City of Richmond

Report to Committee

TO PWT Oct 17 2012

To:	Public Works and Transportation Committee	**Date:**	October 1, 2012
From:	Mike Redpath Senior Manager, Parks John Irving, P.Eng. MPA Director, Engineering	**File:**	06-2345-00/Vol 01

Re: **Steveston Harbour Long Term Development Concept Update 2012**

Staff Recommendation

1. That no greater than $2.0M in funding from utility provisions be approved as the City's proportionate share for the dredging of the Steveston Channel, which will only be expended upon the approval and commitment by senior governments of matching grants.

2. That Council forward a letter to the Richmond MLA's, MP's, Port Metro Vancouver, Small Craft Harbors and the Steveston Harbour Authority seeking financial support for the future dredging of the Local Area channel in Steveston Harbour.

Mike Redpath
Senior Manager, Parks
(604-247-4942)

for John Irving, P.Eng. MPA
Director, Engineering
(604-276-4140)

Att. 1

REPORT CONCURRENCE			
ROUTED TO:	CONCURRENCE	CONCURRENCE OF GENERAL MANAGER	
Finance Division	☑		
REVIEWED BY SMT SUBCOMMITTEE	INITIALS:	REVIEWED BY CAO	INITIALS:

Staff Report

Origin

In November 2010, as part of the report: Steveston Harbour Cannery Channel Long Term Development Plan, Eastern Navigation Channel and Intertidal Habitat, the following recommendation was approved:

(1) "That the concept, use and potential redevelopment of the foreshore in front of the City owned properties at 6240 to 6280 Dyke Road (the Eastern Entrance Plan) for a new navigational channel, causeway, and intertidal habitat area be approved and that the February 2010 Balanced Environmental Plan 5249-D-28.1 provided within the 2010 Hay & Company report be used as the guiding framework until a final plan has been completed;

(2) That City staff work together with Steveston Harbour Authority and Small Craft Harbours to establish a Memorandum of Understanding outlining the intent and commitment to work together towards a mutually beneficial long term vision for Steveston Cannery Channel; and

(3) That City staff continue to work closely with the Province, Port Metro Vancouver, Small Craft Harbours and Steveston Harbour Authority to clarify roles and responsibilities, finalize all plans, and approval processes, for Phase 1 – Construction of the eastern navigational channel, causeway and intertidal habitat area."

The purpose of this report is in response to the above and to present an opportunity to work collaboratively with, the Steveston Harbour Authority, Port Metro Vancouver, and Small Craft Harbour's Canada with the goal of advancing work on the Steveston Harbour Long Term Development Plan Concept.

Analysis

Since November 2010, Staff have been working closely with Port Metro Vancouver, the Steveston Harbour Authority, and Small Craft Harbours Canada to advance the Steveston Harbour Vision. Attachment 1 is a summary detailing the need for dredging in the Steveston Harbour in a letter from the Steveston Harbour Authority sent to the Federal Member of Parliament, Kerry-Lynne Findlay. Within this letter, it is estimated that approximately $8.0M to $9.0M of dredging is required to facilitate the eastern configuration within the Steveston Harbour channel.

Moving Towards the Vision

In order to advance any work on the Steveston Harbour Long Term Vision Concept Plan dedicated funding is necessary. As there are three levels of government and delegated Authorities who are stakeholders in the Steveston Harbour, a commitment to financial contributions is required by all parties. The Steveston Harbour Long Term Vision Concept Plan requires multi-jurisdictional mutual coordination of efforts for activities such as dredging, ecological enhancements, flood protection, infrastructure development and more.

Current Reality- The Need for Dredging

Since the end of the federally funded dredging program in 2008 for local area channels such as the Steveston Harbour, significant sedimentation has occurred in the local waterways resulting in economical and navigational concerns.

For example, the build up of sediment along Steveston Island in the Channel is narrowing the harbour navigable channel width, and access to moorage in the Steveston Harbour for vessels with drafts greater than 12 feet is extremely difficult and impossible at times. In addition, Scotch Pond's entrance from the channel is now only accessible at high tide by shallow draft vessels with visible areas now forming where there never used to be land in the channel.

A safe and accessible harbour ensures continued commerce on and along the Fraser River in Steveston. Local area dredging in the Steveston Channel will also permit the facilitation of special events such as Ships to Shore, the Tall Ship Festival, and other maritime events.

Richmond's maritime commercial and recreational activities will no longer be available in the future if the harbour is not dredged and if a long term strategy is not in placed to maintain the sediment build up of the channels.

Flood Management

The design for the eastern end of Steveston harbour includes the removal of the existing weir, construction of a new causeway and navigation channel that will allow boats to enter the harbour from the east, the development of new and productive marsh and riparian habitat (6.7 acres), and the construction of public amenities such as boardwalks and outlooks. This report proposes that Phase 1 of the Steveston Harbour Long Term Vision Plan be advanced which would result in the establishment of a portion of the new habitat park area, and dredging of the Harbour.

To date, two primary dike alignments for raising dikes between Garry Point and London Farm have been identified. Alignment 1 is on Lulu Island, it follows a combination of existing and new alignments. Alignment 2 makes use of Steveston Island, it would require the construction of a completely new dike on the island plus additional structures to close off the harbour.

Alignment 2 has a similar footprint proposed under the Steveston Harbour Long Term Development Plan, and conceptually the two plans could be designed to complement each other. On July 23, 2012, Council endorsed that the public and key external stakeholders be consulted to provide feedback on the Steveston area and the West Dike flood protection concepts identified in the staff report titled Dike Master Plan – Phase 1. Consultation is currently underway.

Delta Precedent:

Since 2008, the Corporation of Delta's staff has met with Federal Ministers and Senior Government staff to lobby a number of issues, including the reinstatement of funding to dredge their secondary channels of the lower Fraser River. Delta has also been working with Port Metro Vancouver and other stakeholders to develop a strategy and identify funding sources to alleviate the sedimentation problems that are occurring in the Ladner Harbour.

In July 2012, The Corporation of Delta completed a study detailing the social, economic and environmental impacts in support of dredging river sediment in the Ladner Channel basin. Utilizing this background information, the Corporation of Delta has committed $2.0M in funding to dredging in their harbour. Delta is currently seeking partnerships in securing $8.0M in collaborative funding from the following stakeholders, Port Metro Vancouver, the Federal Government of Canada, and the Province of B.C.

Local Area Dredging Contribution Program

Port Metro Vancouver has now established a Local Channel Dredging Contribution Program which can only be used for activities directly related to the preparation of an application to dredge. The funding assistance for up to a maximum of $125,000 or 10% per local channel can only be used for items such as survey depth soundings, computer modelling, volume calculations, soil testing etc. but cannot be used for the dredging operations. It is recommended that the City apply for this potential funding to solicit a similar level of support as was awarded to Delta.

Next Steps

In order to preserve a continued working maritime harbour within the Steveston Channel, funding is required to complete the following:

1. To advance the implementation of the overall Steveston Harbour Long Term Vision Concept Plan - undertake $8.0M of dredging operations in the Steveston Channel.

2. To solicit matching funding from Federal, Provincial levels of Government and port authorities.

Financial Impact

This report proposes that $2.0M in funding from utility provisions be approved as the City's proportionate share for the dredging of the Steveston Channel, which will only be expended upon the approval and commitment by senior governments of matching grants

Conclusion

Richmond's Steveston Harbour is the homeport to over 350 commercial fishing vessels and many other recreational, commercial and heritage interests. It provides a legacy for many generations to come as a historical fishing village that has now evolved into a world class city.

In order for the Steveston Harbour to maintain its operations and activities, planning and preparation for the Steveston Harbour Long Term Vision Concept Plan and the immediate dredging of the channel is required.

Mike Redpath
Senior Manager, Parks

for John Irving, P.Eng. MPA
Director, Engineering

0140-20-SHAR1

September 7, 2012

STEVESTON HARBOUR AUTHORITY

12740 Trites Road, Richmond, B.C. V7E 3R8 604-272-5539 Fax 604-271-6142

Kerry-Lynne D. Findlay, QC, MP
Room 650, La Promenade Building
House of Commons
Ottawa, Ontario K1A 0A6

Dear Ms. Findlay:

RE: DREDGING, STEVESTON HARBOUR

Please allow me to introduce myself, my name is Ross Holkestad and I am the Board Chairman on the Steveston Harbour Authority ("**SHA**") Board of Directors. SHA is the largest commercial fishing harbour in Canada and is homeport to over 350 commercial fishing vessels. The harbour is also home to many services that fishermen all over the province utilize such as a seafood auction, marine insurance, vessel repair, travel lift, an unloading station and an ice house. Each year, anywhere from 30-65 million pounds of seafood are offloaded at our facilities.

I write to bring to your attention a serious challenge facing SHA, its many businesses and fishermen in the lower mainland – maintenance dredging of the harbour and tributaries. I understand that you are familiar with the problems facing Steveston Harbour as the General Manager, Bob Baziuk has provided you with documentation and photographs relating to this issue and that you have had numerous discussions with SHA directors and other stakeholders.

I cannot stress enough the urgency that we face in regards to infill off the Fraser River and in specific, how it affects the Steveston Cannery Channel and Steveston Harbour. As you are aware, in 1998, the Government of Canada, through the Coast Guard, withdrew all funding for local channel dredging on the lower Fraser River. This obligation was subsequently downloaded to local port authorities. In 2008, the Vancouver Fraser Port Authority ("**Port Metro**") abruptly stopped providing any funding for the annual dredging of local channels. Instead, Port Metro established a local channel dredging contribution program; however, this funding can only be used for activities directly related to preparing an application for funding and not for dredging (see Appendix A to this letter). This program does not come anywhere near dealing with the sediment infill accumulation in Steveston Harbour. The impact of this policy change is significant and has placed an impetus on the implementation of a sustainable long-term management plan for Steveston Harbour and the entire lower Fraser River basin. See Appendix B to this letter for recent and past aerial photographs taken in the area that clearly portray the ominous consequences of the reduction in dredging maintenance has caused. The specific needs of the SHA can

be divided into three primary categories, as set forth below.

1. *SHA requires an immediate increase in funding for dredging maintenance from the Government of Canada.*

Steveston Harbour and Steveston Cannery Channel are in desperate need of increased dredging efforts in order to maintain the commercial fishery and the businesses that rely on it. Immediate actions are required to bring both the harbour and channel to a safe and acceptable depth for the safe passage of Canadian fishing vessels as well as pleasure and other boats.

From 2002 to 2012, the Department of Fisheries and Oceans – Small Craft Harbours Division ("**SCH**") has contributed an aggregate of $2,760,000 towards dredging Steveston Harbour. Please refer to the "Steveston Harbour Authority Dredging Funding Summary" attached as Appendix C to this letter. A brief perusal of this appendix will illustrate that funding has been sporadic and has not kept up with the infill. Please note that there are a great number of costs associated with dredging before any infill is actually taken out such as mobilization of equipment, ocean disposal fees and price per cubic meter. All of these factors affect the volume of dredgeate removed.

In recent years, both Port Metro and SCH have established firm jurisdictional boundaries. It is my estimate that to bring the Steveston Cannery Channel back to the historic depth of five (5) meters and the tributary waterlots of SCH and others to three (3) meters at a zero tide would require in excess of $2,000,000 in funding. These historic depths are the minimum acceptable level for SHA to operate and provide services to our vibrant commercial fishing fleet on a consistent and reliable basis. Due to the dramatic decrease in funding for dredging the channel and harbour, the depths are much shallower. In some cases the channel is as shallow as 2.5 meters at 0 tide and the waterlots are as shallow as 1.5 meters at 0 tide.

Furthermore, it has been estimated that the amount of infill settling in Steveston Harbour each year is 22,800m^3. It would also be prudent to review the width of the Steveston Cannery Channel and maximize it for safe passage of all vessels. Adding clear markers that properly outline the navigational channel would greatly improve safety in the channel and harbour. It goes without saying that current levels of funding do not allow for these important studies to take place such that we can properly ascertain our specific needs.

Please continue your efforts in obtaining additional funding for dredging in this area. Our situation is dire, and if something is not done in the very near future, the harbour will become a navigation hazard and rendered unusable for this active fishing fleet, which remains the largest in Canada to this day.

2. *SHA and other stakeholders require funding for permanent structures that will lead to a substantial and perennial reduction in future dredging maintenance costs.*

SHA is fully in line with SCH's ultimate goal to establish a long-term approach to

solving annual maintenance dredging funding issues problems through permanent structures. Particularly in an era of fiscal austerity, we recognize it is not acceptable or realistic to continue asking for increased funding for dredging maintenance without taking serious measures to mitigate the problem.

Accordingly, the SHA has taken a role in working with SCH, Port Metro and the City of Richmond (collectively, the "**Interested Organizations**") in assessing the options, costs and regulatory hurdles in order to erect such structures. More specifically, the Interested Organizations are encouraged by a 2010 report prepared by Hay & Company Consultants for the City of Richmond, attached to this letter as Appendix D. This report concluded that reconfiguration of the harbour and surrounding area would significantly reduce the amount of infill settling in the harbour. A 2008 report from Hay & Company addressed to SCH also indicated that a berm/tidal marsh structure upstream of the eastern entrance of Steveston Harbour could reduce infill inside the harbour by 36% annually. This infill reduction would also be complemented by a substantial reduction in trees and other debris entering the harbour, which in and of itself is major annual expense incurred by SHA and SCH, in addition to causing extreme havoc to both vessels and harbour infrastructure.

Please note that the Interested Organizations have yet to determine what the harbour configuration would look like, have not committed any funds to any such project, and have not obtained enough information on what regulatory and jurisdictions hurdles would face them in embarking on such a project. The Interested Organizations are, however, devoting a great deal of time to study any solutions to the worsening problem of infill in Steveston Harbour.

Clearly, harbour reconfiguration could produce many benefits including: considerably reducing annual dredging costs, creating new inter-tidal marine habitat along the waterfront, reducing the Crown's liability in the event of vessels grounding, improving fishing operations, enhancing harbour navigation and creating new tourism opportunities.

The approximate overall cost to recognize any form of this possible reconfiguration to the eastern harbour channel entrance is difficult to estimate; however, our preliminary research suggests that it would fall in the range of approximately $8-10 million dollars. I write today to seek what funding is available to study the options and finally undertake the project that is determined to be the most economical, efficient and productive for all users of Steveston Harbour.

I wish to emphasize that any additional funds that are committed to any such project would not obviate the need for the Government of Canada to provide initial additional funds for dredging maintenance, as requested in #1, above. It is imperative that the depth of Steveston Harbour and Steveston Cannery Channel be brought down to an acceptable level as soon as possible and prior to the commencement of any such project.

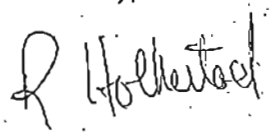
3. *The Interested Organizations require a definitive answer regarding disposing of dredgeate on Steveston Island.*

Whether it is in respect to our request for additional funding for dredging maintenance or a permanent structure that mitigates the problem of infill, it is essential that the Government of Canada provide us with a decision on whether dredgeate may be disposed on Steveston Island. The SHA in particular is extremely frustrated with the lack of clarity on this issue.

