20-year outlook, the potential for renewable energy generation at Ogden Point using solar, wind, tidal, wave, ocean-thermal, biomass, and geo-exchange technologies, based on available information. Consideration was given to capital and operational costs, implications for master planning, emissions of greenhouse gases (GHGs) and conventional air pollutants; discussion of other considerations relevant to stakeholders is included.

It was found that solar, geo-exchange, and biomass are likely viable energy technologies for this site over the time period considered, and that wind, tidal, wave, and ocean-thermal are not. Geo-exchange has significant potential to provide economically competitive space heating and domestic hot water. Further information about what will be built on site is required to undertake a more detailed assessment; it is recommended that such assessments be integrated with master planning efforts going forward. Solar photovoltaic panels (PVs) are not currently competitive from a financial perspective, but if current trends of increasing energy costs and decreasing technology costs continue it will become viable in the next 10-20 years. It is recommended that master planning incorporate “future-readiness” so this technology can be taken advantage of in the future. Biomass is very attractive from a technical and financial perspective, but it has the potential for other significant concerns on this particular site that should be fully considered before the technology is investigated further. Wind energy is technically feasible but the site conditions are marginal and costs would be very high. The other technologies were not thought to be at all viable for this site.

Table 1, below, gives a conceptual overview of the various renewable energy technologies examined in this report. It describes the type of energy they produce (heat, electricity, or both), the potential quantity of energy they could generate on the site (high, medium, or low), cost (with more “$” symbols indicating the total expected costs are higher), the timeline over which the technology may become feasible, and the degree of other potential concerns for using the technology at this specific site (high, medium, or low). These include aesthetics, noise, and other issues that may be of concern to stakeholders.

Table 1: Technology Summary

Technology	Energy Type	Potential Quantity	Cost Magnitude	Other Potential Concerns	Feasibility Outlook
Geo-exchange	Heat	Moderate	$$	Low-Moderate	Immediate
Solar PV	Electric	Low-Moderate	$$$$$$ (⇓[1])	Low	10-20yrs
Biomass	Electric & Heat	High	$	High	Immediate
Wind	Electric	Low	$$$$$$$$$$$$$$	Med	Not foreseeable
Tidal	Electric	NA			
Wave	Electric				
Ocean-Thermal	Electric				

If electrical energy were to be generated on site it would likely be most appropriate for this power to be sold to BC Hydro through the Standing Offer Program. Also considered was the potential for renewable energy infrastructure to be used as the source of power for cruise ships, should shore power infrastructure be developed. Due to the enormous energy demand of the ships relative to the capacity to generate power on site, and the intermittency of this demand (and in most cases supply), attempting to use renewable energy generated on site to power ships would be impractical.

[1] The ⇓ symbol indicates that the price of this technology is rapidly declining

Plan Overview and Objectives

This report examines the potential for renewable power generation at Ogden Point with a 5, 10, and 20-year outlook. It addresses the potential for a broad range of renewable energy technologies including solar, wind, tidal, wave, ocean-thermal, biomass, and geo-exchange. Each was assessed to determine whether it was likely to be a good fit for Ogden Point given the site conditions and available technology. While this assessment is intended to be at a conceptual level, more detailed information has been presented where available.

Capital and operational costs, and potential for energy production, were estimated based on available information. The quantity and timing of energy production, and the ability to make use of this energy on or off-site, is also discussed. From this information, and assumptions about equipment life, and discount and escalation rates, levelized energy costs were determined. This allowed for a comparison to energy prices to ascertain whether potential revenues (or savings) made renewable energy technologies attractive from a financial perspective. Considerations of potential issues for larger site planning are also discussed. Master planning efforts are already well underway at Ogden Point, though it is not yet known what will be built. This report provides guidance to inform the planning process and maximize the chances that renewable energy can be incorporated into site development in both the short and long term.

Renewable energy solutions were also considered in light of their implications for GHG emissions and air quality. While a true “triple bottom line” assessment is beyond the scope of this report, other considerations for renewable energy technologies are discussed where appropriate. These include aesthetics, noise, and other potential stakeholder concerns. The report provides guidance to the Greater Victoria Harbour Authority (GVHA) that will help them make decisions about renewable energy going forward. The level of effort (and cost) that would be required to do a complete assessment of all potential renewable energy strategies would be prohibitive. This report provides GVHA direction on where to focus limited resources when undertaking more detailed analysis and planning efforts so there is maximum chance of success.

Planning Process

This report was prepared by Jordan Fisher and Associates Ltd. (JFA) in collaboration with EA Energy Alternatives Ltd. (EA) and the Sustainable Systems Design Lab, Institute for Integrated Energy Systems at the University of Victoria (UVic). Jordan Fisher, of JFA, was the prime consultant overseeing the project. EA, led by Kevin Pegg, provided wind and solar analyses and a variety of background information. UVic provided comparative wind and solar analyses and a variety of information on other technologies. Eric Hoevenaars conducted this work under the supervision of Dr. Curran Crawford. Hummingbird Urban Biomass Ltd. provided information on biomass systems and related costs and revenues. JFA conducted background research, supervised the technical analysis, synthesized all information, conducted the financial analysis, and produced the report.

JFA began by working with GVHA to define the scope of the report and the process used to produce it. It was originally planned that this project would be completed in conjunction with master planning efforts, though due to delays in those efforts the consulting team was unable to participate as part of the larger master planning team. Specific information was not yet available regarding what will be built on site so a more generalized approach was used where necessary. This report can inform future planning efforts and it is recommended that as the master planning process moves forward an integrated planning, design, and management process be used to ensure renewable energy (and other) considerations are effectively integrated.

Trends in Renewable Power Generation

Renewable Energy has been of increasing interest to a wide variety of energy users in part due to concerns about a broad range of environmental impacts associated with non-renewable energy (e.g. fossil fuels), including GHGs and air pollutants. Increasing demand for energy both locally and globally, and the limited availability of new energy sources, has resulted in increasing energy costs, a trend that is expected to continue.

BC Context

The BC Energy Plan, released in 2007, features 55 policy actions to address climate change and energy security. BC also established a new Innovative Clean Energy Fund to help develop clean and renewable energy technologies for British Columbians in areas such as solar, geothermal, tidal, wind, and bioenergy.[2] BC Hydro's Bioenergy Call for Power focuses on converting biomass into clean, cost-effective and carbon-neutral electricity. In 2007 the BC Government also announced a commitment to reduce province-wide GHG emissions to 33% below current levels by 2020 and 80% by 2050. Known as Bill 44, the Greenhouse Gas Reduction Targets Act[3] legally binds the Province to achieve these ambitious targets. Since that time, the BC Government has begun to develop plans and policies that will require and support all sectors of the province to contribute to this commitment.

At current levels BC already uses more electricity than it produces, requiring costly energy imports from other regions to satisfy 10-15% of electric needs. The BC Energy Plan mandates energy self-sufficiency by 2016. With energy demand projected to grow between 20-40% over the next 20 years, it is clear that a reduction in energy use and the development of new sources of energy are high priorities.[4]

Energy prices are generally expected to rise rapidly, though they can be difficult to predict, especially over the long term. This is especially true of fossil fuels, as prices fluctuate continually and are affected by a range of global issues that can be hard to foresee. Electricity prices are regulated in BC and somewhat easier to predict, at least in the shorter term. In March of this year BC Hydro announced plans to increase rates by about 10%/year over the next five years, though the Province has challenged this and

[2] The BC Energy Plan. http://www.energyplan.gov.bc.ca/
[3] Greenhouse Gas Reduction Targets Act (2008). http://www.env.gov.bc.ca/epd/codes/ggrta/
[4] Forecasting Growth, BC Hydro.
http://www.bchydro.com/planning_regulatory/meeting_demand_growth/forecasting_growth.html

it is currently uncertain exactly what will happen to rates. Nonetheless, it is reasonable to expect that in the coming years rates will increase significantly.

There is often a perception that the cost of renewable energy will decrease significantly in the near future. This may be true in some circumstances, though this notion often does not account for the fact that energy infrastructure costs are not just made up of technology that is continuously improving, but also raw materials (e.g. concrete, steel, copper) and soft costs (e.g. engineering, permitting), all of which are increasing. Of all the renewable technologies being considered solar photovoltaic panels (PVs) are most likely to see significant cost decreases. This technology is rapidly evolving and the panels themselves, which have dropped in price roughly 50% since 2007, make up a large portion of total system costs. Despite this, PVs are still very expensive relative to today's energy prices, but given that energy costs are increasing while PV costs are decreasing there is growing interest in designing buildings to be capable of easily incorporating PVs in the future.