As you may be aware, Steveston Island is a man-made island and was erected by dumping dredgeate from the mid 1900s. It would be ideal, for example, if the dredgeate could be used to create an environmental tidal marsh at the east end of Steveston Island. I will note that using dredgeate for land reclamation ensures that the functionality of the harbour is achieved as well as contributing to the enhancement of the environment and subsequent feeding grounds for the Fraser River salmon. Furthermore, disposing of dredgeate on Steveston Island would significantly reduce the dumping fees incurred by SCH and the Government of Canada in terms of annual dredging maintenance.

Please be advised that this letter is being provided to you by the undersigned solely on behalf of the SHA. I await your reply on these most important matters. If you require any further information from the SHA, please do not hesitate to contact me.

Yours truly,



Ross Holkestad, Chairman
Board of Directors
Steveston Harbour Authority

Cc: Steveston Harbour Authority Board of Directors
Mayor & Council, City of Richmond
Robert Gonzalez, General Manager, Engineering & Public Works, City of Richmond
Dave Semple, General Manager, Parks & Recreation, City of Richmond
Ken Smith, Regional Director, SCH
Robin Richardson, Regional Manager – Client Services, SCH
Allan Baydala, Chief Executive Officer, Port Metro
Tom Corsie, Vice President – Real Estate, Port Metro

APPENDIX D

CREATING AND DELIVERING BETTER SOLUTIONS

www.hayco.com

City of Richmond

ISSUED FOR USE

PROPOSED UPSTREAM ENTRANCE MODIFICATION
STEVESTON HARBOUR

V31101113

February 2010

HAY & COMPANY CONSULTANTS – A Division of EBA Engineering Consultants Ltd.
p. 604.875.6391 • f. 604.875.8363
#900 - 1066 West Hastings Street • Vancouver, British Columbia V6E 3X2 • CANADA

EXECUTIVE SUMMARY

The principal findings of this study can be summarized as follows:

- The conceptual layout of proposed artificial islands to be located upstream of the eastern entrance to Steveston Harbour appears to be feasible with respect to the expected flow velocity field that would result from this construction.
- The concept of artificial islands and habit creation in this area can reasonably be incorporated into the original idea of controlling sediment and debris flows into Steveston Harbour, previously considered by the Harbour Authority and the Small Craft Harbours Branch of Fisheries and Oceans Canada.
- There are limited volumes of suitable dredgeate material currently being hauled by barge past this area for disposal by operators. Only one, Fraser River Pile and Dredge, working for Fraser Port (Port Metro Vancouver), currently disposes of material of sufficient quality and quantity for application to the proposed reclamation.
- The present Fraser River Pile and Dredge operation in maintaining the Steveston Cut portion of the adjacent navigation channel offers the possibility of utilizing the dredgeate material produced by their hopper dredge. However, this would entail a transfer pit for dumping into and then hydraulic pipelining to the desired island reclamation. This could be done at an estimated net cost of $\$7.50/m^3$.
- A more cost effective method may be to negotiate an arrangement with Fraser River Pile and Dredge by which a hydraulic pipeline dredge would be used for maintenance dredging a portion of the adjacent Steveston Cut. The material would be pipelined directly to create the desired islands. From discussions with the Port and Fraser River Pile and Dredge, this cost is estimated at $\$6.50/m^3$.
- Clamshell maintenance dredging could also be considered as another possible economical method to use maintenance dredged material for construction of the habitat islands, given the material would not have to be barged for ocean disposal.
- The project costs have been estimated at $9.7 million for the least favourable option and $9.24 million for the most cost-effective option, including a contingency allowance of 15% but excluding engineering, permitting and site data acquisition.
- The area of new productive habitat created by the proposed reclamation would be approximately 66,815 m^2 or 6.7 hectares.
- The estimated value of the new habitat created would be in the range of $3,000,000 to $4,000,000 which may be recoverable a credit for use on other projects with Fishery impacts.

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FIGURES

APPENDICES

1.0 INTRODUCTION

This study, undertaken at the request of the City of Richmond, encompasses a concept for modification to the upstream entrance to Steveston Harbour. The Terms of Reference for the study were finalized through discussions with the City of Richmond, resulting in a proposal by Hay & Company Consultants (Hayco) dated August 18, 2009.

2.0 TERMS OF REFERENCE

A copy of the Hayco proposal is attached as Appendix A and the listed task items are discussed in the following sections.

3.0 STUDY APPROACH

For purposes of this study, the concept layout proposed by Balanced Environmental has been superimposed on the modelled layout of a control structure previously considered by Hayco for reduction of sediment inflow into Steveston Harbour. This has resulted in a baseplan that incorporates the original concept of reducing maintenance dredging in Steveston Harbour while maximizing the potential for habitat creation immediately upstream of the proposed sediment control structure. In addition, the concept layout now provides a suitable channel for future navigation by vessels that wish to use an upstream access route into the harbour. Two possible options for the width of an access channel have been considered, i.e. 30 m and 40 m. This is a design feature that will be dependant on any future modifications that may be considered for the downstream harbour entrance.

From initial discussions with the client, it was directed that the level of effort involved in this assessment would not justify additional numerical model analysis of the island creation concept. Rather, the previous modelling outputs would be sufficiently indicative of sideslope stabilities and armouring requirements. Also, existing geotechnical data would be sufficient to estimate seismic stability and settlement of the reclamation.

3.1 HYDRAULIC FEASIBILITY AND STABILITY ASSESSMENT

A concept for a sediment control structure at the upstream entrance to Steveston Harbour is attached as Appendix B. The proposed structure was developed by Hayco under the direction of the Small Craft Harbours Branch (SCH) of Fisheries and Oceans Canada. This model study demonstrated the effectiveness of sediment control, and some variation is assumed will be suitable for the proposed artificial islands and enlargement of the habitat creation area. A velocity field resulting from the sediment control structure, with the proposed artificial islands superimposed, is shown in Appendix B.

The expected change in flow velocity due to the proposed reclamation has been estimated on the basis of the previously modelled results for a control structure to reduce harbour sedimentation. Sideslope protection is envisaged where necessary to cope with the expected velocity change.

With respect to stability of the proposed reclamation, our overview assessment is outlined in attached Appendix C. The only significant concerns relate to potential long-term settlements and seismic performance of the proposed fill and berms. For the future purpose of this initial feasibility overview and cost estimating, the long-term settlements are a factor that should be taken into account. These settlements could be in the range of 1 m and the resulting increase to the fill quality could be approximately 50,000 m. Hence, this contingency cost item could be in the order of $350,000.

3.2 CONCEPT BASEPLAN DETAILS

The attached baseplan has been developed from the concept that was presented by SCH to Stakeholders during a meeting recently conducted at the office of the Steveston Harbour Authority. The engineering details that have now been added, such as layout adjustment for hydraulic performance, sideslope armouring and harbour access channel dimensions, are features that we consider to be appropriate for this initial level of project feasibility and cost estimating. The baseplan includes a typical cross-section through the islands to illustrate the assumed reclamation methodology.

3.3 PUBLIC AMENITIES

From initial discussion with the client, we understand that the public amenities envisaged at this conceptual stage would involve a public access foot bridge connecting Richmond with the upriver island, a walkway across the island and a public viewing structure extending out from the new upstream island. The addition of a possible landing float extending out into the river is not envisaged at this time.

For the purpose of costing the proposed public amenities, we have assumed the following:

- Access from Richmond to the island would be via a wooden pile structure supporting a wooden deck 3 m wide, with suitable handrails;
- A walkway across the upstream island would entail a 0.5 m lift of gravel topped with crushed surface material, 3 m wide, and;
- A public viewing facility is assumed to be a wood pile trestle structure, 2 m wide connecting the new upstream island to two wooden viewing platforms, each measuring 50 m^2 in area.

All of the public amenity features would ultimately be subject to design by the City of Richmond. For estimating, it is assumed that approximately 500 m^2 of access trestles would be provided.

3.4 DREDGEATE MATERIAL UTILIZATION

We have contacted Environment Canada, Ocean Dumping Branch, in order to obtain relevant data concerning the ocean dumping permits now in effect that could yield material for creation of the proposed artificial islands. The objective would be to utilize barged material from dredging in the river that would otherwise be dumped at the ocean disposal sites either off Sandheads or the one off Point Grey. We are advised that permits are currently held by the following operations:

- Fraser Port (now Port Metro Vancouver);
- Fraser River Pile and Dredge;
- JJM Construction;
- Vancouver Piledriving, and;
- Delta Tug and Barge.

We have contacted these operators to discuss the possibility of utilizing some of their dredgeate material for the creation of artificial islands as configured on our conceptual baseplan. From these discussions, we are given to understand that the following volumes might be considered for diversion from ocean disposal:

- Fraser Port – covers channel maintenance in the lower reaches of the river. Allows for ocean dumping as required by the contractor that undertakes channel maintenance.
- Fraser River Pile and Dredge – hopper dredging disposal at Sandheads conducted annually with volumes generally exceeding one million m^3.
- JJM Construction – no dredgeate disposal in foreseeable future.
- Vancouver Piledriving – possibly 10,000 m^3 from a new moorage at Tilbury Island.
- Delta Tug and Barge – annual dredging of approximately 20,000 m^3 from marine maintenance, usually done for existing marinas.

From our discussions with the various operators on the river, it is clear that Fraser River Pile and Dredge, under contract to Port Metro Vancouver, would be the only viable operator in a position to supply the volume and quality of material necessary for creation of the proposed artificial islands. Each year, they are disposing of volumes by hopper dredge that far exceed the required total volume of material needed for construction of the proposed islands. The quality of material disposed of is generally sand with a small percentage of silt, ideal for the base material of the proposed islands.

From the standpoint of feasibility, the utilization of hopper dredged material would entail the creation of a transfer pit into which the hopper dredge would deposit its load. Once filled, this transfer pit would be cleaned out periodically by hydraulic pipeline dredge and the material would then be distributed as required to create the islands that are envisaged. With the transfer pit in place, other operators on the river, with small

quantities of fine-grained dredgeate available for possible diversion from ocean dumping, could be invited to dump into the transfer pit. Presumably a dumping fee might be applied for the use of the transfer pit but we have not accounted for this potential minor revenue source in our cost estimates. Our basic assumption of developing the proposed transfer pit by hydraulic pipeline dredge, filling it from materials derived from hopper dredge operations and cleaning it out periodically by pipeline dredge would entail a cost estimated at $7.50/m^3$, assuming the dredge "Columbia" is used by Fraser River Pile and Dredge to initially create the transfer pit and ultimately transfer the material from the pit to the islands. We also assume that the dredgeate deposited by the hopper dredge would be made available free of charge because it would provide some savings to Fraser River Pile and Dredge since this alternative would reduce the distance for disposal of at least some of the material dredged annually from Steveston cut.

A more cost-effective alternative for obtaining the reclamation material for creation of the proposed artificial islands would be to arrange for direct hydraulic pipeline dredging of maintenance dredging material from Steveston Cut. This would entail some type of suitable agreement with Fraser River Pile and Dredge. Such an agreement would spell out the volumes, disposal requirements and associated costs. We have discussed this possibility in general terms, with Mr. Dave Hart of Port Metro Vancouver and Mr. John Helmerick of Fraser River Pile and Dredge. Both have indicated that this idea could be arranged within the existing contract. The economic advantages would be:

- Cost would be reduced to between $5.50 and $7.50/m^3$. (We assume $6.50 for estimating.)
- The material could be placed as needed on the islands, to reduce subsequent contouring costs.

Hayco has been requested to consider whether the materials derived from on-going maintenance dredging operations within Steveston Harbour could be used to contribute to the artificial island creation concept. There are a number of challenges associated with this approach:

- The materials that comprise the riverbed within Steveston Harbour are generally finer grained than those within the main channel of the River. Thus the material derived from within the harbour are more likely to remain in suspension and drift downstream during placement, or to remobilize subsequent to placement due to main channel currents;
- The fine grained materials derived from within Steveston Harbour are not as well suited for use as the foundation materials for the artificial island as are the coarser grained sediments available within the main channel;
- The costs associated with pipeline dredging within the harbour and extending the discharge pipeline to the artificial island locations are likely to exceed that associated with simply discharging the material directly to the main channel as has been successfully completed on two previous occasions.

- Material derived through clamshell dredging within the harbour could be disposed within the artificial islands at reduced cost relative to that associated with ocean disposal on the assumption that hopper dredges are utilized. However, a transfer pit would still be necessary and the transfer pit would infill as a consequence of sediment transport within the main channel during freshet. Thus this approach would only be feasible if a large quantity of maintenance dredging by clamshell was envisaged.

3.5 ENVIRONMENTAL DESIGN AND HABITAT CREATION

The proposed habitat treatments include the creation of the following high value habitats, all of which provide unique habitat functions to enhance the Fraser River Estuary:

1. Off-Channel Fish Habitat
   a. A variety of juvenile fish, such as Coho salmon, use the Fraser River Estuary as a stopping ground to become acclimated to saltwater on their seaward migration. They prefer areas of slower velocity water that are protected from predators and abundant in food. These conditions are provided by off-channel habitats.
   b. The proposed habitat treatments will create 32,165 m^2 of new off-channel fish habitat.
2. Brackish Marsh Habitat
   a. Brackish marsh habitat provides shelter for juvenile fish from predators during periods of inundation. It also is home to a variety of invertebrates which provide food to juvenile fish, birds, and other wildlife. Marshes improve water quality by slowing water flow and allowing the deposition of fines and also uptake of hydrocarbons and other deleterious substances. Marshes provide natural shoreline stabilization with their root structures, avoiding the need for unnatural riptap shorelines.
   b. The proposed habitat treatments will create 25,555 m^2 of new brackish marsh habitat.
3. Riparian Habitat
   a. A riparian fringe along a watercourse is an important component of an ecosystem. Riparian areas contribute large woody debris, insect drop, detritus and shade to the neighbouring watercourse. They also provide natural slope stability and improve water quality. A variety of raptors and other birds live, feed, and nest along riparian areas.
   b. The proposed habitat treatments will create 28,592 m^2 of new riparian habitat.
4. Freshwater Wetland Habitat
   a. The fresh water habitat feature will provide habitat for freshwater amphibians and invertebrates, providing food for a variety of bird species and other organisms.
   b. The proposed habitat treatments will create 3,503 m^2 of new freshwater wetland habitat.

Implementation of the habitat treatments will involve contouring placed dredge material and growing medium by land based plough over the specified areas (see attached drawings). Planting of the riparian areas will be divided into high-density (1 plant per m^2) and low-density (1 plant per 5 m^2) plantings depending on their proximity to public amenities. Marsh planting will occur at the typical marsh planting density of 2 plugs per m^2.

To determine the estimated cost of habitat treatments for the proposed islands, an estimated volume of material (59,524 m^3) to be contoured was estimated and multiplied by the rate at which the proposed equipment is expected to operate ($5.0 per m^3). These rates are based on previous marsh construction projects supervised by Balanced Environmental Services Inc.

In addition to contouring, an estimated number of plant plugs have been determined from the assigned planting densities shown on Drawings 5192-D-02.1 and 03.1 and multiplied by estimated purchase and labour rates to determine the cost of planting the new habitat treatments. Surveying and monitoring were included in these estimates. Tables, Drawings, and a description of assumptions are listed in Appendix D, Section 2.

To determine the amount of habitat credit that may be available from proposed habitat treatments, habitat values from previous *Fisheries Act* Authorizations were used in comparison with the types of net habitat areas that will be created or lost. The resulting credits from this analysis yielded a net increase in habitat value of +238,473 *beu*.

Construction of the proposed enhancement features may provide compensation credits that could be used to offset compensation requirements for other projects ranging in footprint size from 30,600 m^2 to 150,000 m^2. The sale of these credits to other projects represents an opportunity to the City of Richmond to recover its investment in the construction of the artificial islands. The habitat credits provided by the project are considered to represent a value of between $3,000,000 and $4,000,000.

Habitat credits vary depending on project specific factors raised during negotiations with DFO, including the amount of critical habitat impacted by the other project proponents seeking credit, and the cost to construct similar compensation near the other project proponent's site. DFO would have to agree to the actual value of these credits. It is our understanding that Port Metro Vancouver is seeking habitat credits to offset a number of its development project and, as such, may be an interested partner in this project.

If the habitat island concept is not pursued, there will still, presumably, be a requirement for improved sediment and debris control at the upstream end of the harbour and this will necessitate the construction of a suitable control structure. Once the control structure has been implemented there would be the potential to create, on a progressive basis, a sloped habitat infill bench using dredge spoil. It is uncertain whether DFO would recognize habitat credits for a progressive infilling that may evolve over a relatively longer period of time.

For additional information of preliminary habitat design and costing calculations, see Appendix D.

3.6 COST ESTIMATION

The estimated cost for implementing the conceptual layout illustrated on our baseplan will be broken down for two possible options:

Option 1 - Provides a 40 m wide navigation access channel into the existing harbour.

Option 2 - Provides 30 m wide channel.

For the two options, we have considered the possibilities of:

(a) Utilizing dredgeate from the ongoing Fraser River Pile and Dredge hopper dredging; and,

(b) Utilizing navigation channel dredgeate that could be placed by way of a hydraulic pipeline dredge, through an arrangement with Fraser River Pile and Dredge.

Our cost estimates include a $0.5 million allowance for public amenities, but this amount will have to be reviewed in detail subject to confirmation from the City of their specific requirements.

Estimates:

Option 1(a) – Estimated cost utilizing hopper dredging with transfer pit and 40 m wide access channel:

Berm construction along access channel and river side of East Island 60,000 m^3 (12" minus material) @ $50	$ 3,000,000
Access channel slope protection and toe berm 16,000 m^3 (6" minus material) @ $50	800,000
Quarried rock mattress for berms 12,000 m^3 (3" minus material) @ $60	720,000
Dredge access channel, 59,000 m^3 @ $8	470,000
Net reclamation volume by hopper dredge 210,000 m^3 @ $7.50	1,600,000
Remove existing rock weir 3,000 m^3 @ $50	150,000
Habitat treatments for islands (contouring, planting)	1,000,000
Public Amenities	500,000
	$8,240,000

Option 1(b) – Estimated cost utilizing pipeline dredge, pumping directing into proposed islands:

Same as 1(a) except cost of dredgeate reduced by $1/$m^3$, i.e. from $7.50 to $6.50/$m^3$ covering 210,000, i.e. reduction of $210,000	-210,000
	$8,030,000

Option 2(a) – Estimated cost utilizing hopper dredging with transfer pit and 30 m wide access channel:

Same as 1(a) except cost of dredging access channel reduced by $90,000, reclamation increased by $150,000 and habitat treatment increased by 100,000 for a net increase of $160,000	+160,000
	$8,400,000

Option 2(b) – Estimated cost utilizing pipeline dredge, pumping directly into proposed islands:

Same as 1(a) except cost of dredging access channel reduced by $90,000, reclamation increased by $137,000. and habitat treatment increased by 100,000 for a net increase of $147,000	+147,000
	$8,387,000

In all cases, a contingency allowance of 15% should be applied. Hence the more costly option 2(a) would be estimated at $8,400,000 x 1.15 = ... $9.7 million

And the least costly option 1(b) would be estimated at $8,030,000 x 1.15 = ... $9.24 million

The above estimates do not include the costs of engineering, site testing or permitting.

4.0 CONCLUSIONS

On the basis of the foregoing general assessment of the reclamation and habitat enhancement concept, it appears feasible to:

- Obtain and place the dredgeate material at reasonable cost;
- Create the desired habitat enhancement of the area that would qualify for off-site "credits" normally applied to development projects on the foreshore; and
- Configure the concept to yield hydraulic impacts that will be acceptable with respect to resulting sedimentation, velocity fields and river dynamics. This presumes that more detailed hydraulic numerical modeling would form the basis for a preliminary engineering design.

5.0 LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of the City of Richmond and their agents. Hay & Company Consultants (Hayco), a Division of EBA Engineering Consultants Ltd., does not accept any responsibility for the accuracy of any of the data, the analysis or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than the City of Richmond, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this report is subject to the terms and conditions stated in EBA's Services Agreement and in the General Conditions provided in Appendix B of this report.

6.0 CLOSURE

We trust this report meets the requirements of the City of Richmond. If you have any questions, please do not hesitate to contact the undersigned.

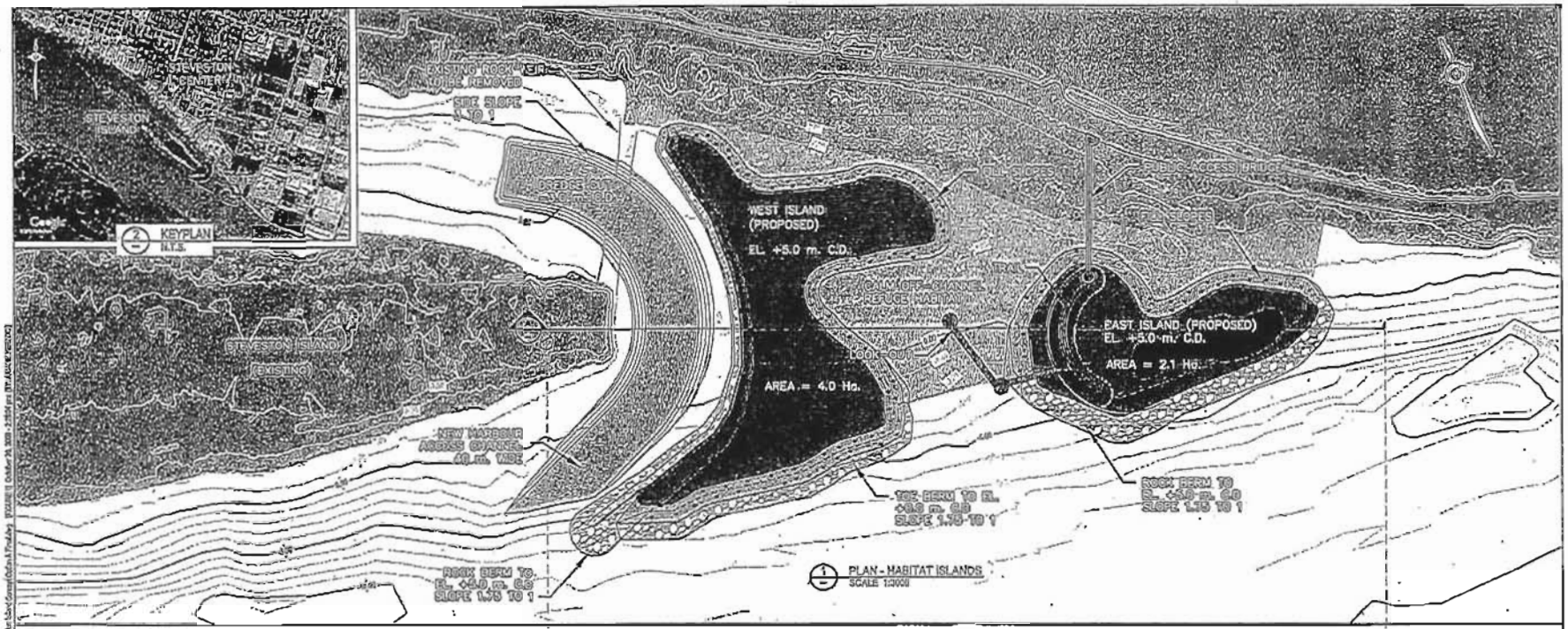
Sincerely,
Hay & Company Consultants
A Division of EBA Engineering Consultants Ltd.

Ralph Everts

Ralph Everts, P.Eng.
Project Director
Ports & Harbours Practice
Direct Line: 604.875.6391 x248
reverts@hayco.com

EOI/RE/rbt

FIGURES



NOTES

1. BASE DRAWING AND CONCEPT PROVIDED BY BALANCED ENVIRONMENTAL, 113 GARDEN AVENUE, NORTH VANCOUVER, BC, DRAWING NO. 5182-0-06.2
2. RIVER BED CONTOURS IN METERS, CHART DATUM. CHART DATUM IS 2.26 m. BELOW GEODETIC DATUM.
3. BATHYMETRIC SURVEY PROVIDED BY BALANCED ENVIRONMENTAL, DRAWING 5182-01-0.1; SURVEY CONDUCTED IN MARCH, 2009.
4. KEYPLAN IMAGE FROM GOOGLE EARTH, IMAGERY DATE AUGUST, 2008.

BALANCED ENVIRONMENTAL

CITY OF RICHMOND

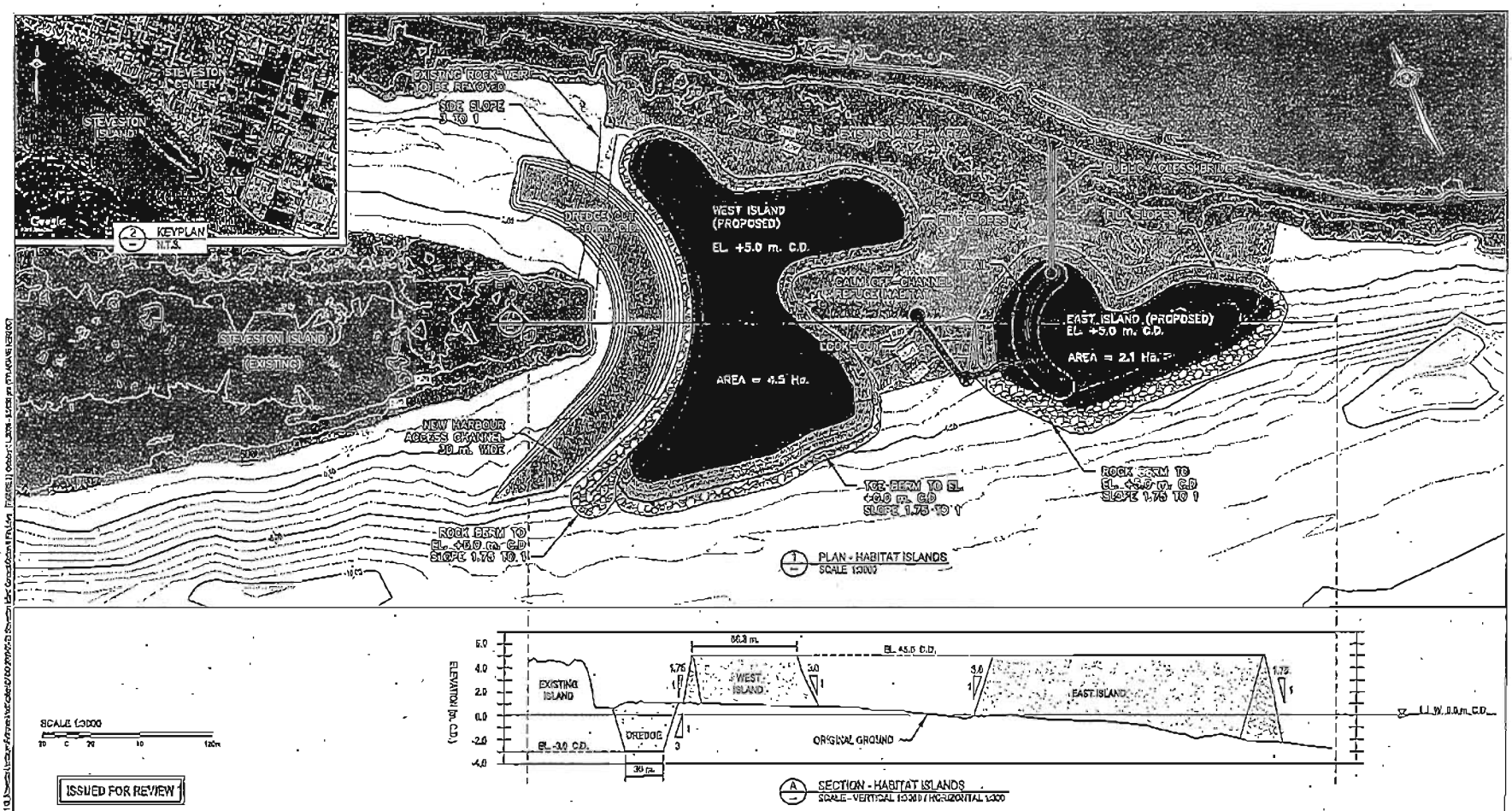
STEVESTON UPSTREAM HARBOUR ENTRANCE

HABITAT ISLANDS CONCEPT PLAN AND SECTION OPTION A

HAY & COMPANY CONSULTANTS A DIVISION OF BBA

PROJECT NO.	DRN	DES	REV
V11001113	AGH	01	0
OFFICE: VANC	DATE: SEPT. 24, 2009		

Figure 1



ISSUED FOR REVIEW 1

NOTES

1. BASE DRAWING AND CONCEPT PROVIDED BY BALANCED ENVIRONMENTAL, 116 GARDEN AVENUE, NORTH VANCOUVER, BC, DRAWING NO. 5182-D-05.2
2. RIVER BED CONTOURS IN METERS, CHART DATUM. CHART DATUM IS 2.25 m. BELOW GEODETIC DATUM.
3. BATHYMETRIC SURVEY PROVIDED BY BALANCED ENVIRONMENTAL, DRAWING 5182-01-0.1; SURVEY CONDUCTED IN MARCH, 2009.
4. KEYPLAN IMAGE FROM GOOGLE EARTH, IMAGERY DATE AUGUST, 2008.