In contrast to PVs, wind turbines are a fairly mature technology. While there is room for innovation, the cost of raw materials has gone up and turbine prices have actually increased slightly in recent years. As described in the Wind Energy section of this report, a large portion of costs for small wind sites relate not to the turbines themselves but to the associated infrastructure and soft costs. Geo-exchange and biomass technology are also improving, though these too have significant material and soft costs associated with their infrastructure. Nonetheless these technologies are seeing rapid uptake, as they can be very cost competitive and reduce reliance on fossil fuels.

There is an increasing trend towards better monitoring of energy use and production, which enables organizations to use energy more efficiently and make more effective use of renewable energy systems. While energy efficiency is not part of the scope of this report, no discussion on renewable energy would be complete without noting that the first priority should always be to maximize efficiency through good design and efficient equipment. Simply put, it is generally much cheaper to save energy than to produce it. It is highly recommended that an integrated design process be utilized as planning moves forward to ensure efficient and effective solutions are developed.

Solar Energy

Solar energy can be harvested in a number of ways, though the most common type of energy generation involves the use of photovoltaic panels (PVs). These panels are sometimes arranged in large "farms" to create power stations, and are often used on building rooftops for smaller scale generation. For the purposes of this report, a rooftop application of PVs is considered.

Solar panels have the advantage of not requiring any input of materials during their operation (unlike biomass). They have no moving parts (unless more complex systems that rotate the panels to track the sun are used), and therefore have relatively low operation and maintenance requirements. They do not produce any GHG or air pollutant emissions in their operation. They produce no noise and are not

generally considered to present aesthetic issues. These are all characteristics that make PVs an attractive option for renewable energy. Figure 1, below, shows an example of a rooftop PV array.

Figure 1: Rooftop PV Array

Analysis was done to estimate the potential for solar generated electricity at Ogden Point. First, modeling was done based on resource data obtained from the NASA Surface Solar Energy Data Set[5], which estimates the amount of solar energy falling on the site. This allowed for an estimate of the amount of energy that could be produced by PVs. Using assumptions on the capital and operating costs, and a 5% discount rate, a levelized cost of energy per kWh was determined. No cost for the use of the rooftop space (e.g. a lease) is included. This assessment was then compared to a more detailed study that was done in 2007 for a building at a nearby location, The Legislature.

[5] NASA Atmospheric Science Data Center. Surface Meteorology and Solar Energy. [Online] http://eosweb.larc.nasa.gov/sse/.

The modeling done for Ogden Point suggested that for each 1MWp of PV panels installed, between **1.27 GWh/yr** and **1.42 GWh/yr** can be generated, depending on the derating factor assumed (i.e. losses due to dirt, fog, shading, etc.). Costs were roughly estimated at about **$6.5 million per MWp** including installation. Using First Solar thin film modules, a popular model for PV plants, estimates were made on the amount of energy that could be generated over a given area. These panels have a footprint of 111 W_p/m^2, though they cannot all be placed side-by-side in practice and it was estimated 83 W_p/m^2 would be a more realistic estimate (conventional PV panels would produce more energy per m^2, though would not necessarily be cheaper per kWh). Based on these figures, we can expect generation between 105.8 kWh/yr/m^2 and 118.3 kWh/yr/m^2 at Ogden Point. Therefore, 1MWp of thin film PVs would occupy about 12,000m^2 of roof area. For comparison, the existing warehouse on the site is approximately 9,100m^2. Based on the above figures, a $5,000/yr operation and maintenance budget (escalating at 2%/year) and a 25 year equipment lifetime, the estimated levelized cost for photovoltaic generated energy on the site would be between **$0.33/kWh** and **$.37/kWh**.

The above figures can be compared with those from the 2007 Legislature study. That study found that for a system with 200kWp of photovoltaic panels about 246MWh/year could be generated. Therefore for each 1MWp, 1.23GWh/yr was expected, which is fairly close to the figures found in this analysis. The installed cost for the Legislature system in 2007 was estimated to be $2 million, or $10 million/MWp. While this figure is substantially higher than the $6.5million/MWp assumed in this study, as noted in the above section on Trends In Renewable Power Generation, the costs of PVs/MWp has been reduced by about 50% since 2007, though this would apply only to the panels themselves and not the installation costs. Given this, the $6.5million/MWp used in this study seems reasonable.

If photovoltaic panels were installed at Ogden Point the energy produced could either be used on site or sold back to BC Hydro. The exact costs of electricity that will be used at Ogden Point in the coming decades are difficult to estimate. Rates depend on the characteristics of the user and much uncertainty remains as to what site uses will be in the coming decades and what the energy use profile of those users will be. To complicate matters further BC Hydro's rates are changing rapidly and are difficult to predict over the long term. Currently, rates for residential users (who pay the highest rates for electricity) are less than $0.09/kWh. Rather than simply using energy on site, another option, with greater financial advantage, is to sell the energy to BC Hydro. Energy can be sold to BC Hydro either through the Standing Offer Program or the Clean Power Call (intended for larger producers). In this situation the Standing Offer Program is likely more appropriate. The Standing Offer Program is described by BC Hydro as follows:

"BC Hydro implemented a Standing Offer Program to encourage the development of small and clean or renewable energy projects throughout British Columbia. The program was developed to streamline the process for small developers selling electricity to BC Hydro, simplify the contract and decrease transaction costs for developers while remaining cost-effective for rate payers. The Standing Offer

Program embodies the principles and policies set out in the BC Energy Plan and the Clean Energy Act."[6]

Under this program energy producers are paid a base price, which is adjusted for the time of delivery and escalates yearly with the consumer price index. Energy delivered during periods of higher demand is purchased at a higher rate than during periods of lower demand. The rates consider the time of day that the energy is delivered as well as the month in which it is delivered. In general, rates are highest in the winter and lowest in the summer, and highest between 4pm and 8pm and lowest between 10pm and 6am. For the Vancouver Island region, the base price for 2010 was $101.25/MWh, or about **$0.10/kWh**. Table 2, below, outlines the off-peak, peak, and super peak rate adjustments from the base price for each month.

Table 2: BC Hydro Standing Offer Program Rate Adjustments

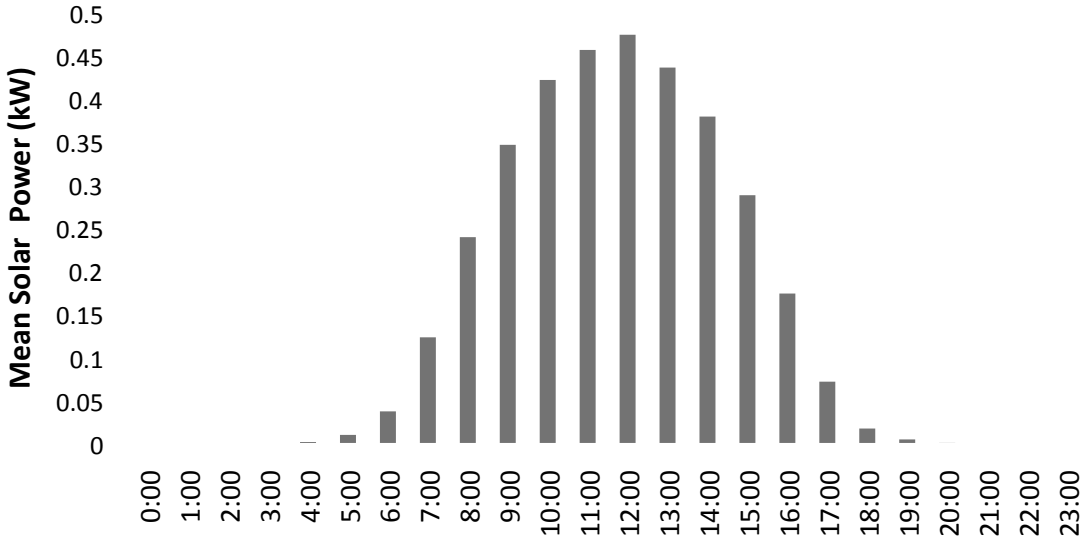
	Off-Peak	Peak	Super Peak
January	105%	122%	141%
February	101%	113%	124%
March	99%	112%	124%
April	85%	95%	104%
May	70%	82%	90%
June	69%	81%	87%
July	79%	96%	105%
August	86%	101%	110%
September	91%	107%	116%
October	93%	112%	127%
November	99%	112%	129%
December	104%	120%	142%