CLIENT: CITY OF RICHMOND

STEVESTON UPSTREAM HARBOUR ENTRANCE

HABITAT ISLANDS CONCEPT PLAN AND SECTION OPTION B

BALANCED ENVIRONMENTAL

HAY & COMPANY CONSULTANTS A DIVISION OF IBI GROUP

PROJECT NO.	TYP	SHT	REV
V31/201513	A01	01	0
DRGN: VANC	DATE: SEPT. 24, 2009		

Figure 2

APPENDIX

APPENDIX A - HAYCO'S PROPOSAL LETTER

ISSUED FOR USE

CREATING AND DELIVERING BETTER SOLUTIONS

www.hayco.com

August 18, 2009 Hayco File: PV31101113

City of Richmond
6911 No. 3 Road
Richmond, BC V6Y 2C1

Attention: Mr. John Irving, P.Eng.
Director, Engineering

Dear Sir:

Subject: Steveston Harbour Upstream Entrance Modification

This will refer to our telecom of August 10, 2009 (Isfeld/Irving) in which amendments to the Hayco proposal of July 13, 2009 were discussed. Based on the level of effort envisaged by the City of Richmond by which the feasibility assessment would be limited to providing an order of magnitude project costing, Hayco hereby offers the following package of engineering and environmental services:

1. Hydraulic Feasibility and Stability Assessment:
   - Utilize previous modelling outputs to estimate sideslope stability and armouring requirements.
   - Utilize existing geotechnical data for the area to estimate effects and stability of proposed reclamation.
   - Allow $5,000.00

2. Finalize a concept base plan, utilizing the outline of reclamation prepared by Balanced Environmental. Ensure reasonable conformity with the configuration of control structures previously tested on the Hayco numerical hydraulic model for Small Craft Harbours.
   - Allow $2,000.00

3. Conceptualize public amenities including a bridge access, walkway and public viewing platform.
   - Allow $2,500.00

4. Assess feasibility of potential reclamation methodology through discussions with contractors and operators on the river, taking account of available dredgeate materials and methods of delivery.
   - Allow $2,000.00

5. Environmental Design and Habitat Creation.
   This task will include:
   - Co-ordinate transfer of assumed site data for a base plan to be prepared by Hayco;
   - Determine species and target areas to optimize habitat creation;

HAY & COMPANY CONSULTANTS – A Division of EBA Engineering Consultants Ltd.
p. 604.875.6391 • f. 604.875.8363
#900 - 1066 West Hastings Street • Vancouver, British Columbia V6E 3X2 • CANADA

- Mould the target habitat areas into practical locations, given the constraints of material stability, side slopes, plant elevations, biodiversity, species at risk, construction methodology, plant availability and seeding methods. This exercise will form the basis for cost estimating;
- Consider impacts of proposed public amenities;
- Present two schemes for habitat credit, i.e. most costly and least costly;
- Discuss feasibility implications of the above factors in terms of approvals, habitat credits and design of more definitive concept.

- Allow $8,500.00

6. Cost estimation, report preparation and consultation with client

   The report will include a discussion of the feasibility assessment findings, the effect on estimated costs, the analysis required to produce a preliminary engineering design, and discussion of the draft report with the client prior to submission.

   - Allow $5,000.00

7. Clerical and Disbursements:

   - Allow ..... $ 400.00

Total, excluding GST = $25,400.00

Sincerely,
Hay & Company Consultants
(a division of EBA Engineering Consultants Ltd.)

Prepared by:

E.O. Isfeld, P.Eng.
Senior Marine Engineer
Direct: 604.875.6391 x249
oisfeld@hayco.com

Authorized by:

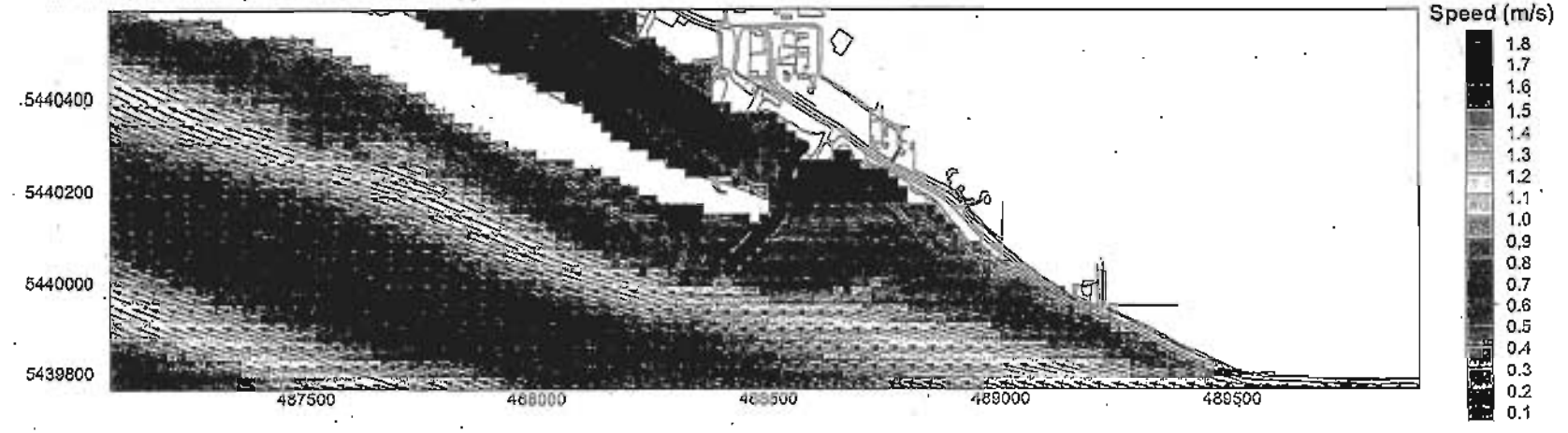
Ralph Everts, P.Eng.
Principal / Senior Design Engineer
Direct Line: 604.875.6391 x248
reverts@hayco.com

EOI/rbt

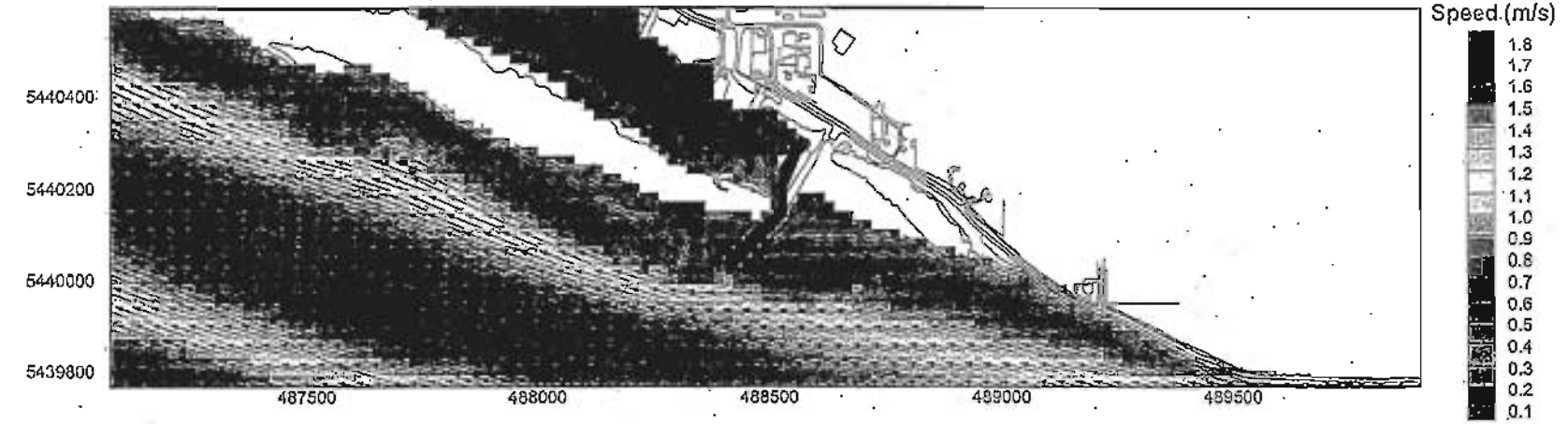
APPENDIX

APPENDIX B - HAYCO'S SEDIMENT CONTROL MODEL RESULTS

DEPTH 0 TO 1.5 m GCD (to 0.7 m above LLW)



DEPTH 1.5 TO 3.0 m GCD (to 0.8 m below LLW)



LEGEND

NOTES

CLIENT

CITY OF RICHMOND

HAY & COMPANY
CONSULTANTS
A DIVISION OF EBA

STEVESTON UPSTREAM HARBOUR ENTRANCE

VELOCITY FLOW FIELDS EXTRACTED FROM PREVIOUS MODEL STUDY RESULTS

PROJECT NO.	DWN	CKD	REV
V31101113	EW	OI	0

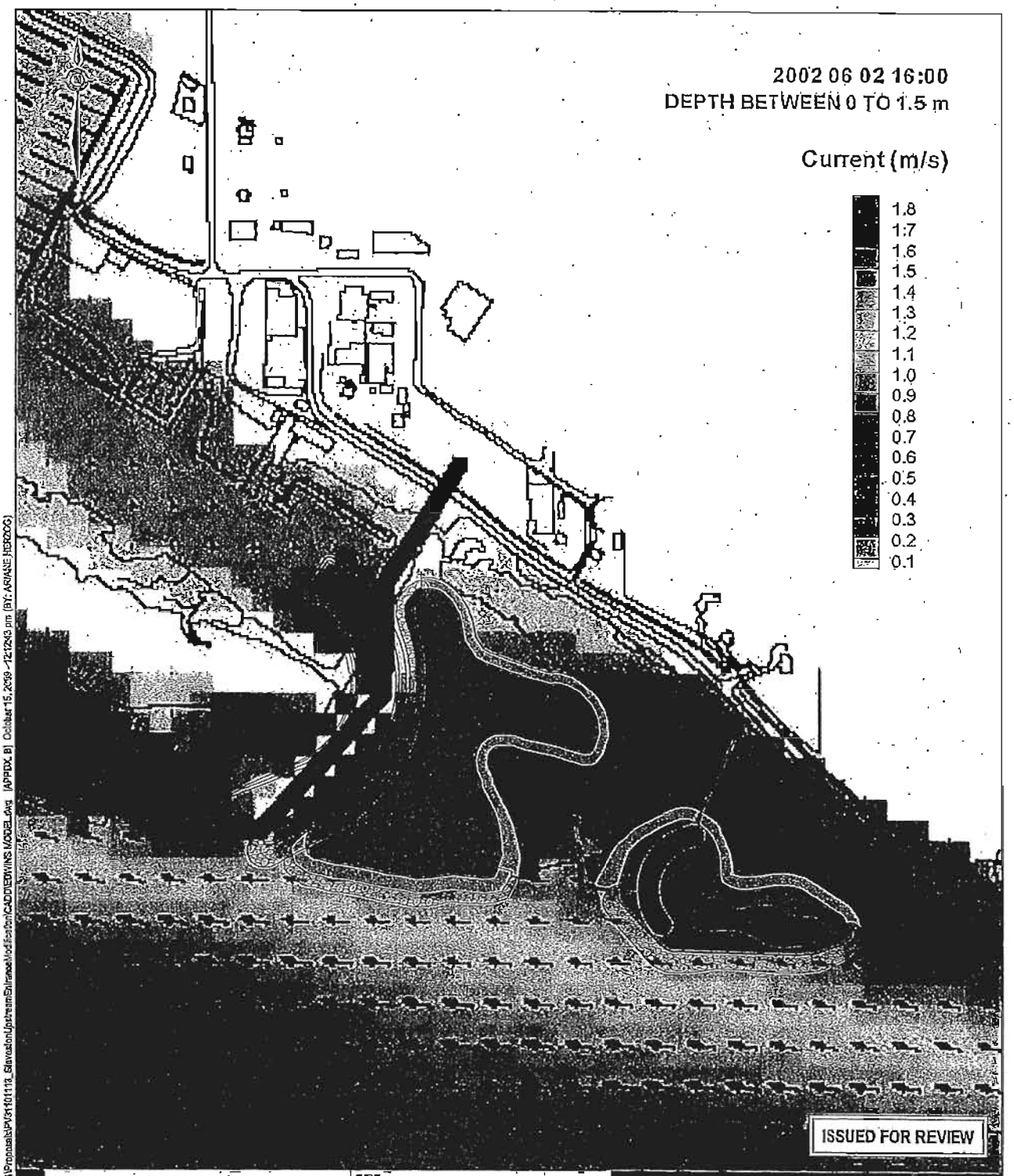
OFFICE: EBA-VANC

DATE: October 2009

Appdx. B

F:\projects\V31101024.019 - Steveston Harbour\working\EW\03D\Version03\03-Steveston\Run04\-proposal_toebcm\map.bay

15 Oct 2009 11:29:17



LEGEND/NOTES

SCALE 1:5000

50 0 50 100 200m

CLIENT

CITY OF RICHMOND

HAY & COMPANY CONSULTANTS A DIVISION OF EBA

STEVESTON UPSTREAM HARBOUR ENTRANCE

HABITAT ISLANDS CONCEPT AND FLOW VELOCITY MODEL

PROJECT NO.	DWN	CKD	REV
V31101113	AOH/EW	OI	0
OFFICE: VANC	DATE: OCT. 2009		

Appdx. B

\\WAN-EB-FILE99\Vancouver\Transportation\V31\Proposals\PV31101113_Steveston\UpstreamShimaoa\Modification\CADD\EBWINS MODEL.dwg [APPDX. B] October 15, 2009 - 12:12:43 pm (BY: ARIANE HERZOG)

APPENDIX

APPENDIX C - HAYCO'S ASSESSMENT OF THE STABILITY OF THE PROPOSED RECLAMATION

Stability Overview

Hayco/EBA completed an assignment for the City of Richmond under which the seismic stability and performance of the Fraser River dyke located between No. 4 and 5 Roads was assessed. The study included advanced modelling and prediction of post-seismic movements of the dyke system in order to perform an option assessment considering the flood risks and costs of ground improvement.

Geotechnical concerns stem from the fact that the area is underlain by soft silts and potentially liquefiable sands. These soil conditions limit the superimposed loading from structures such as the proposed public access bridge as well as the proposed fills, and gravel or quarried rock /berms.

In particular, geotechnical issues/risks include:

1. long-term settlement and/or bearing failure of the proposed reclamation area due to consolidation of compressible clay/silt layers present at the site which may require placement of additional fill to compensate for the large-scale settlement of the area; and,
2. seismic performance of the proposed fill/berms to be placed on the existing loose sand layers which will undergo significant movements and/or failure due to earthquake shaking and liquefaction.

Detailed assessment will be required to determine the rock berm side-slopes as well as other ground improvement measures to meet the performance criteria under normal working and seismic loading conditions. Procedures, extent and pattern of ground densification necessary to improve the seismic performance of the site will be described and cost estimates will be provided in the next stages of the design.

The performance criteria should be established in close interaction with the City of Richmond based on an assessment of risks and consequences. Depending on the component under consideration, i.e. the proposed islands and the access bridges, life safety and/or economic impacts should be considered.

APPENDIX

APPENDIX D BALANCED ENVIRONMENTAL'S ENHANCEMENT FEATURES FEASIBILITY STUDY

APPENDIX D

ENHANCEMENT FEATURES FEASIBILITY STUDY, STEVESTON HARBOUR EAST ENTRANCE, RICHMOND, BRITISH COLUMBIA

SECTION 1 – PRELIMINARY ENVIRONMENTAL DESIGN

1.1 Introduction

Marshes are some of the most ecologically diverse communities in the world. They are home to a variety of fish, birds, plants, invertebrates, mammals, amphibians, and are stopping grounds for a vast array of migratory species en-route to the nesting grounds of the north. Human development has resulted in the destruction of acres of these habitat features over the past 100 years resulting in significant accumulative environmental impacts that have trickled up the food chain, directly adversely impacting local fisheries and the economy itself. Restoration efforts to restore the lost functions of marshes along our coast should be a priority to ensure our way of life is persevered for future generations. By creating new functional marsh features, the City of Richmond would be taking a proactive approach to improving the environment through the creation of high value habitat.

Steveston is located at the mouth of the Fraser River. Tidal saltwater mixes with freshwater to create a unique brackish environment for local wildlife. A fusion of saltwater species and freshwater species occur here, resulting in high biodiversity. The transition also allows juvenile salmon to acclimate to saltwater. Off-channel habitats and marshes provide key habitat functions to these species.

Because of the unique location, marsh restoration efforts should focus on creating the following types of habitat to maximize functionality of the site:

- Off-channel fish habitat
- Brackish marsh habitat
- Riparian fringe habitat (backshore vegetation)
- Freshwater wetlands

All of the above have been incorporated into the habitat concept shown on Drawing 5192-D-01.1, which involves the construction of two new islands at the east end of Shady Island (Steveston Island) on the Fraser River.

1.2 Off-Channel Fish Habitat

1.2.1 General

Functional off-channel fish habitat typically use some or all of the below features:

- A muddy seabed
- A marsh perimeter
- A riparian fringe
- Shallow water depth
- Narrow channels with lengthy perimeters
- Woody debris (logs)

The off-channel fish habitat shown on Drawing 5192-D-01.1 will contain all of the above features.

1.2.2 Newly Constructed Area

Drawing 5192-D-01.1 shows the creation of 32,165 m^2 of new off-channel fish habitat. The area will be created by the construction of the two islands as shown, which will provide wave protection, nutrients, and shelter for the off0channel areas shown. The area includes the side slopes of the new island features up to the lower elevation of the proposed and existing marshes.

The side slopes of the islands have not been designed at this stage. Future investigation by a hydraulic engineer with hydraulic modelling capabilities may be required to determine the slope and material size that will allow the proposed islands to be stable. Non-riprap shorelines are preferred wherever possible from a habitat perspective.

1.3 Brackish Marsh

1.3.1 General

Brackish marsh construction requires consideration of the following factors:

- Proximity to freshwater
- Abundance of sunlight
- Wave protection
- Correct distribution and layering of organics, clay, silt, and sand
- Elevation for target marsh species
- Growing medium thickness
- Correct slope for soil stability
- A source for propagation

1.3.2 Areas Created

Drawings 5192-D-02.1 and 02.3 shows the preliminary brackish marsh planting scheme for the East Island and West Islands, respectively. The East Island will have 2,949 m^2 of marsh and the West Island will have 22,606 m^2 of marsh. The total area of brackish marsh for the two islands combined is 25,555 m^2. These newly created areas will serve as high value fish habitat.

The areas described above may become adjusted during the actual design stages of the project due to island side-slope design criteria determined by the hydraulic engineer. For example, if it is determined that a side slope of 3 horizontal to 1 vertical cannot sustain stable brackish marsh growing medium, marsh plants may not be capable of surviving on these side slopes and the area of brackish marsh would decrease.

1.3.3 Target Plant Species and Elevations

The marsh design shall focus on including equal distribution of elevation ranges for the following key species:

Table 1.1 – Key Indicator Species Elevations for the Steveston Marsh

Common Name	Scientific Name	Lower Elevation	Upper Elevation
Dunegrass	*Elymus mollis*	3.7m CD	5.0m CD
Creeping Spikerush	*Eleocharis palustris*	1.7m CD	2.0m CD
Soft-stemmed Bulrush	*Scirpus lacustris*	2.1m CD	3.7m CD
Lyngby's Sedge	*Carex lyngbyei*	1.7m CD	2.8m CD
Beach Pea	*Lathyrus japonicus*	3.8m CD	5.2m CD
Arctic Rush	*Juncus arcticus*	2.7m CD	3.8m CD
Pacific Silverweed	*Potentilla pacifica*	3.8m CD	4.5m CD
Sea Arrowgrass	*Triglochin maritimum*	2.5m CD	3.0m CD
Spearscale	*Atriplex patula*	3.8m CD	4.5m CD

A station (nail) has been installed on the south-west corner of the wharf immediately west of the site. The elevation was measured in comparison to the tide and determined to be 5.18m Chart Datum. All plant elevations provided are in reference to this location, and should be used during construction to determine growing elevations.

All growing boundaries should be established during construction to within +/- 5 cm accuracy.

1.2 Off-Channel Fish Habitat

1.2.1 General

Functional off-channel fish habitat typically use some or all of the below features:

- A muddy seabed
- A marsh perimeter
- A riparian fringe
- Shallow water depth
- Narrow channels with lengthy perimeters
- Woody debris (logs)

The off-channel fish habitat shown on Drawing 5192-D-01.1 will contain all of the above features.

1.2.2 Newly Constructed Area

Drawing 5192-D-01.1 shows the creation of 32,165 m^2 of new off-channel fish habitat. The area will be created by the construction of the two islands as shown, which will provide wave protection, nutrients, and shelter for the off0channel areas shown. The area includes the side slopes of the new island features up to the lower elevation of the proposed and existing marshes.

The side slopes of the islands have not been designed at this stage. Future investigation by a hydraulic engineer with hydraulic modelling capabilities may be required to determine the slope and material size that will allow the proposed islands to be stable. Non-riprap shorelines are preferred wherever possible from a habitat perspective.

1.3 Brackish Marsh

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Brackish marsh construction requires consideration of the following factors:

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- Growing medium thickness
- Correct slope for soil stability
- A source for propagation

1.3.2 Areas Created

Drawings 5192-D-02.1 and 02.3 shows the preliminary brackish marsh planting scheme for the East Island and West Islands, respectively. The East Island will have 2,949 m^2 of marsh and the West Island will have 22,606 m^2 of marsh. The total area of brackish marsh for the two islands combined is 25,555 m^2. These newly created areas will serve as high value fish habitat.

The areas described above may become adjusted during the actual design stages of the project due to island side-slope design criteria determined by the hydraulic engineer. For example, if it is determined that a side slope of 3 horizontal to 1 vertical cannot sustain stable brackish marsh growing medium, marsh plants may not be capable of surviving on these side slopes and the area of brackish marsh would decrease.

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Soft-stemmed Bulrush	*Scirpus lacustris*	2.1m CD	3.7m CD
Lyngby's Sedge	*Carex lyngbyei*	1.7m CD	2.8m CD
Beach Pea	*Lathyrus japonicus*	3.8m CD	5.2m CD
Arctic Rush	*Juncus arcticus*	2.7m CD	3.8m CD
Pacific Silverweed	*Potentilla pacifica*	3.8m CD	4.5m CD
Sea Arrowgrass	*Triglochin maritimum*	2.5m CD	3.0m CD
Spearscale	*Atriplex patula*	3.8m CD	4.5m CD

A station (nail) has been installed on the south-west corner of the wharf immediately west of the site. The elevation was measured in comparison to the tide and determined to be 5.18m Chart Datum. All plant elevations provided are in reference to this location, and should be used during construction to determine growing elevations.

All growing boundaries should be established during construction to within +/- 5 cm accuracy.

1.3.4 Base Material Placement and Requirements

Base material shall be placed by suction dredge. Base material must pass Environment Canada Ocean Dumping criteria. This may include sand from maintenance-dredged locations.

The base material will be required to harden such that heavy machinery can contour the site prior to placement of the growing medium.

1.3.5 Contouring

A land-based plough will perform contouring during periods of low tide. Contours shall adhere to those provided on the final design drawings. Contouring will allow for placement of growing medium. Drainages shall be constructed at the low points to ensure water, which may trap fish and other organisms, can escape during receding tides.

1.3.6 Growing Medium Requirements

A minimum of 30 cm and maximum of 100 cm of growing medium shall be placed over the entire area designated for new marsh. The growing medium shall consist of dredged material from the adjacent harbour entrance. With consideration to the types of plants listed in Table 1.1, except Dunegrass and Beach Pea, the following growing medium requirements will have the highest success rate:

- Gravel (greater than 2mm, less than 75mm) 0-10%
- Sand (greater than 0.05mm, less than 2mm) 30-60%
- Silt (greater than 0.002mm, less than 0.05mm) 20-50%
- Clay (less than 0.002mm) 10-40%
- Organic content 10-30%
- Acidity 5.0 – 6.5 pH

For Dunegrass and Beach Pea, riparian growing medium requirements should be used (see Section 1.4.6).

1.3.7 Transplanting

Transplanting shall conform to the following criteria:

- Plugs to be between 15 and 30 cm diameter
- Plug height to be between 15 and 30 cm diameter
- Plugs to be placed at a minimum 2 plugs per m^2
- Plugs to be arranged such that each plant is placed within its corresponding growing elevation shown in Table 5.1.
- Plugs to be planted in the early spring or late fall
- The entire root ball shall be placed below the surface.
- Plugs shall not remain out of the ground for longer than 24 hours

1.3.8 Maintenance

There is a chance that soil erosion may occur in exposed areas. These areas will either require routine placement of material, protection from waves and currents, or may be lost as functional areas.

1.4 New Riparian Areas

1.4.1 General

To construct a successful riparian area, the following conditions are required:

- A well drained, aerated growing medium
- Elevation near high water (see planting list)
- Proper rooting depth
- A stable slope
- A source for propagation

1.4.2 Riparian Length and Areas

The proposed riparian areas for the East and West Islands are shown on Drawings 5192-D-02.1 and 03.1, respectively. The total length of fringe riparian vegetation created is 889m on the East Island and 1,595m on the West Island, totalling 2,484m.

Two types of planting are proposed: high density and low density planting. The high density areas are located on the East Island and represent a 5 m wide strip adjacent to watercourses or public amenities. The lower density planting areas are proposed for all other inland areas on the East Island, and all riparian areas on the West Island.

The high-density areas conform to the Ministry of Environments planting guidelines for riparian areas. Following these criteria are only cost-feasible over small areas due to the 1m spacing requirement. These areas visually resemble an established riparian area more closely than low density planting areas. Therefore, to save cost, high density planting is only proposed in areas near public amenities.

Lower-density planting (1 plug per every 5 m) will be effective in establishing riparian vegetation in the long term, however will take longer to become established. As this density more accurately reflects tree density than the higher density planting schemes, these riparian areas will function similar to natural distributions. Visually they will be less impressive initially, and therefore have been placed further from public amenities.

1.4.3 Target Plant Species and Elevations

Table 1.2 – Key Riparian Species Elevations

Common Name	Scientific Name	Lower Elevation	Upper Elevation
Nootka Rose	*Rosa nootkana*	4.1m CD	> 5.2m CD
Black Hawthorn	*Crataegus douglasii*	5.2m CD	> 5.2m CD
Pacific Willow	*Salix lucida*	4.5m CD	> 5.2m CD
Scouler's Willow	*Salix scouleriana*	4.5m CD	> 5.2m CD
Beaked Hazelnut	*Corylus cornuta*	5.0m CD	> 5.2m CD
Oceanspray	*Holodiscus discolor*	4.5m CD	> 5.2m CD
Salal	*Gaultheria shallon*	5.0m CD	> 5.2m CD
Black Twinberry	*Lonicera involucrate*	4.5m CD	> 5.2m CD
Salmonberry	*Rubus spectabilis*	4.5m CD	> 5.2m CD
Red Elderberry	*Sambucus racemosa*	5.2m CD	> 5.2m CD
Snowberry	*Symphoricarpos albus*	5.0m CD	> 5.2m CD
Hardhack	*Spiraea douglasii*	4.5m CD	> 5.2m CD
Black Cottonwood	*Populus trichocarpa*	4.5m CD	> 5.2m CD
Red Alder	*Alnus rubra*	4.5m CD	> 5.2m CD
Bigleaf Maple	*Acer macrophyllum*	5.0m CD	> 5.2m CD
Western Red Cedar	*Thuja plicata*	5.0m CD	> 5.2m CD
Vine Maple	*Acer circinatum*	5.0m CD	> 5.2m CD
Pacific Crabapple	*Malus fusca*	4.5m CD	> 5.2m CD
Bitter Cherry	*Prunus emarginata*	5.0m CD	> 5.2m CD

A station (nail) has been installed on the south-west corner of the wharf immediately west of the site. The elevation was measured in comparison to the tide and determined to be 5.18m Chart Datum. All plant elevations provided are in reference to this location, and should be used during construction to determine growing elevations.

1.4.4 Base Material Placement and Requirements

All base materials to be placed with suction dredge as previously discussed.

1.4.5 Contouring

A land-based plough shall perform contouring. Contours shall allow for a natural appearance, leaving the surface within +/- 1 meter of the elevations shown on the final design drawings. Contours should allow for flow towards drainage areas as shown on the attached drawings.

1.4.6 Growing Medium Requirements for Riparian Site

With consideration to the types of plants listed in Table 1.2, the following growing medium requirements will have the highest success rate.

• Gravel (greater than 2mm, less than 75mm)	0-10%
• Sand (greater than 0.05mm, less than 2mm)	50-70%
• Silt (greater than 0.002mm, less than 0.05mm)	10-30%
• Clay (less than 0.002mm	10-20%
• Organic content	10-30%
• Acidity	5.0 – 6.5 pH

Growing medium soil shall be tested such that no visible water is present 120 minutes after a rain event of moderate to heavy intensity of at least 10 minutes. Growing medium shall not be compacted by heavy machinery and have a rough surface to promote colonization by native plants and reduce sediment and erosion. Growing medium that does not meet the above requirements may still support some local plant species, however results may vary for each species.

1.4.7 Planting

The following planting criteria may be required:

- Plants obtained from a credible plant nursery carrying native plants
- No. 2 pot size for high-density areas / combination of staking and No.2 pot size for low-density areas. In some cases seedlings may be used.
- Spacing 1 shrub/tree every 1 metre in high density areas (see attached drawings)
- Spacing 1 shrub/tree every 5 metres in low-density areas (see attached drawings)
- Plant types to be distributed evenly
- Planting to occur in early spring or late fall
- Irrigation may be required for the first year of growth
- Mulching may be required, but should be avoided adjacent to watercourses if it will not decompose naturally or produce leachate that might enter the watercourse.

1.4.8 Maintenance

After the first year, a crew of labourers should remove any invasive species which have colonized the site. This will be required until plant densities become established to levels that will out compete invasive species.

1.5 Freshwater Wetland Feature

1.5.1 General

Freshwater wetlands provide valuable habitat for a variety of species. To increase biodiversity at the site and better serve species present, a freshwater wetland feature is also proposed (see new water feature on drawing 5192-D-02.1).

5.5.2 Areas Created

A 3,503 m^2 new freshwater feature is proposed for the East Island.

5.5.3 Contouring

The inner side-slope will slope down at shallower than a 3:1 slope. The base material shall be clay, 0.5m thick over the entire area designated for wetland. A plough or other suitable heavy equipment shall place the material. The lowest point around the perimeter should be higher than 4.5m Chart Datum to ensure that fish do not enter the system and become trapped should the system dry up during the summer.

1.6 Environmental Impacts And Benefits

1.6.1 Off-Channel Fish Habitat

The environmental impacts of constructing off-channel fish habitat features will be as follows:

- Permanent loss of water column
- Permanent loss of sandy riverbed habitat
- Temporary generation of turbidity during construction
- Temporary disruption to local fish populations from equipment

A variety of juvenile fish, such as Coho salmon, use the Fraser River Estuary as a stopping ground to become acclimated to saltwater on their seaward migration. They prefer areas of slower velocity water that are protected from predators and abundant in food. These conditions are provided by off-channel habitats.