Source: BC Hydro

[6] http://www.bchydro.com/planning_regulatory/acquiring_power/standing_offer_program.html

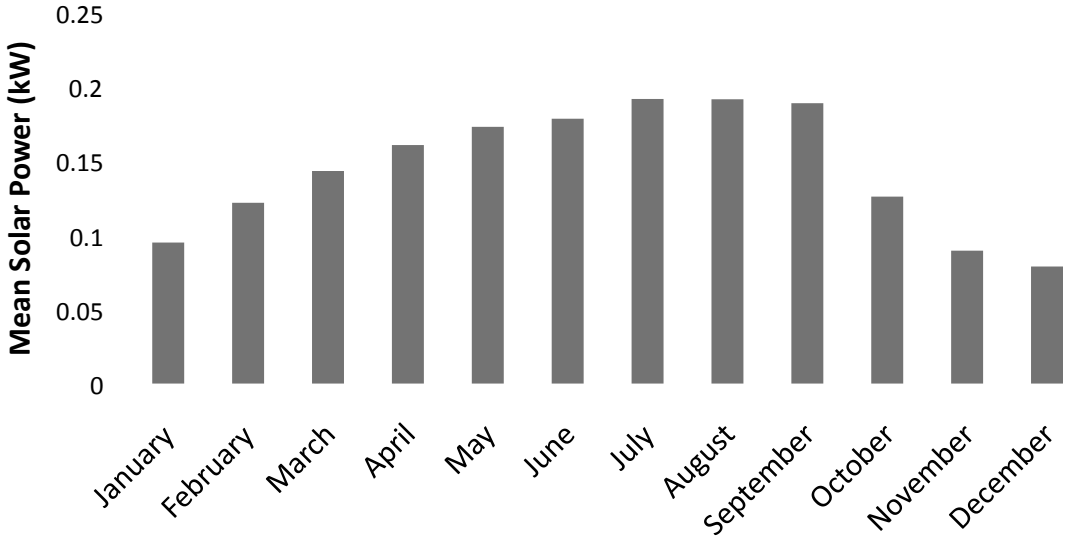
Figures 2 and 3, below, show the diurnal (i.e. daily) and monthly distribution of solar energy on the site.

Figure 2: Diurnal Distribution of Solar Energy



Source: analysis based on data from the NASA Surface Solar Energy Data Set[7].

Figure 3: Monthly Distribution of Solar Energy



Source: analysis based on data from the NASA Surface Solar Energy Data Set[8].

[7] NASA Atmospheric Science Data Center. Surface Meteorology and Solar Energy. [Online] http://eosweb.larc.nasa.gov/sse/.
[8] NASA Atmospheric Science Data Center. Surface Meteorology and Solar Energy. [Online] http://eosweb.larc.nasa.gov/sse/.

In general, the highest energy production would occur mid-day, and in the summer. Therefore, the time of day when most energy would occur would be during peak hours, with a small amount of energy generated during super peak hours and almost no energy generated during off-peak hours. In contrast, from an annual perspective, the greatest energy production would occur during the summer months, when rates are lower. Detailed analysis to estimate the portion of power that would be generated during each rate period is beyond the scope of this report but could be undertaken as part of a more detailed feasibility study.

It is unknown what pricing may be used for future programs but the 2010 rate for Vancouver Island is about 15% higher than original pricing when the Standing Offer Program was introduced in 2008. The 2010 rate is based on the Clean Power Call. The Clean Power Call is an RFP process and is geared towards larger projects. Given the relatively small size of a PV project one might expect at Ogden Point it is likely that the Standing Offer Program would be more appropriate.

It is clear that the value of grid electricity is substantially less (about 4 times less) that the levelized cost for photovoltaic energy based on *today's* figures. In March of this year BC Hydro announced plans to increase rates by about 10%/year over the next five years, though the Province has challenged this and it is currently uncertain exactly what will happen to rates. Nonetheless, it is reasonable to expect that in the coming years rates will increase significantly and the cost of PV panels will decrease significantly. If both these trends continue it is reasonable to assume that the levelized cost of installing PV panels will become competitive in the foreseeable future. If the value of electricity were to double from where it is today and the cost of photovoltaic electricity were to drop by 50%, this option would become very attractive. So, while photovoltaic electricity production would not be economical today, or in the next 5 years, it may become appealing in the next 10-20 years.

Given the fact that the cost of photovoltaic electricity is not currently competitive, but has a good chance of becoming competitive in the foreseeable future, it is recommended that GVHA incorporate considerations for "future-readiness" into the development of Ogden Point. "Future-readiness" means developing the site and its buildings in a way that will enable the project to more easily adapt to future conditions. From the perspective of PVs, this would mean designing buildings so their rooftops can accommodate solar installations when energy pricing and PV costs justify doing so. Considerations include the placement of mechanical equipment and vents, roof orientation and aspect, connectivity with the electrical distribution system, minimizing shading from other structures, and structural strength. One study done on "solar-ready" strategies noted that the most common reasons for rejecting a building as a candidate for rooftop photovoltaic installations were roof obstructions (40%), bad orientation (25%), and bad roof profile or design (15%).[9] Ensuring that the master planning process effectively integrates these considerations will be critical to future success.

[9] Bryan, H. et.al, 2010 "Solar Ready Roof: Establishing the Conditions for a High-Performing Solar Installation", American Solar Energy Society National Conference

Wind Energy

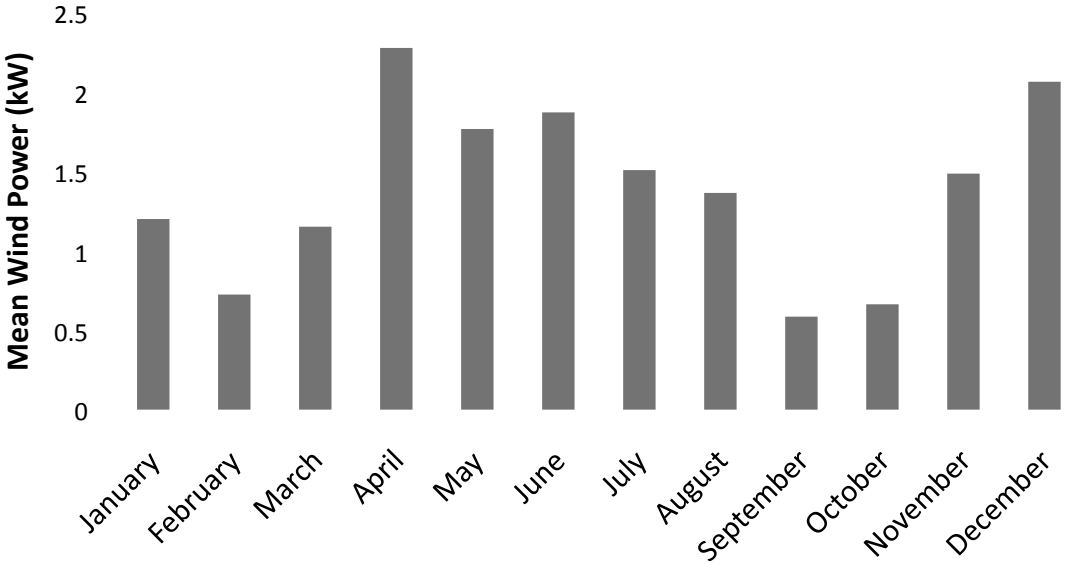
Wind energy is harvested using turbines, usually placed on top of a pole or tower. Wind turbines are a fairly mature and well-proven technology. They function best in areas with strong, and constant wind. Winds are typically stronger with increased elevation above the ground so wind turbines work best at higher heights. There is debate about the impacts of turbines on the surrounding environment. While they are generally considered to be an environmentally friendly technology, and produce no GHGs or air pollutants in their operation, there are some potential risks to avian life. People in close proximity to wind turbines sometimes complain about noise, and some people find them unsightly, while others welcome them in the visual landscape. Figure 4 shows a picture of a 10kW Bergey wind turbine.