1.6.2 Intertidal Marsh

The environmental impacts of constructing the marsh features will be as follows:

- Permanent loss of water column
- Permanent loss of sandy river habitat
- Temporary generation of turbidity during construction
- Temporary disruption to local fish populations from equipment

Brackish marsh habitat provides shelter for juvenile fish from predators during periods of inundation. It also is home to a variety of invertebrates which provide food to juvenile fish, birds, and other wildlife. Marshes improve water quality by slowing water flow and allowing the deposition of fines and also uptake of hydrocarbons and other deleterious substances. Marshes provide natural shoreline stabilization with their root structures, avoiding the need for unnatural riprap shorelines.

1.6.3 Riparian Area

The environmental impacts of constructing the riparian features will be as follows:

- Permanent loss of water column
- Permanent loss of sandy river habitat
- Temporary generation of turbidity during construction
- Temporary disruption to local fish populations from equipment

A riparian fringe along a watercourse is an important component of an ecosystem. Riparian areas contribute large woody debris, insect drop, detritus and shade to the neighbouring watercourse. They also provide natural slope stability and improve water quality. A variety of raptors and other birds live, feed, and nest along riparian areas.

1.6.4 Freshwater Wetland Habitat

Construction of the fresh water habitat feature will result in the following environmental impacts:

- Permanent increase of water column
- Less space for construction of riparian habitat
- Temporary generation of turbidity during construction

The fresh water habitat feature will provide habitat for freshwater amphibians and invertebrates, providing food for a variety of bird species and other organisms.

1.7 Habitat Value For Off-Site Compensation

Balanced Environmental Services Inc. performed a biophysical survey of the site as part of their preliminary habitat review of Steveston Harbour in 2009. The work was performed for Fisheries and Oceans Canada – Small Craft Harbours Branch (SCH), and provides baseline data that can be used to determine the environmental impacts of proposed works in those areas.

The biophysical survey identified physical and biological conditions at the site, including generating a detailed species list of organisms observed, and accurate topographical data referenced to Chart Datum.

The footprint of the proposed habitat features will avoid all critical marsh habitat identified in the biophysical survey. The majority of the footprint will be placed over sand flat with low biodiversity.

The following is a summary of habitat areas lost or created by the proposed enhancement feature:

Table 1.3. Habitat Balance Sheet

Habitat Type	Pre m^2	Post m^2	Net m^2
Dredge Cut Bottom	0	11030	11030
Dredge Side Slope	0	6798	6798
Riprap	0	11483	11483
Riparian	0	28592	28592
Fresh Water	0	3503	3503
Marsh	0	25555	25555
Off-Channel	0	32165	32165
Trail / Lawn	0	2898	2898
Unprotected Sandy Bottom	-123675	1651	-122023

While the project results in a loss of 123,675 m^2 of sandy riverbed, the equivalent area of high value habitat will be created.

To determine the amount of habitat credits are available, the Balanced Environmental Units (BEU) can be calculated as follows:

Table 1.4. Habitat Credit Calculations

Habitat Type	Pre m^2	Post m^2	Net m^2	H	A	Value beu
Dredge Cut Bottom	0	11030	11030	1	1	11030
Dredge Side Slope	0	6798	6798	1	1	6798
Riprap	0	11483	11483	0.5	2.5	14353
Riparian	0	28592	28592	2	1	57183
Fresh Water	0	3503	3503	6	1	21016
Marsh	0	25555	25555	6	1	153330
Off-Channel	0	32165	32165	3	1	96496
Trail / Lawn	0	2898	2898	0.1	1	290
Unprotected Sandy Bottom	-123675	1651	-122023	1	1	-122023
					Net	238,473

H = Habitat Factor, A = Area Factor, BEU = Balanced Environmental Unit

While BEU's have been used in a variety of Environmental Impact Assessments and Fisheries Act Authorizations, the values are subjective and are negotiated on a project by project basis, therefore Fisheries and Oceans Canada (DFO) does not endorse their use. However, they do provide a rough means of calculating habitat credits for a project prior to DFO review.

Using the beu calculations, the proposed enhancement area would result in a net habitat credit of + 238,473 *beu*, which could be applied to other projects in the area.

The amount of credit required by a project will depend on the type of habitat being impacted. For example, if critical habitat such as eelgrass is destroyed, DFO will require 2:1 like for like habitat compensation to offset those impacts. Only if it can be demonstrated that this form of compensation on site is not possible, can offsite locations be considered. If offsite like for like is not available, only then can habitat credits be used, and often will require it in the form of high value fish habitat such as new marsh. In that case, the proposed enhancements would compensate for a project footprint of 30,600 m^2.

The majority of projects which do not adversely affect critical habitat will be more favourable as options to purchase the above habitat credits. Some projects have required that 1:1 mud lost to new habitat created be implemented for compensation, and 2:1 mud lost to new marsh as compensation. Under these circumstances, the construction of the proposed enhancement features would be able to compensate for a project with an intertidal or subtidal footprint of up to 150,000 m^2.

Therefore, construction of the proposed enhancement features may provide compensation credits for other projects ranging in footprint size from 30,600 m^2 to 150,000 m^2 depending on the impacts of the proposed project. As the enhancement will create high value critical habitat in the Fraser River Estuary, enhancements to this location may be able to compensate for more than that typically observed along our coast in other locations, therefore the footprints described above may be larger than projected. To determine the actual value of the habitat created, negotiation with DFO will be required (on a project by project basis).

SECTION 2 - COST

2.1 Costing Assumptions

To determine the cost of contouring and planting of the proposed habitat features, the following assumptions have been made:

- Only 1 metre of material will need to be handled by the plough after placement by suction dredge.
- Only areas designated as riparian, marsh, and a 2 metre wide strip along the toe of the marsh, will need to get contoured.
- Dense planting, as per the Ministry of Environment Guidelines, will only be required near public amenities.
- All materials, such as clay, sand, silt, etc, are delivered and in close proximity such that they do not require an excavator or dump truck to move or place.
- A site supervisor and environmental monitor will only spot-check the work.
- The work will only require a few surveying site visits.

2.2 Costing Calculations

Detailed costing calculations for contouring and planting are shown below in Table 2.1.

Table 2.1. Contouring and Planting Cost Analysis

East Island

Activity	Area m^2	Volume m^3	Rate	Cost
Contouring				
Plough	19824	19824	5	$99,119
Engineering Inspection				$10,000
Surveying				$10,000
Monitoring				$10,000
Planting				
1m Density	6760		16	$108,157
5m Density	4737		3	$14,212
Grass	2484		0.01	$25
Marsh	2949		10	$29,494
			subtotal	$281,007

West Island

	Area	Volume	Rate	Cost
Contouring				
Plough	39700	39700	5	$198,500
Engineering Inspection				$10,000
Surveying				$10,000
Monitoring				$10,000
Planting				
1m Density			16	$0
5m Density	17094		3	$51,283
Grass			0.01	$0
Marsh	22606		10	$226,056
			subtotal	$505,839

Off-Channel

	Length	Width	Rate	Cost
Contouring	28350	56700	5	$283,500
			Total	$1,070,347

2.3 Costing Discussion

Costs are expected to vary considerably with the ability of the contractors to place the bedding material. The closer the bedding material is placed to the proposed contours the less costs will be required for contouring. For example, if bedding material is placed to within 0.5m of that required by contouring, the cost estimate would be $150,000 cheaper.

In addition, as the work is performed in a tidal environment, part of the work will require working at different times of the day. The above cost estimate does not include extras imposed by contractors to work around the tides.

The cost to perform the planting can be reduced through the purchasing of stakes rather than No.2 plants in the low plant density areas - additional savings of up to $30,000. However, the labour required to plant varies and will depend on who performs the work.

If additional equipment, such as excavators and dump trucks, are required, the costs will be significantly higher than projected. Additional requirements necessary to fulfill permits obtained from regulatory agencies, such as DFO, may increase actual project costs. For example, DFO may increase the plant density of low planting areas, ask for additional mitigation measures, etc.

In general, the cost to perform the contouring and planting will be of the order of magnitude of $1,000,000.

SECTION 3 - SIGNATURES

3.1 General

Balanced Environmental Services Inc. declares that qualified environmental professionals acting within their areas of expertise have duly prepared the attached work.

Report By:

Warren Appleton, RPBio
Biologist
Balanced Environmental Services Inc.

Reviewed By:

Scott Christie, RPBio
President
Balanced Environmental Services Inc.

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Table 1: Plant Species Commonly Observed In Brackish Marsh East of Steveston Harbour and Shady Island, Steveston, B.C.

Date: August 27, 2009

Common Name	Scientific Name	Range*		Abundance**
		Upper	Lower	
Algae, Green				
Green String Lettuce	*Phaluris arundinacea*	4.2	1.5	Common
Ferns				
Lady Fern	*Athyrium filix-femina*	5.2	4.5	Sparse
Grass				
Dunegrass	*Elymus mollis*	5.0	3.7	Sparse
Reed Canarygrass	*Phalaris arundinacea*	5.2	3.7	Abundant
Horsetails				
Swamp Horsetail	*Equisetum fluviatile*	4.5	3.7	Sparse
Rush				
Arctic Rush	*Juncus arcticus*	3.8	2.7	Common
Sedge				
American Bulrush	*Scirpus americanus*	2.8	1.9	Few
Creeping Spikerush	*Eleocharis palustris*	2.0	1.7	Common
Lyngby's Sedge	*Carex lyngbyei*	2.8	1.7	Abundant
Soft-stemmed Bulrush	*Scirpus lacustris*	3.7	2.1	Sparse
Shrubs				
Black Hawthorn	*Crataegus douglasii*	5.2	5.2	Rare
Black Twinberry	*Lonicera involucrata*	5.2	4.5	Sparse
English Holly	*Ilex aquifolium*	5.2	4.5	Rare
Evergreen Blackberry	*Rubus laciniatus*	5.2	4.1	Sparse
Himalayan Blackberry	*Rubus discolor*	5.2	4.1	Few
Japanese Knotweed	*Polygonum cuspidatum*	5.2	4.1	Few
Nootka Rose	*Rosa nootkana*	5.2	4.1	Common
Red Elderberry	*Sambucus racemosa ssp. Pubens*	5.2	5.2	Rare
Scotch Broom	*Cytisus scoparius*	5.9	4.5	Sparse
Sitka Mountain-Ash	*Sorbus sitchensis*	5.2	4.5	Rare
Snowberry	*Symphoricarpos albus*	5.2	4.5	Sparse
Trees				
Black Cottonwood	*Populus balsamifera spp. Trichocarpa*	5.2	4.5	Few
Red Alder	*Alnus rubra*	5.2	4.5	Few
Scouler's Willow	*Salix scouleriana*	5.2	4.3	Few
Vine Maple	*Acer circinatum*	5.2	4.5	Sparse
Western Crabapple	*Pyrus fusca*	5.2	4.5	Sparse
Wildflowers				
American Vetch	*Vicia americana*	5.2	3.8	Sparse
Beach Pea	*Lathyrus japonicus*	5.2	3.8	Sparse
Canada Goldenrod	*Solidago canadensis*	5.2	4.1	Few
Canada Thistle	*Cirsium arvense*	5.2	4.1	Sparse
Common Plantain	*Plantago major*	5.2	3.5	Sparse
Curled Dock	*Rumex crispus*	5.2	3.5	Sparse
Douglas' Aster	*Aster subspicatus*	5.2	3.2	Sparse
Field Mint	*Mentha arvensis*	5.2	3.5	Sparse
Hedge False Bindweed	*Calystegia sepium*	5.2	4.5	Rare

** Range elevations are measured in metres, Chart Datum*

*** Abundance is relative to availability of suitable habitat within the observed elevation range.*

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Pacific Silverweed	*Potentilla pacifica*	4.5	3.8	Few
Prickly Sow-thistle	*Sonchus asper*	5.2	4.1	Sparse
Purple Loosestrife	*Lythrum salicaria*	5.2	3.7	Few
Sea Arrowgrass	*Triglochin maritimum*	3.0	2.5	Few
Smartweed	*Polygonum sp.*	5.0	3.5	Few
Spearscale	*Atriplex patula*	4.5	3.8	Sparse
Springbank Clover	*Trifolium wormskjoldii*	5.2	3.5	Few
Water Parsnip	*Sium suave*	3.8	2.5	Sparse
Yellow Flag Iris	*Iris pseudocorus*	5.2	3.7	Few

**ABUNDANCE ESTIMATES		
Description	*Aerial Coverage*	*Individual Counts*
Rare	<5%	1
Sparse	5-25%	2-4
Few	26-50%	5-10
Common	51-75%	11-30
Abundant	>75%	>30

** Range elevations are measured in metres, Chart Datum*
*** Abundance is relative to availability of suitable habitat within the observed elevation range.*

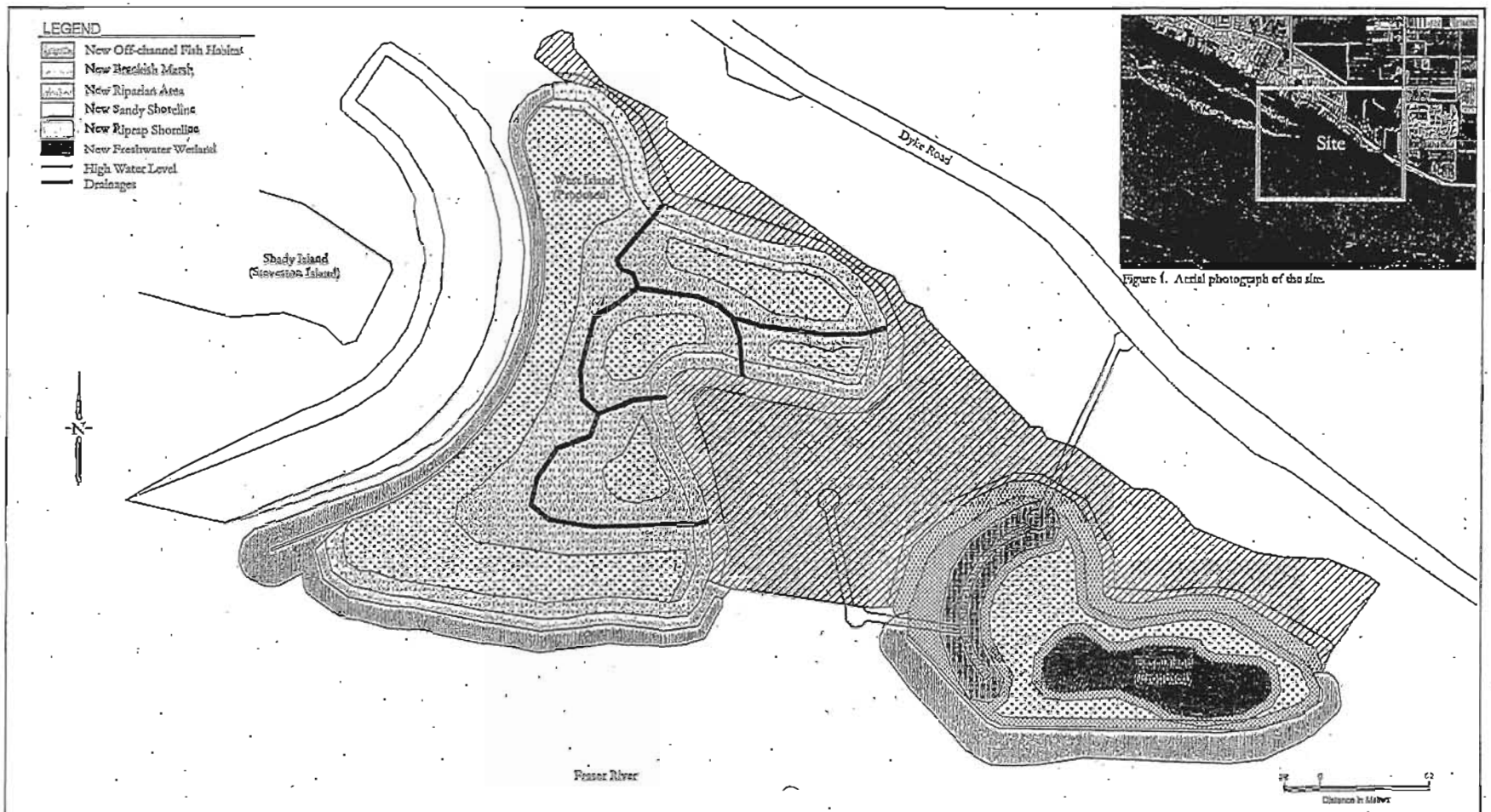
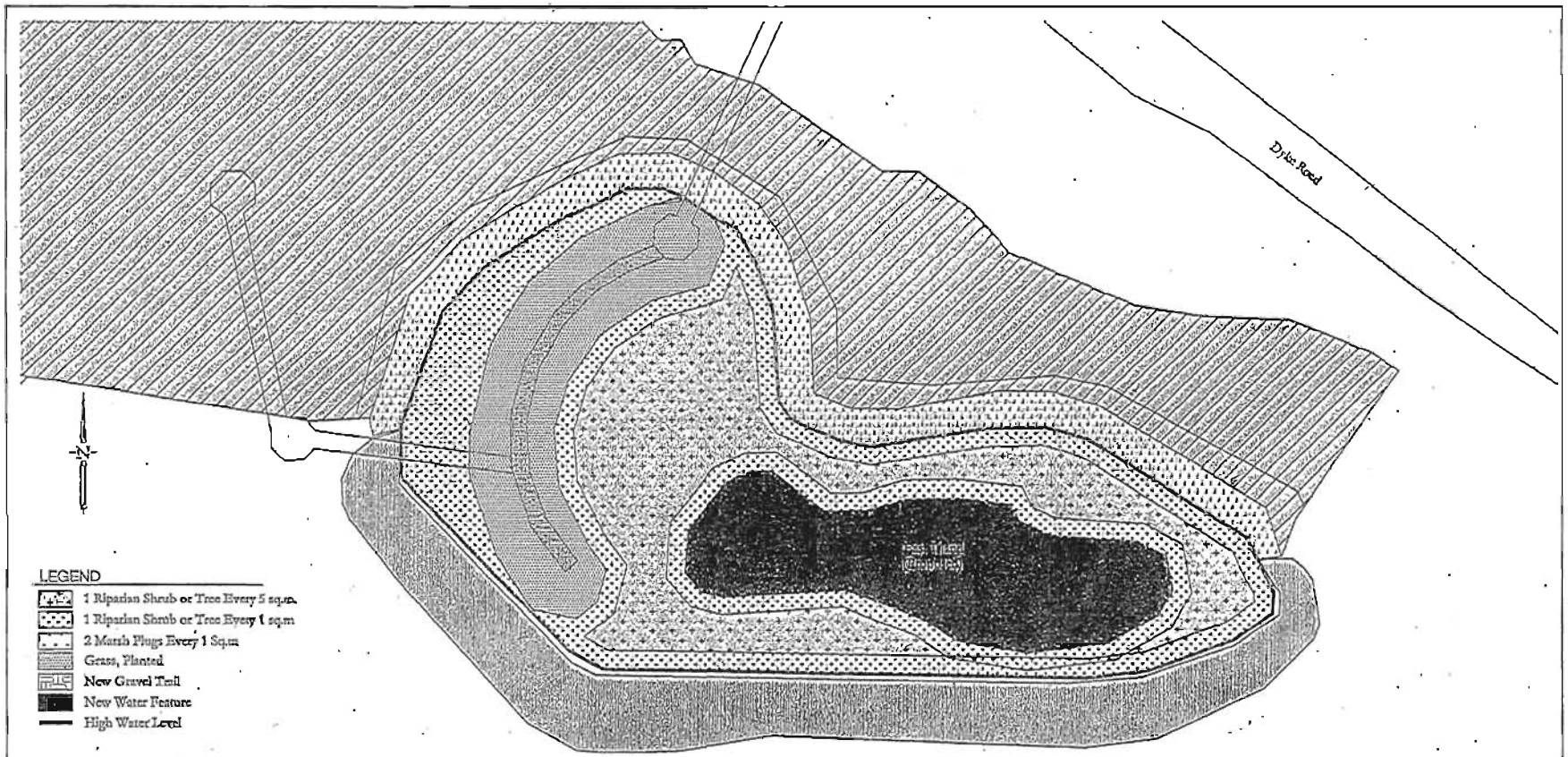
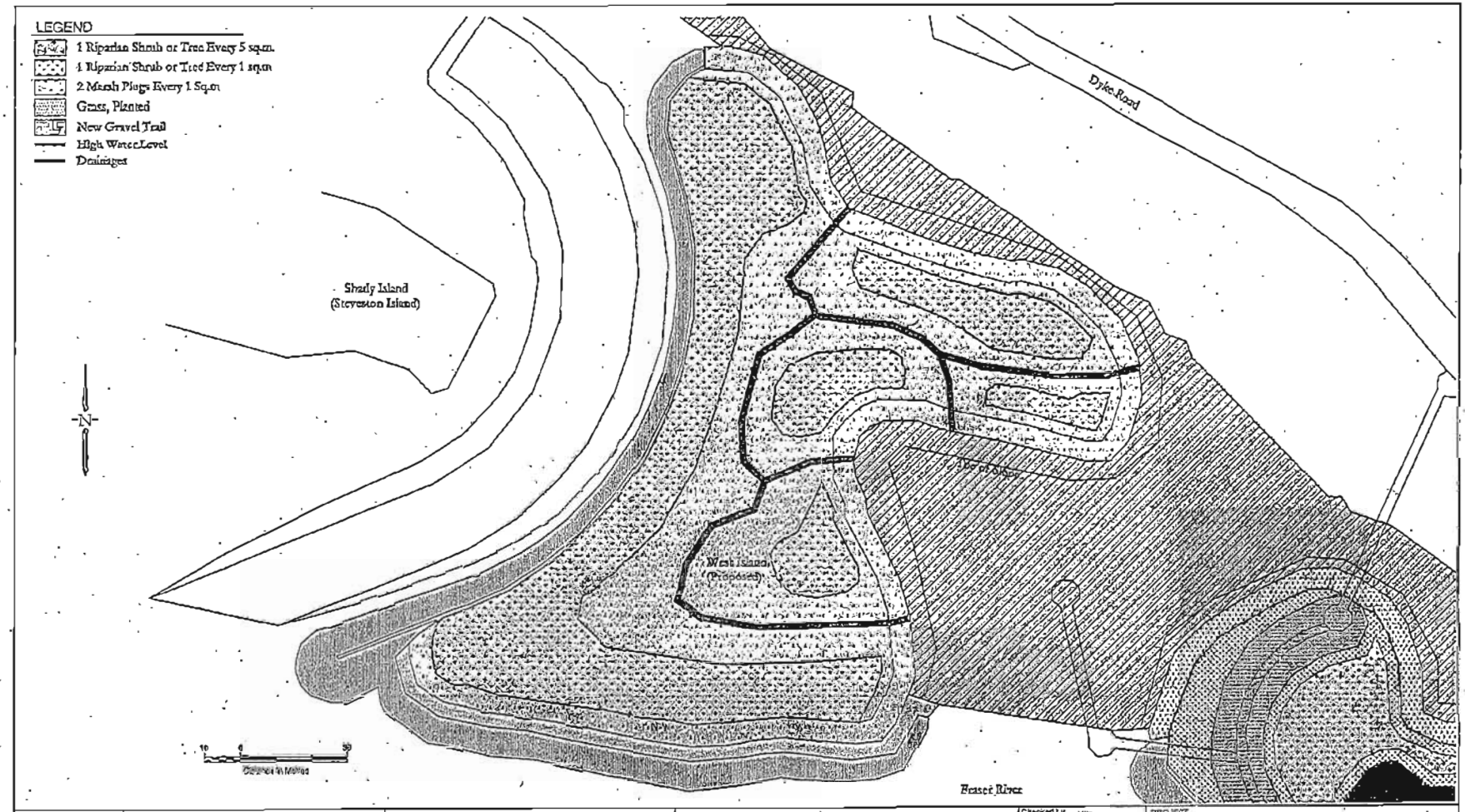


Figure 1. Aerial photograph of the site.

		Client	Author	Checked by: KE	PROJECT: HABITAT BALANCE SHEET AREAS, EAST ENTERANCE MODIFICATIONS, STEVESTON HARBOUR, BRITISH COLUMBIA
		HAYCO	BALANCED ENVIRONMENTAL	Drawn by: WA	
				Date: Oct. 6, 2009	
				Scale: 1:2000	
				Inspector: DC	
Ref. No.	REFERENCE			Paper: 11 x 17	DWG. No. 5192-D-01.1



		Client: HAYCO	Author: BALANCED ENVIRONMENTAL	Checked by: XIE	PROJECT: EAST ISLAND PLANTING CONCEPT, EAST ENTERANCE MODIFICATIONS, STEVESTON HARBOUR, BRITISH COLUMBIA
				Drawn by: WA	
				Date: Oct. 6, 2009	
				Scale: 1:1000	
				Inspector: DC	
Ref. No.	REFERENCE			Paper: 11 x 17	DWG. No. 5192-D-02.1



		Client: HAYCO	Author: BALANCED ENVIRONMENTAL	Checked by: XIE Drawn by: WA Date: Oct. 8, 2009 Scale: 1:1500 Projection: DC Paper: 11 x 17	PROJECT: WEST ISLAND PLANTING CONCEPT, EAST ENTERANCE MODIFICATIONS, STEVESTON HARBOUR, BRITISH COLUMBIA
					DWG. No. 5192-D-03.1
Ref. No.	REFERENCE				

Photo 1. Rocky berm connecting mainland to island consists of small riprap.

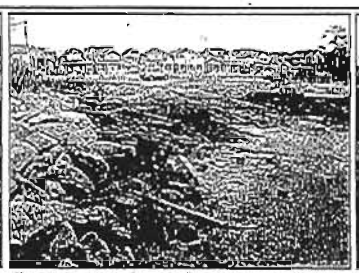


Photo 2. Deteriorated concrete launching ramp ending in a muddy sand substrate.

Photo 3. Looking east along transition from mud to sand substrate.

Photo 4. Erosion along edge of marsh.

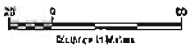
Photo 5. Concrete wall, walking path, and road above High Water Mark.

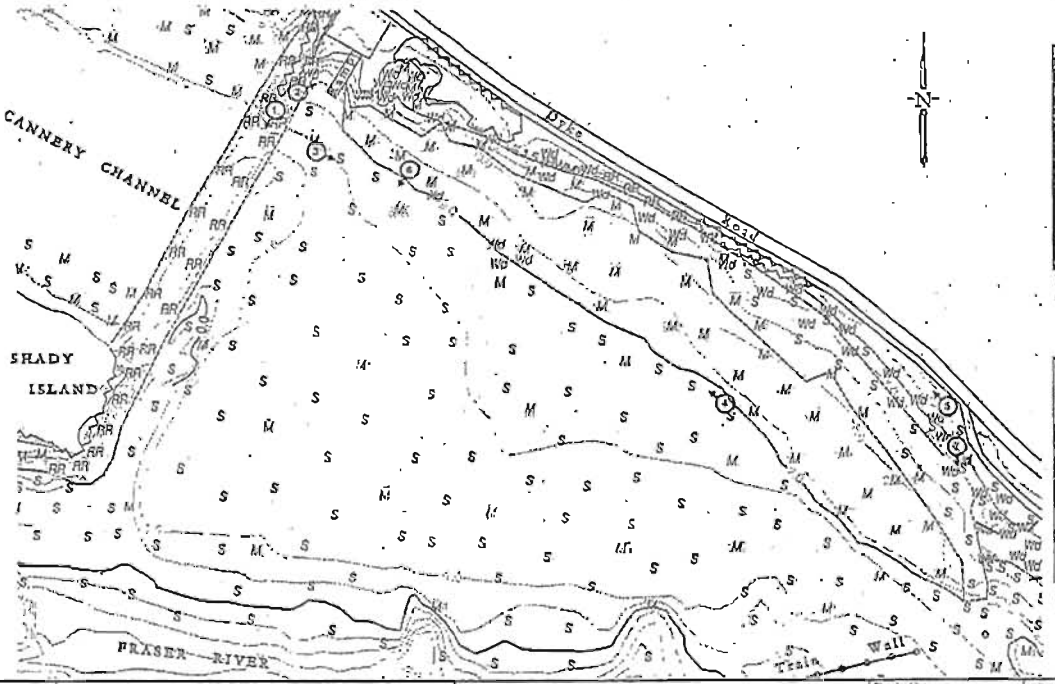
LEGEND

- High Water Level (4.5m Chart Datum)
- Low Water Level (0m Chart Datum)
- Bed Bedrock
- RR Riprap (Angular rock > 64mmØ)
- Bol Boulders (>255mmØ)
- Cob Cobble (64mm to 255mmØ)
- Peb Pebble (2mm to 64mmØ)
- S Sand (0.0625mm to 2mmØ)
- M Mud (<0.0625mmØ)
- Shl Shell Hash
- Wd Woody Debris
- Riparian Vegetation Perimeter
- Approximate location and direction photograph taken

DRAWING NOTES

- Site Visits Mar 4 and July 20, 2009
- Elevations are in metres chart datum.





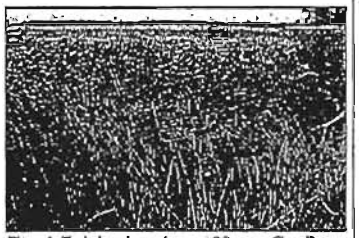


Photo 6. Typical sandy area between 2.0 metres Chart Datum and Low Water Level.

Photo 7. Accumulation of woody debris along High Water Mark at east end of site.

Ref. No.	REFERENCE

Client

Fisheries and Oceans / Pêches et Océans

Small Craft Harbours Branch

Author

BALANCED ENVIRONMENTAL

118 Garden Avenue, North Vancouver, B.C., V7P 3H2

www.balanced.ca

Checked by	XIE
Drawn by	WA
Date	July 21, 2009
Scale	1:2000
Inspectors	WA/DO/DB
Paper Size	11 x 17

PROJECT

PHYSICAL CONDITIONS, EAST ENTRANCE, STEVESTON HARBOUR, BRITISH COLUMBIA

DWG. No. 5182-D-11.1

Photo 1. Looking southeast over Sedge and Rush marsh towards Shady Island. The sand flats and the riprap berm across the Cannery Channel have low biodiversity.

Photo 2. Woody debris accumulates along the High Water Mark above the marsh.