Figure 4: 10kW Bergey Wind Turbine

The potential for generating electricity from wind energy at Ogden Point was assessed in two separate analyses, one completed by EA and one by UVic. The analyses were based on data collected by GVHA from sensors at the end of the breakwater at Ogden Point at a height of about 15m. The analyses then estimated the wind speeds at higher heights based on local conditions, as a wind turbine would typically be located at a height in excess of 30m. Based on the wind profile, the amount of energy that could be generated using a 10kW Bergey Excel turbine was estimated. Each study then estimated related costs and, using a 5% discount rate, a levelized cost was determined.

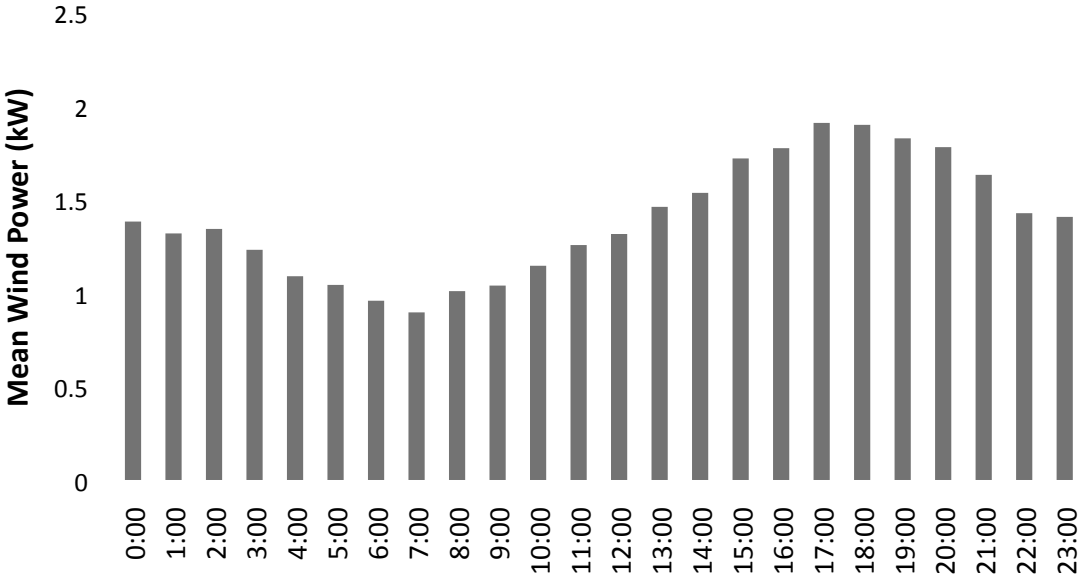
The studies used slightly different methodologies but produced similar results in terms of estimates of energy generation potential. The EA study synthesized wind speeds at 35m, and estimated an average of 4.79m/s. The UVic study synthesized wind speeds at 30m, and estimated an average of 4.99m/s. Figures 5 and 6, below, show the monthly and diurnal (i.e. daily) wind power profiles.

Figure 5: Monthly Wind Power Distribution



Source: analysis based on data from GVHA sensors at the Ogden Point breakwater.

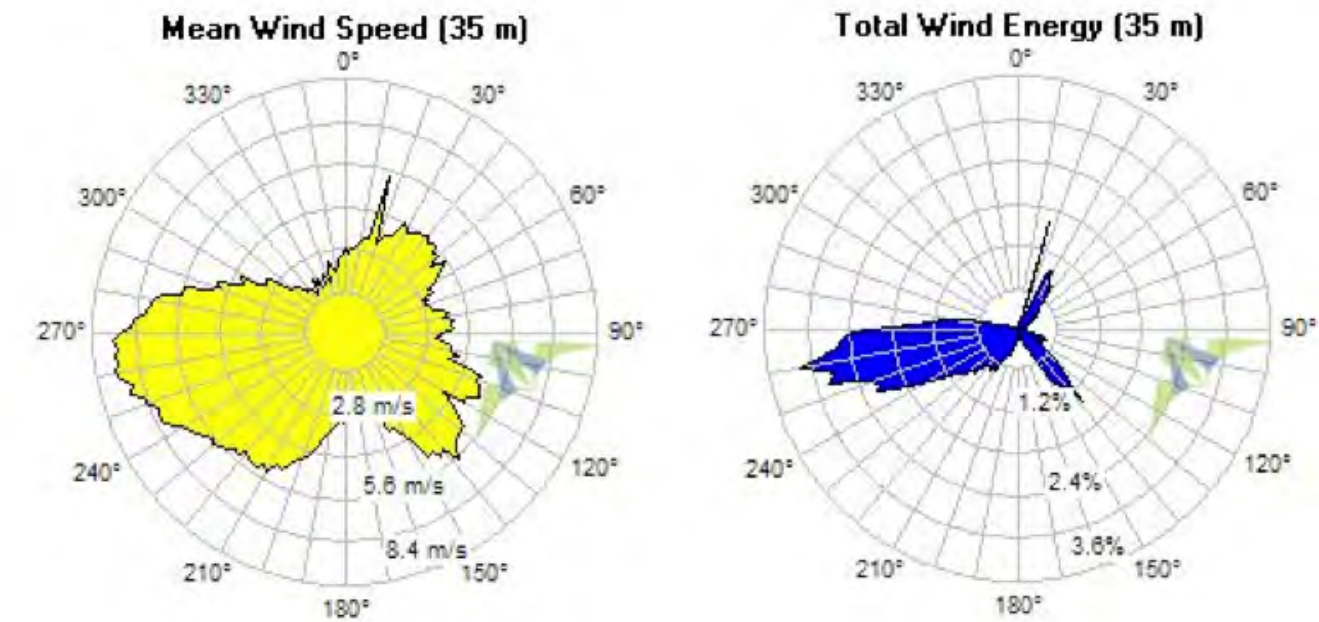
Figure 6: Diurnal Wind Power Distribution



Source: analysis based on data from GVHA sensors at the Ogden Point breakwater.

Wind roses are used to illustrate the direction and magnitude of wind at Ogden Point. Figure 7, below, shows the mean wind speed and total wind energy.

Figure 7: Mean Wind Speed and Total Wind Energy



Source: analysis based on data from GVHA sensors at the Ogden Point breakwater.

The site was found to be of marginal quality for wind energy. It has a sufficient wind resource to be technically feasible, but not enough to warrant commercial application. The EA analysis estimated that a 10kW Bergey Excel turbine would produce about **11MWh/yr** of electricity on this site. The UVic analysis estimated that the same turbine would produce about **12MWh/yr**. These differences are relatively small and are likely a result of minor differences in methodology (e.g. how errors or gaps in the data were handled, differences in extrapolating wind speeds with height). Where the studies differed greatly was in their estimates of the installed cost of the turbine. The UVic study estimated that the installed cost would be **$60,000** (including the turbine, the tower, and installation). This assumes that a tilt-up lattice tower would be used, which is a relatively inexpensive tower that is structurally sufficient but generally thought to be less aesthetically pleasing. The EA study estimated that costs would be **$130,000**. This assumes that a more aesthetically pleasing freestanding monopole would be used, which is much more expensive, but thought to be more appropriate for this site. EA also believed a more conservative estimate was appropriate to fully account for costs associated with engineering, wiring, shipping/crating, foundation, crane, permitting, and tie-in to electrical service.

Based on the above figures, and assuming a 25 year equipment lifetime, a $5,000/yr operation and maintenance budget (escalating at 2%/year), the levelized cost of electricity is estimated at **$0.87/kWh**

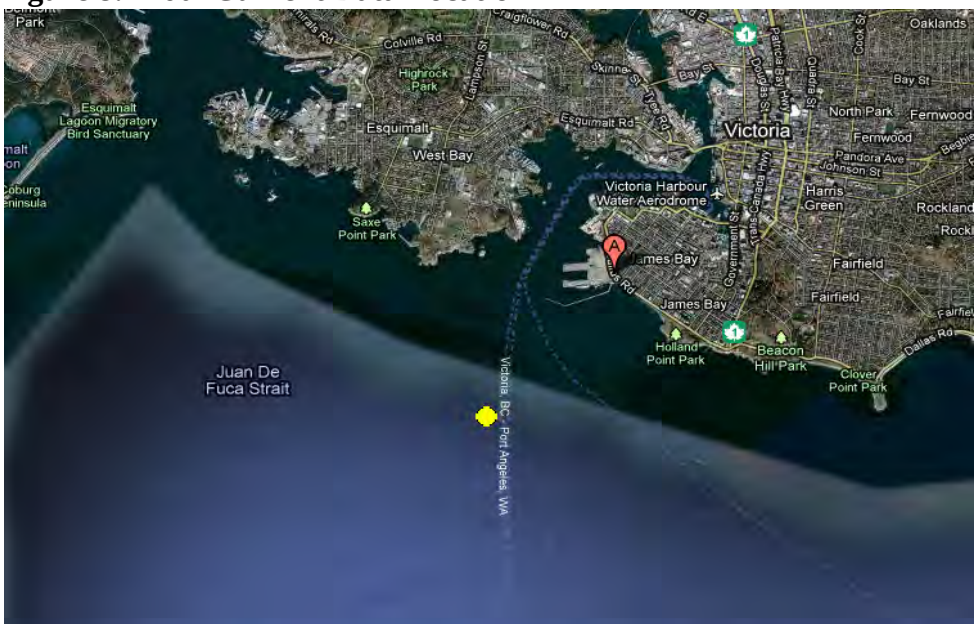
based on the UVic figures, and **$1.42/kWh** based on the EA figures. Even if the figures presented here are overly conservative, the costs are clearly very high. While energy prices are likely to increase, the total cost of installing wind turbines are not likely to decrease as discussed in the section on Trends In Renewable Power Generation. As a result, the site is considered to be a very poor candidate for wind energy both today, and over the next 5, 10, and 20 years.

Tidal Energy

Tidal energy is harvested using turbines that capture energy from the raising and lowering of water levels, primarily resulting from the interplay of the gravitational forces of the sun and moon. Tidal conversion technologies can be categorized as either 'tidal current energy' or 'tidal range energy' systems. 'Tidal current energy' relies on some sort of horizontal or vertical axis turbine concept, with or without ducts. This technology is still in a relatively early stage of development and many designs are in the works by different companies. 'Tidal range energy' uses a similar process as hydroelectric power plants. A barrage separates a tidal bay from the sea, and gates and turbines are installed along the dam. As the sea level changes with the tides, the gates on the barrage are opened when the difference in water level between the two sides of the barrage is sufficiently large. The hydrostatic head causes the water to flow through the turbines turning a generator (this technology would not be applicable at this site).

Tidal current data was obtained from the nearest location available from Fisheries and Oceans Canada[10], south west of Ogden Point, shown in figure 8 below.

Figure 8: Tidal Current Data Location



[10] Fisheries and Oceans Canada. Pacific Region. [Online] Institute of Ocean Sciences Data Archive. Ocean Sciences Division. [Cited: 03 07, 2011.] http://www-sci.pac.dfo-mpo.gc.ca/osap/data/default_e.htm.

The most recent data (from 1995-1996) provided average and maximum current speeds at different depths during three different time periods, which is illustrated in table 3 below.

Table 3: Current Speeds

Start Date	End Date	Depth (m)	Average Speed (m/s)	Maximum Speed (m/s)
May 6 1995	October 5 1995	35	0.154	0.872
May 6 1995	October 5 1995	55	0.232	0.803
October 5 1995	April 25 1996	34	0.219	0.827
October 5 1995	April 25 1996	54	0.231	0.732
April 25 1996	October 10 1996	27	0.211	0.721
April 25 1996	October 10 1996	47	0.185	0.798

Source: Fisheries and Oceans Canada. Pacific Region. Institute of Ocean Sciences Data Archive. Ocean Sciences Division.

While there is a lot of variability in tidal currents with location, this data was used as a starting point as it was the best data available and the cost of undertaking on-site analysis of currents in locations directly around Ogden Point would be significant.

According to the Research Institute for Sustainable Energy (RISE), peak tidal current velocities below 2 m/s are generally uneconomic[11]. Clean Current's tidal turbine technology has been designed to rotate only when the current velocities exceed 1 m/s.[12] The average current velocity for the best dataset shown above is 0.232 m/s and the maximum velocity from all datasets is 0.872 m/s. Given this, it appears that tidal flow is insufficient to be feasible for energy generation. While it is possible that speeds are somewhat greater immediately adjacent to Ogden Point it believed that it is highly unlikely that conditions would be sufficient to make tidal current energy a viable option. Given these site conditions, it is unlikely that viability will change significantly over the next 5, 10, or 20 years.

Race Rocks, a site approximately 16km southwest of Ogden Point, was home to a demonstration project for tidal energy done in partnership with ENCANA, Pearson College, and Clean Current. In recent discussions with Pearson College (a not-for-profit private school in Metchosin) it was learned that they retained the equipment necessary to measure tidal currents and offered to lend it to GVHA if there was an interest in more detailed analysis of the tidal energy potential of the site. Even if this equipment were obtained at no charge, Pearson College estimated that it would cost at least $10,000 to undertake the analysis. Given the low likelihood of feasibility, and the lack of maturity of the industry, it is not recommended that further analysis be undertaken.

[11] Research Institute for Sustainable Energy. Tidal Barrage & Tidal Turbines. [Online] [Cited: 03 07, 2011.] http://www.rise.org.au/info/Tech/tidal/index.html.

[12] Clean Current. Clean Current and the Environment. [Online] http://www.cleancurrent.com/technology/environment.htm.

Wave Energy

Wave energy capturing technology is in a very early stage of development. To date, there are only a few pre-commercial installations in the world, with approximately 50 companies working on various concepts, and various associated research institutes and offshore testing centers being set up. Most wave energy conversion technologies are based on a floating structure interacting with incident waves. The most common type resembles a surface-piercing bobbing buoy in appearance, although others are articulated "snake" like devices on the surface, and some are bottom mounted directly interacting with the pressure field of the passing waves. Still other approaches directly harness the kinetic movement of the water particles with some type of fin or rotor, while other at-sea or land-based devices impound the waves and use resulting air pressure in a driven cavity to power a bi-directional turbine. The majority of the concepts however use some type of hydraulic or direct-drive linear electric motor for power takeoff. The lack of convergence in design in the wave energy arena points to the early state of the technology.

As Ogden Point is not exposed to open-ocean swells, the wave energy at the site is limited to locally generated wind waves. The location of Ogden Point near a busy shipping channel and harbor entrance limits the possibilities for floating structure deployment unless a much more detailed study was to be conducted into navigational constraints and/or integration into harbor defense structures. In addition, no readily accessible data source to analyze the resource was available; significant costs would be required to undertake site-specific analysis. It is not believed that wave energy warrants further investigation at this time and it is unlikely to make sense over the next 5, 10, or 20 years.

Ocean-Thermal Energy

Ocean thermal energy conversion (OTEC) is an energy-harvesting concept whereby the temperature differential between ocean surface water and deep waters is harnessed to drive a thermal cycle and produce electricity. Even in the tropics, this temperature differential is on the order of 20-25°C, which is extremely small compared to conventional power plants and hence inherently limits the thermodynamic efficiency theoretically available. In Victoria, the temperature differential is considerably smaller than in the tropics, further limiting possible application of OTEC. As with wave energy, OTEC is only just at the prototype stage, requiring work to maximize efficiency of the specialized Rankine cycles used in the devices to maximize possible energy extraction towards the thermodynamic limits. Additionally, significant challenges remain with respect to biofouling and offgassing of the seawater in the heat exchangers and the large pipes required for water circulation. It is not believed that further investigation is warranted now, and it is unlikely to be a competitive energy source for Ogden Point in the next 5, 10, or 20-years. Note that OTEC is a technology to produce energy from the thermal gradient in the ocean. It is therefore distinct from ocean geo-exchange heat pumps, which can provide heating and cooling functions to buildings, and may be a viable source of renewable energy at Ogden Point at present. This is discussed further under the Geo-Exchange section of this report.

Biomass Energy

Biomass energy is produced from organic material that was recently living. An urban biomass plant would typically run on organic waste such as woody yard and garden waste or organics that are source separated from businesses or households (e.g. food waste). If these organics are left to break down anaerobically in a landfill, they produce large quantities of methane, a greenhouse gas that is approximately 20 times more powerful that CO_2. Another potential input for biomass plants are biosolids that are output from wastewater treatment processes. These "biosolids" actually contain a large amount of water and first need to be dewatered before they can be used to generate energy.[13]

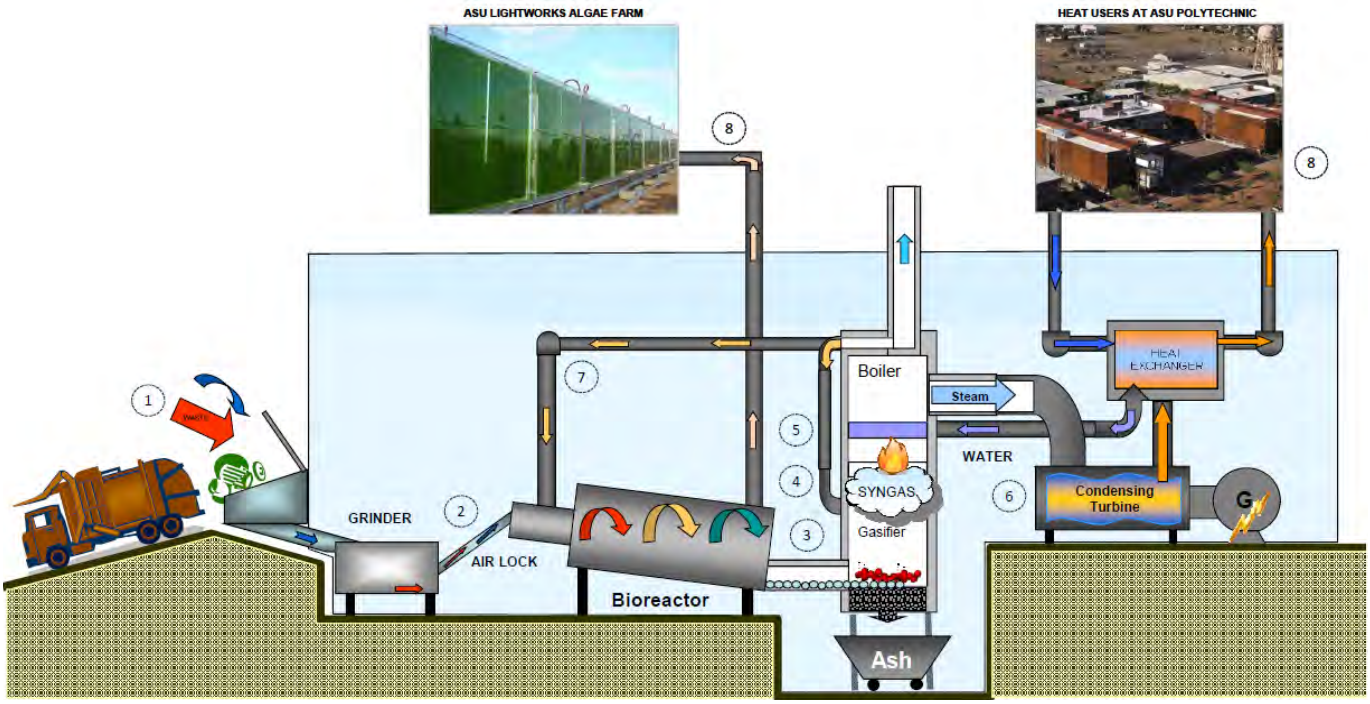
Biomass energy plants typically convert their waste inputs into a higher-grade fuel, and then convert that fuel into electricity, heat, or both.[14] This is commonly done using a gasification process, where the waste is converted into "syngas", which is combusted, thus generating heat. This heat can either be used directly for space heating or domestic hot water (e.g. as done in the Dockside Green project in Vic West) or used to drive a steam turbine to generate electricity. If used to drive a steam turbine, some heat can be recaptured and used for space heating or domestic hot water, a process known as combined heat and power (CHP). Some biomass plants can also produce biofuels that can power vehicles, and output fertilizers that can be sold.

This report does not attempt to give a complete description or analysis of all possible options for biomass energy but provides an example of a biomass system that can be used to produce heat, electricity, or both. The figures for capital and operation costs, energy produced, and site area requirements, were provided by Hummingbird Urban Biomass Ltd., a Victoria based company currently working in Phoenix, Arizona. Figure 9, below, provides an overview of their technical process and is based on a plant the company is developing at Arizona State University.

[13] It is interesting to note that the CRD is planning a sewage treatment plant at McLaughlin Point, several hundred meters NW of Ogden Point and the sewage main that will supply that plant will run through the Ogden Point site. The CRD currently plans to transport the biosolids to the Hartland Landfill (approximately 15km road distance from the treatment site) unless another suitable site can be found where these materials could be processed and, ideally, harvested energy could effectively be made use of.

[14] Systems that directly combust organic material to produce energy would also be considered biomass energy, but this report focuses on systems that first convert this waste into a cleaner fuel.

Figure 9: Overview of Hummingbird Urban Biomass Ltd. Biomass Energy Plant



1. Source Separated Organic Waste, in the form of food waste and green yard and garden waste is delivered to the urban biomass facility.

2. The waste is mixed and ground then sent through a bioreactor dryer to create clean, dry, and uniform biomass fuel.

3. This fuel is then fed into a pyrolyzer where it undergoes a state change that generates heat and decomposes the organic material in a matter of minutes.

4. During the decomposition, carbon monoxide and hydrogen gas are produced. These gases (syngas) are safely exhausted from the pyrolysis zone.

5. Additional oxygen is introduced into the syngas in a separate part of the chamber where it combusts at temperatures in excess of 1200 degrees Fahrenheit.

6. The heat is used to generate electricity through a condensing steam turbine.

7. The heat recovered, is available to be used in the drying process inside the bioreactor dryer.

8. Exit flu gas can be used in algae production, and remaining heat can be utilized in a nearby heat loop.

The emissions from such a plant would have a relatively low particulate count. The basic emissions profile based on the type of fixed bed updraft gasifier being used is:

Particulate (mg/m3)	= 10
SOx (mg/m3)	= 34
NOx (mg/m3)	= 17
CO (mg/m3)	= 170

Biomass plants of this type perform well from a greenhouse gas emissions perspective. In BC, biomass energy is generally considered to be GHG neutral. If not used to produce energy in the plant the waste would otherwise decompose, thus producing methane.

The figures in this report are based on a plant that produces **1.55MW** of electricity and **4.5MW** of useable heat at a facility that would require approximately 2 acres (including buildings, vehicle access, etc.). For comparison, this is approximately the same size as the existing warehouse at Ogden Point (not counting vehicle access, surrounding site area, etc.). It is assumed that the plant would have 8,000 operating hours per year, producing a total of **12,400 MWh** of electricity and **36,000 MWh** of heat, though it is unlikely that all this heat could be utilized in practice. Such a facility would typically earn the majority of its revenue from tipping fees (i.e. fees paid by people disposing of source separated waste), as well as earning substantial revenue from energy sales.

The plant described here would require approximately **$14 million** in capital costs and **$1.4 million** per year in operations and maintenance costs (escalating at 2%/year). The plant is assumed to have a lifespan of 20 years and, for the purposes of this report, a 5% discount rate is used to estimate the levelized cost of energy. It is important to note that the first set of levelized costs that are presented are based solely on the capital and operational costs of the plant; any revenues from tipping fees would be additional and could be very substantial (tipping fee revenues are accounted for in the second set of levelized costs).

If it is assumed that only electricity were to be produced from such a plant (i.e. none of the heat was utilized) the levelized cost of energy would be about **$0.23/kWh**. This cost is substantially less than the cost of electricity that would be generated by wind or solar energy on this site, though substantially more than the current price of grid electricity. If one assumes that the heat energy is also utilized (e.g. by way of a heat loop that provides space heating and/or domestic hot water), the costs are considerably lower. In order to properly assess the ability for heat energy to be utilized more information is required as to what will be built on the site so that heating loads can be determined. Once site planning is further advanced there will be more certainty in this regard. In addition to on site heating needs, it is possible that some heat could be sold to offsite users if there was a user with such a need and interest in relatively close proximity (i.e. existing or future buildings). For example, Dockside Green's biomass plant provides heat to the nearby, and previously existing, Delta Ocean Pointe Resort.

As mentioned above, it is unlikely that all heat could be used in practice (unless there was a very large user that needed as much heat as the plant could produce year round). For illustration purposes, if 50% of this heat was utilized the total levelized cost of energy of the plant would be under **$0.10/kWh**. If only 25% of heat was utilized the levelized cost of energy would still be under **$0.14/kWh**. As mentioned above, a biomass plant would also have substantial revenues from tipping fees. Hummingbird estimates that these revenues would be above **$2 million/year** (escalating at 2%/year), significantly more than operations and maintenance expenses. Such revenues, if realized, would allow for such a plant to generate substantial profits. Looking at it another way, if one deduced the tipping fee revenues from the sum of the annuitized capital cost and levelized operation and maintenance costs, the resulting levelized energy costs would be extremely low (far lower than BC Hydro's rates). In other words, most of the costs of the plant would be covered by tipping fee revenues leaving a small cost easily justified by the significant energy generation. Viewed in this manner, even if the plant only generated electricity, the levelized cost would be less than **$.03/kWh**. If it also utilized 25% of the available heat the levelized energy cost drops to less than **$.02/kWh**, and if 50% of heat is utilized the figure drops to about **$.01/kWh**.

From a technical and financial perspective, biomass energy has a number of advantages for Ogden Point. It has the potential to generate a substantial amount of "green" energy (with relatively low emissions of air pollutants) and revenue using renewable materials that are essentially waste products. Unlike some other renewable energy technologies (e.g. solar, wind) biomass provides continuous rather than intermittent power output. From a utility's perspective this is very attractive as incorporating large amounts of intermittent renewable energy sources into a grid poses great challenges for balancing loads. Given this, utilities may be willing to pay more for biomass energy than intermittent sources of renewable energy. Therefore, it may be possible for the developer of a biomass plant to negotiate a better rate with BC Hydro than would otherwise be available. The Ogden Point site is of sufficient size to accommodate such a plant and has both road and water access to allow for the delivery of organic materials. The location of Ogden Point is also in close proximity to the planned CRD wastewater treatment plant at McLaughlin Point, a potential source of biomass, with one pipe already planned between the two sites. If this option were considered, master planning efforts would have to account for such a plant in the site layout, though some of the infrastructure could likely be built underneath other uses to maximize site utilization and allow the plant to remain partially hidden from view. It would be possible to build a smaller plant than the one described here, though doing so would lose economies of scale and likely result in significantly higher levelized energy costs.

While biomass has a number of advantages, there are other important considerations. While a complete triple bottom line assessment is beyond the scope of this report, a few considerations are highlighted here. Ogden Point is an established working harbour with a history of uses that include industrial activities, cruise ships, air and marine transportation, etc. At the same time, the site is located within a primarily residential neighbourhood and many residents already have concerns about the amount of noise, odour, traffic, and air quality impacts associated with Ogden Point. For example, the GVHA engaged the James Bay Neighbourhood Association (JBNA) to get their feedback on elements of the master plan that is under development. JBNA recommended that a number of uses be prohibited, such as

power generation plants, bulk good transfer/storage, wastewater treatment, as well as a number of other uses, and expressed concern about traffic (including from heavy weight vehicles), noise pollution, etc.

The development of a biomass plant would require a large amount of material to be transferred to the plant, either by ship/barge or truck (or by pipe in the case of biosolids from wastewater treatment). The plant described above would require about 135 tonnes of material per day, equivalent to 6-14 truckloads (depending on truck capacity). Some or all of this material could potentially be barged, though barging has its own challenges (e.g. it must be ensured that no waste materials are inadvertently blown into the water). While biomass technology has come a long way from simple combustion of organic materials, and produces relatively few air pollutants, some stakeholders would likely object to even the cleanest of biomass technologies in this location. While trucking issues would not apply to biosolids piped from a nearby wastewater treatment plant, there would likely be other concerns about such a facility (e.g. potential for odours), even if aesthetic concerns were sufficiently addressed.

Biomass has tremendous potential as a renewable energy source and, in the right location, can be an excellent way to produce “green” energy (and revenue) from waste products, and can perform well with regard to emissions (both conventional and GHG). The nature of the neighbourhood surrounding Ogden Point and stakeholder concerns raise questions about whether this is an appropriate site for such a use and whether requisite approvals are likely to be obtained. If GVHA is interested in investigating biomass energy further it is recommended that these broader issues be fully considered prior to undertaking more detailed technical analysis.

Geo-exchange

Geo-exchange, sometimes called geothermal, involves capturing heat from the surrounding environment and using it to provide space heating or domestic hot water to buildings. Geo-exchange systems can be either closed or open loop. In closed loop systems a water and anti-freeze solution runs through a closed pipe in the ground or a water body and absorbs surrounding heat, which is then transferred into buildings using heat pumps. The pipes can either be horizontal or vertical. Horizontal pipes are typically cheaper but require a large area, whereas vertical pipes require more expensive drilling but a smaller area. Most applications require vertical pipes as there typically isn’t enough area surrounding buildings to meet heating needs. Where possible, heat can be extracted from the water rather than the ground, which avoids drilling costs. This requires that the water body be sufficiently large in order to provide enough heat without significantly changing the temperature of the water body. Open loop systems involve actually drawing water out of the ground or a water body, extracting heat from the water, and then discharging the water back into the environment. The heat pumps use electricity to run but output 3-4 times as much heat energy as they use in electrical energy. This is because they are utilizing the heat energy from the surrounding environment that has been delivered through the pipes. Typically, geo-exchange systems rely on natural gas as a back up and for peak loads, though most of the energy a system uses in a given year can be obtained from the geo-exchange system itself.

Geo-exchange systems can also be used for cooling by running the process in the other direction. In other words, they can use heat pumps to draw heat out of a building and discharge the heat into the environment (this is the same way a refrigerator works). In our climate, most of our energy needs relate to heating rather than cooling, though by using hydronic (i.e. water based) loops in a district geo-exchange system it is possible to transfer heat from users that want to discharge it to those that want to use it. For example, facilities with a lot of refrigeration equipment (e.g. grocery stores) or computer server centers are continuously discharging heat, which could be transferred to nearby users that require space heating in the winter or hot water all year round (e.g. for domestic purposes or swimming pools).

Geo-exchange systems have attracted great attention in recent years as they can provide a very cost effective solution for space heating and domestic hot water, as well as cooling. The exact costs are very situation specific and depend both on the natural site conditions (e.g. ground conditions, accessibility of a water body) as well as the heat loads of the user. Given that it is not yet known what will be built at Ogden Point it is not yet possible to assess heat loads and undertake an analysis of the feasibility of a geo-exchange system, though general guidance can be given at a conceptual level with some reference to other local examples of geo-exchange systems.

The Westhills Development in Langford features a district geo-exchange system made up of a network of vertical wells, though it is designed to accommodate other heat sources in the future. These could include a limited amount of fresh-water heat exchange, heat from a future wastewater treatment plant, or excess heat from buildings connected to the district system (e.g. grocery stores). Currently, the system is entirely used for residential purposes but it is intended to accommodate large amounts of commercial space in the future. The system is operated by Sustainable Services Limited, a private company created for the purpose of operating an on-site renewable energy utility. As the system is privately owned financial information is not available, however, the company provides thermal energy at the same rates that BC Hydro charges for electricity. Given that, it is reasonable to assume that the costs associated with the system are competitive with BC Hydro's rates. Other private developments also use geo-exchange systems, such as the Aquattro Development in Colwood, which uses vertical wells to heat four-story condominiums. The Sidney Pier Hotel & Spa uses an ocean geo-exchange system. Unfortunately costs for this system were not available for review, though it is reasonable to expect that the capital costs of such a system were lower than costs would have been to drill vertical wells. The District of West Vancouver is investigating a large ocean geo-exchange system to provide heating and cooling to municipal buildings and high rises, and is considering partnering with FortisBC to develop it. They anticipate that the system will be more efficient than ground-geo-exchange due to the stable temperature of the ocean. There are also a number of waterfront homes in Vancouver that are using ocean geo-exchange systems.[15]

Ogden Point's proximity to the Juan de Fuca Strait suggests there is an opportunity to use an ocean-based geo-exchange system for future development. Such a system could be either open or closed and would benefit from the enormous thermal mass of this water body. Using a closed system could be done

[15] Seyd, Jane. West Vancouver looks to ocean for heat. [Online] 03 02, 2011. http://www.globaltvbc.com/technology/West+Vancouver+looks+ocean+heat/4372526/story.html.

by submerging coils of pipe, protected using fencing materials, or by using "SlimJim" technology, a plate heat exchanger that can be mounted underneath a pier. For seawater use SlimJims would need to be titanium, as would most equipment used in an ocean application.[16] The Coast Guard Chicago Marine Safety Station installed a 32 ton SlimJim heat exchanger in 2005 to heat and cool their 12,000 ft^2 (1115 m^2) structure.

Open loop systems would require that water be drawn through intake pipes to a titanium heat exchanger and then out through discharge pipe(s). About 160 gpm of flow would be required to produce 200 kW of power.[17] Regulatory criteria would need to be considered in the design stage for specifications such as volume of water intake/discharge, temperature of water discharge, potential pollutants in discharge, dimensions of infrastructure, etc. A Canadian Environmental Assessment Agency screening would be necessary and marine traffic issues would have to be considered.

Another similar option is the use of sewer heat exchange technology. Essentially, this involves using heat exchangers inside sewage pipes to extract heat from raw sewage and transfer it into buildings in the same way as described above. Vancouver's Olympic Village uses sewage heat exchange to provide space heating. Detailed system costs are not known but the on-site utility provides this energy at $.084/kWh, which is competitive with BC Hydro's rates. There will be a new sewage main that will carry raw sewage through the Ogden Point site to the CRD's McLaughlin Point wastewater treatment plant. One challenge may be that in order for wastewater treatment plants to operate effectively the sewage must be above a certain temperature. Given the close proximity of the plant withdrawing too much heat from the sewage prior to it entering the treatment plant may be a concern. Discussions with CRD would be necessary to assess whether this is an option at Ogden Point.

Further investigation would be needed into the above heat exchange technologies to assess feasibility at Ogden Point. If ocean geo-exchange is possible it is expected that this would be of greatest interest out of the three options discussed in this section (heat exchange from the ground, ocean, or sewer main). Investigations should be done in conjunction with master planning efforts and ensure that the heat loads of different development options are considered. While further study is needed, it is believed there is excellent potential for heat-exchange technology on the site. These technologies would not involve unsightly infrastructure, would not have negative impacts on air quality, have very low GHG emissions, and are likely to be very competitive from a financial perspective.

[16] Personal communication, Aaron McCartie, DEC Design Mechanical Consultants Ltd., January 12, 2011.
[17] ibid

Technology Summary

Table 4, below, gives a conceptual overview of the various renewable energy technologies examined in this report. It describes the type of energy they produce (heat, electricity, or both), the potential quantity of energy they could generate on the site (high, medium, or low), cost (with more "$" symbols indicating the total expected costs are higher), the timeline over which the technology may become feasible, and the degree of other potential concerns for using the technology at this specific site (high, medium, or low). These include aesthetics, noise, and other issues that may be of concern to stakeholders.

Table 4: Technology Summary

Technology	Energy Type	Potential Quantity	Cost Magnitude	Other Potential Concerns	Feasibility Outlook
Geo-exchange	Heat	Moderate	$$	Low-Moderate	Immediate
Solar PV	Electric	Low-Moderate	$$$$$$ (⇓[18])	Low	10-20yrs
Biomass	Electric & Heat	High	$	High	Immediate
Wind	Electric	Low	$$$$$$$$$$$$$$	Med	Not foreseeable
Tidal	Electric	NA			
Wave	Electric				
Ocean-Thermal	Electric				

The technology summary table indicates that biomass energy is likely the most attractive from a financial perspective, has the potential to produce the greatest quantity of energy, and is the only option capable of producing both heat and electricity. Conversely, it has the greatest amount of other potential issues for this site, which may be of significant concern to key stakeholders. Geo-exchange systems can likely produce a moderate amount of energy (heat only) at a relatively low cost, and other potential concerns are likely to be low-moderate in significance. These are unlikely to be a major problem, but there will be considerations for potential environmental or marine transportation impacts of infrastructure that must be evaluated. Solar PV can produce low-moderate amounts of energy (electric only), and has costs that are not currently competitive, but it is reasonable to expect they could become competitive in the next 10-20 years; it is the only viable technology that is also likely to decrease in cost rapidly. Other technologies may also decrease in cost in some respects (e.g. turbines and heat pumps will likely become more efficient), but as a large portion of their costs relate to infrastructure or soft

[18] The ⇓ symbol indicates that the price of this technology is rapidly declining

costs that are likely to increase over time, they are not likely to experience a decrease in overall costs the way solar PV may. Solar PV also has the advantage of having the lowest number of other potential concerns. PVs have little impact on the surrounding environment, do not make noise, are not generally considered to be an aesthetic issue, do not require a constant input of materials (and the associated traffic), have no odour, etc. Wind turbines can produce a small amount of energy (electric only), but the site conditions are marginal for wind and costs would be very high. Wind turbines likely have moderate other potential concerns; some people find them unsightly, they produce some noise, and there are concerns about some potential impacts for avian life. Tidal, wave, and ocean-thermal technologies (OTEC, not geo-exchange) are not thought to be feasible either because site conditions are not favourable or technologies are not near maturity (or both). While it is always possible that a major breakthrough can be made in any of these technologies at any time, based on the information available, these technologies are not thought to be worthy of further investigation for Ogden Point.

The ability for the energy produced to be used on or off site was also considered. For the heat producing technologies (biomass and geo-exchange) more information is required about what will be built on site to make a proper assessment of heat loads, though there is a good chance that new (and potentially existing) buildings can make effective use of these technologies. System design must be completed in conjunction with site planning efforts. For electricity generating technologies the on-site electricity demand will of course also depend on what is built, but there is the potential to sell this energy to BC Hydro at rates above what consumers pay, so if a significant amount of energy is generated this is likely the preferred option (if only a very small amount of energy were produced one would have to assess whether it was worth the effort of connecting to the grid and entering into an agreement with BC Hydro).

One other issue that has been discussed is the potential for electricity produced on site to be used to power ships while in port, in the event that shore power infrastructure were developed. GVHA did a preliminary study on shore power at Ogden Point, which noted that shore power will significantly reduce air emissions associated with the burning of marine fuels at berth, including reductions in nitrogen oxides (NOx), sulphur oxides (SOx), particulate matter (PM), and volatile organic compounds (VOCs). In addition, when ships use shore power, they are significantly reducing emissions of GHGs. In these respects, shore power would be a great benefit, though the costs would be significant (early estimates suggest costs would be in the range of $10-11 million to upgrade the electrical grid and $5-9 million for shore power infrastructure).[19] GVHA is working towards the creation of a detailed feasibility study that will more fully consider the costs and benefits. The preliminary study did not outline the amount of power that would be used by ships while in berth, but the average electrical load of a cruise ship connected to shore power was estimated at 7MW in a study done on the Port of Los Angeles.[20] For comparison, the highest output of any technology considered in this report is 1.55MW, far less than the draw of even one ship, and there can be up to three ships berthing at any given time. The ships are also only present for a small portion of the year, and while there would only use shore power for an average

[19] Shore Power For Ogden Point: Pre-Feasibility Study, Greater Victoria Harbour Authority, 2011
[20] Use of Shore-Side Power For Ocean-Going Vessels White Paper (Draft), prepared by Tetra Tech, Inc. for the American Association of Port Authorities, May 1, 2007

of 5.5hrs per call.[21] Due to the sheer magnitude of the ship's energy usage, and the intermittency of this use, one must conclude that attempting to use renewable energy generated on site to power ships would be impractical.

Conclusion

Geo-exchange technologies are likely the most favourable overall, and could produce a significant amount of renewable heat energy. Further investigation into system feasibility, in conjunction with site planning efforts, is highly recommended. Solar PV has a good chance of becoming a viable option in 10-20 years and it is recommended that planning efforts incorporate considerations for "future-readiness" to take advantage of future conditions. Biomass, while very attractive from a technical and financial perspective, has the potential for other significant concerns on this site that should be fully considered before the technology is investigated further. Wind turbines are technically feasible but this site is a very poor candidate for wind energy, costs would be very high, and further investigation is not recommended. The other technologies discussed are not thought to be worthy of further exploration based on current information.

[21] Shore Power For Ogden Point: Pre-Feasibility Study, Greater Victoria Harbour Authority, 2011