Photo 3. Typical rush found throughout marsh area on site.

Photo 4. Transition from marsh to sand flat.

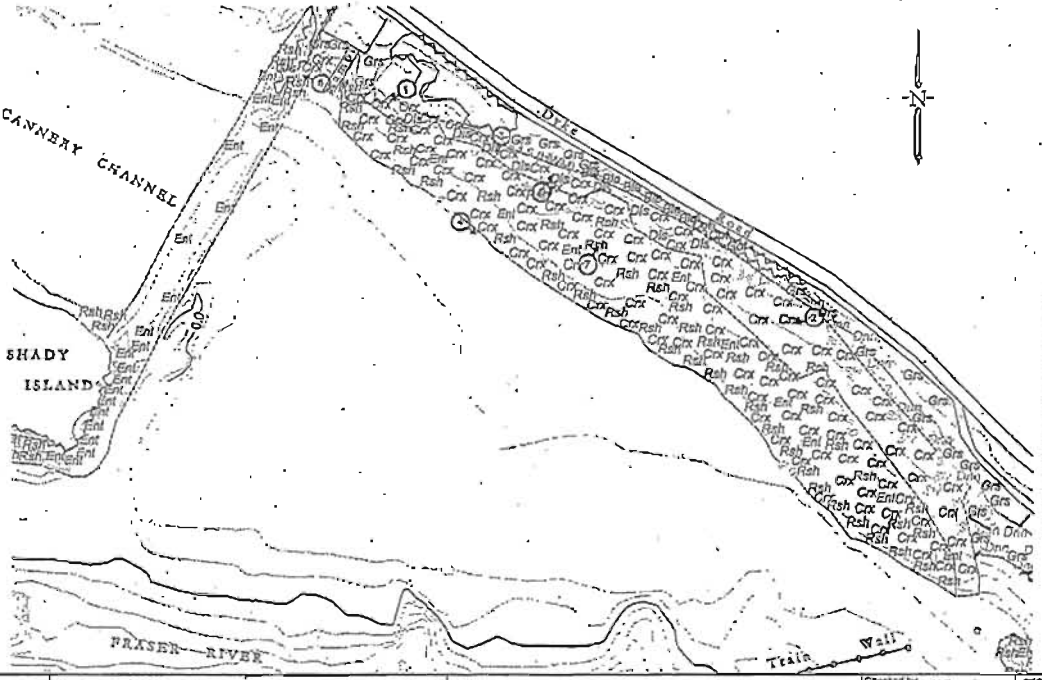
Photo 5. Distichlis competing for sunlight with Silverweed, Green String Lettuce, sedges and rushes.

LEGEND

- High Water Level (4.6m Chart Datum)
- Low Water Level (0m Chart Datum)
- Blo Blackberry
- Cot Cottonwood, Black
- Gra Grasses
- Dsp Dunegrass
- Sil Silverweed
- Crx Sedge
- Dis Distichlis
- Rsh Rush
- Ent Green String Lettuce
- Riparian Vegetation Perimeter
- Approximate location and direction photograph taken

DRAWING NOTES

- Site Visits Mar 4 and July 20, 2009
- Elevations are in metres chart datum



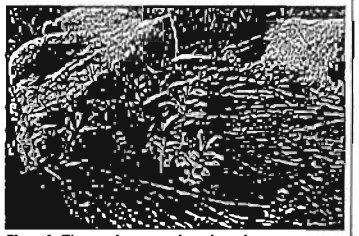


Photo 6. Silverweed common throughout site.

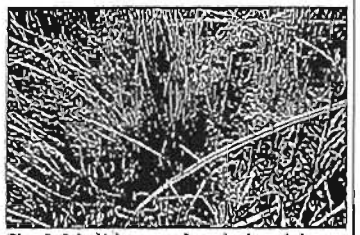


Photo 7. Sedge blade overlap of several scales typical throughout site.

Ref. No.	REFERENCE

Client: Fisheries and Oceans / Pêches et Océans — Small Craft Harbours Branch

Author: BALANCED ENVIRONMENTAL, 116 Gordon Avenue, North Vancouver, B.C., V7P 3H2, www.balanced.ca

Checked by	XIE
Drawn by	WA
Date	July 31, 2009
Scale	1:2000
Inspectors	WA/DC/DB
Paper Size	11 x 17

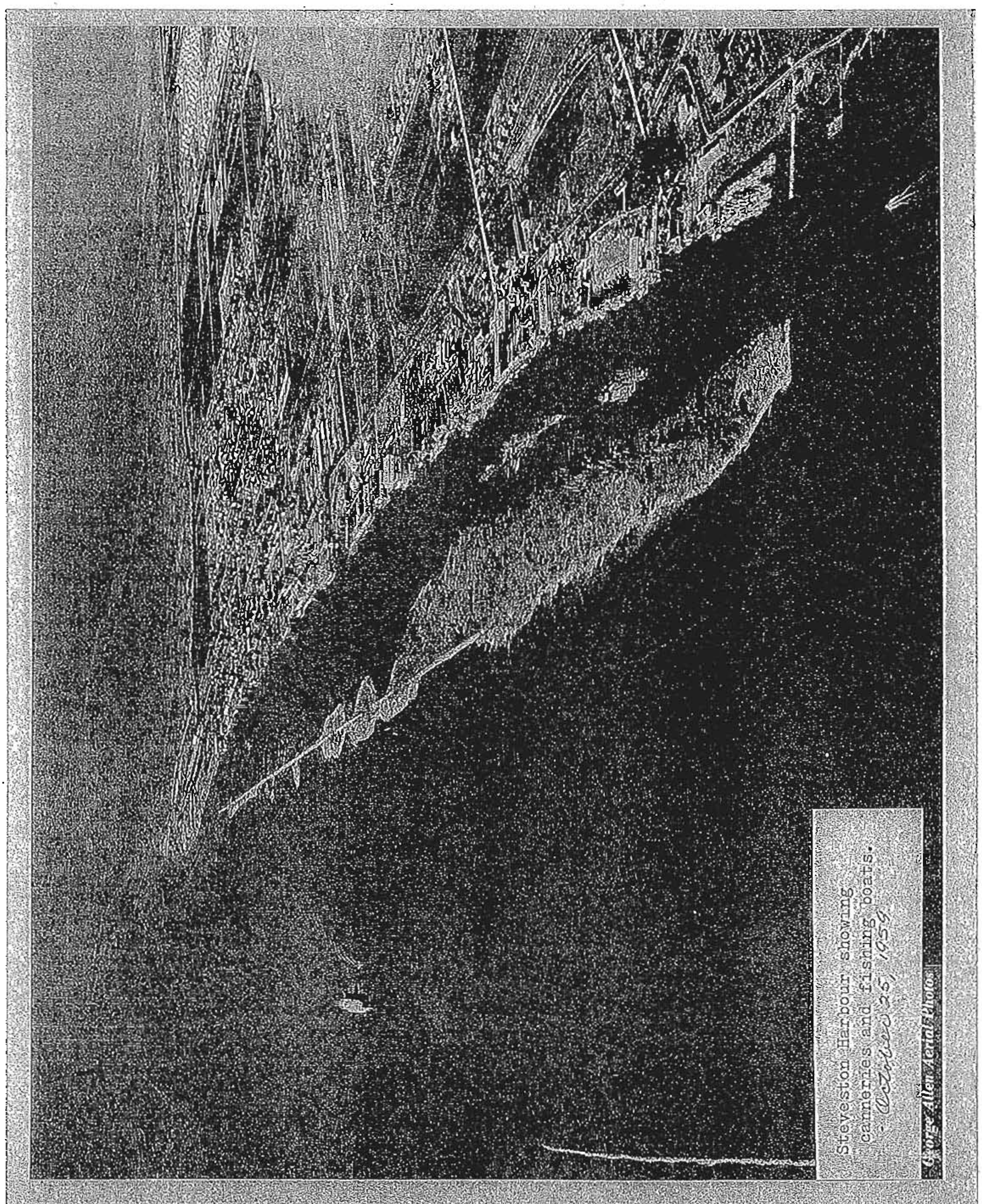
PROJECT: BIOLOGICAL CONDITIONS, EAST ENTRANCE, STEVESTON HARBOUR, BRITISH COLUMBIA

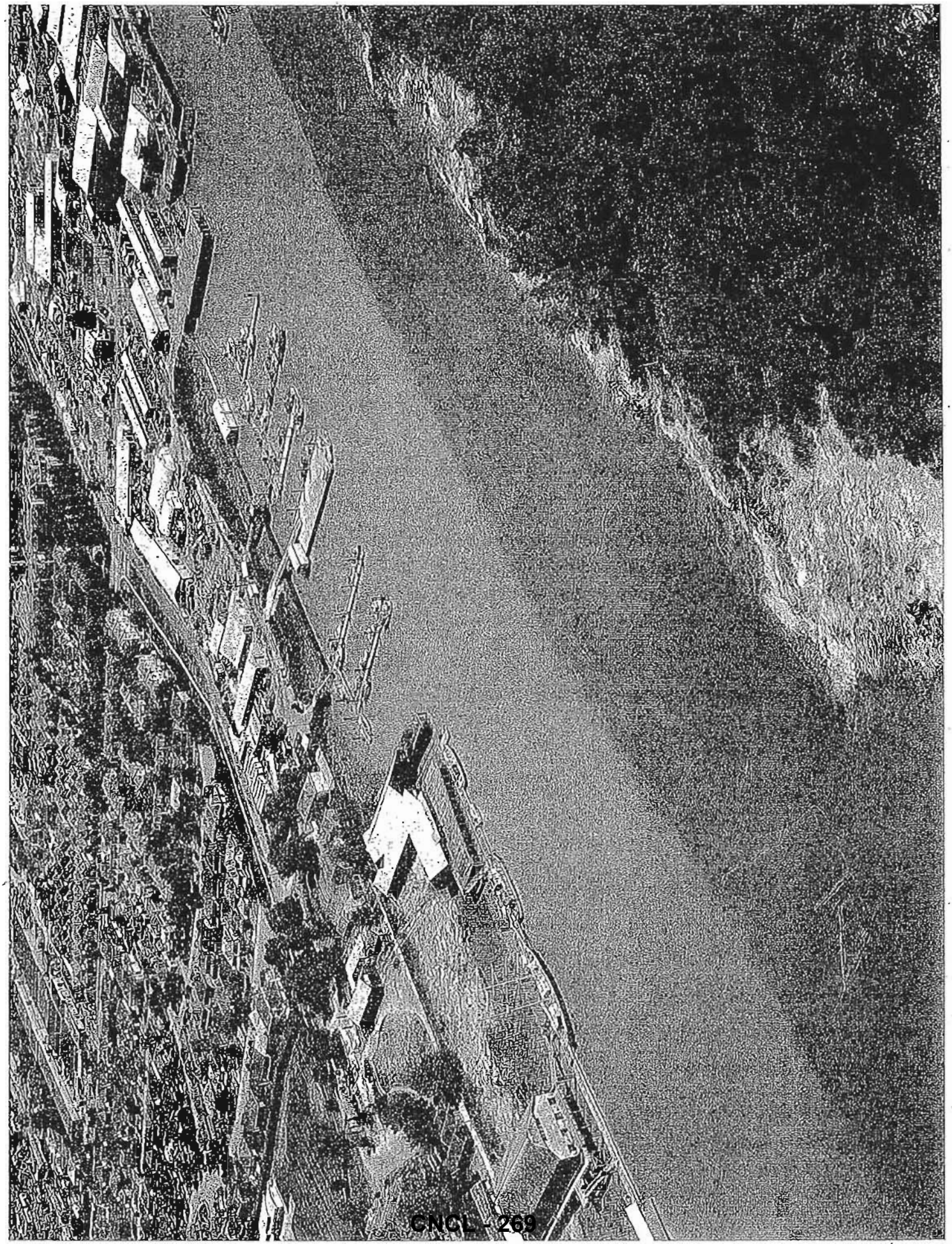
DWG. No. 5182-D-12.1

APPENDIX C
Steveston Harbour Authority
Dredging Funding Summary

YEAR	FUNDING RECEIVED
2002/2003	275,000.00
2003/2004	200,000.00
2004/2005	200,000.00
2005/2006	200,000.00
2006/2007	350,000.00
2007/2008	200,000.00
2008/2009	335,000.00
2009/2010	400,000.00
2010/2011	400,000.00
2011/2012	200,000.00

Panoramic View - Steveston to
mouth of Fraser River - May 25, 1960.


Steveston Harbour showing
canneries and fishing boats.
October 25, 1959
George Allen Aerial Photos



APPENDIX B

PORT METRO vancouver

APPLICATION FORM
Local Channel Dredging Contribution Program – Advance of Funds

Society/Company Name:	Society/Company Number:
Contact Name:	Phone Number (s):
Mailing Address:	Email Address:

LIST OF APPLICABLE LOCAL CHANNELS

1.
2.
3.
4.
5.

INTENDED PURPOSE OF ADVANCE FUNDS

	Estimate /Proposal Amount
☐ Consulting	
☐ Samples/ Tests	
☐ Computer modeling	
☐ Other. Please describe:	

Please provide copies of firm proposals for indicated services and/or backup for estimates

TOTAL REQUESTED AMOUNT

Application Date: _____

Name (please print): _____

Signature: _____

Please forward application to:
Port Metro Vancouver
Planning and Development Department
100 The Pointe, 999 Canada Place
Vancouver, BC Canada V6C 3T4

By signing and submitting this Application you agree to be bound by the above terms and conditions.

PORT METRO vancouver

APPENDIX A

Local Channel Dredging Contribution Program

Application for Advance of Funds

Background
In 2008, the Vancouver Fraser Port Authority, doing business as Port Metro Vancouver ("PMV") finalized a Dredging Policy which included a 10-year **Local Channel Dredging Contribution Program** that will provide financial support for riverfront communities to undertake their own dredging activities beyond deep sea and domestic shipping channels.
This Application for Advance of Funds form is designed to enable designated riverfront communities to apply for advance funding to assist with preparing their formal application under this program.

Applicant Eligibility
Applications for Advance of Funds will only be accepted from designated riverfront communities which have registered with the B.C. Corporate Registry as a Society or B.C. Company.

Use of Funds
Funds advanced under this program can only be used for activities directly related to preparing a full application for funding i.e. third-party consulting, computer modeling, samples, tests etc. The funds cannot be used for dredging or administrative costs of the applicant. The maximum advance which may be approved is 10% of funding available per channel to a maximum of $125,000 for multi-channel applicants.

Application Process
The Application for Advance of Funds will be reviewed by PMV within 4 to 6 weeks. Delays may result from incomplete Applications.

Advance for Funds Approval
- If the Application is approved, Applicants will receive written notification from PMV along with a cheque for the approved amount.
- PMV reserves the right to approve all, some or none of the requested amount.

Reporting Requirements:
- Applicants are required to make available to PMV, on request, copies of all reports, computer models, tests, samples etc. funded by the advance.
- PMV reserves the right to request the Applicant to provide a summary accounting of the use of funds. The summary must be signed by at least three Directors of the company/society.

Return of Funds
PMV reserves the right to request the Applicant to return any unused funds based on its review of Applicant's accounting summary.

Required Attachments:
1. **Certification of Incorporation under the British Columbia Corporate Registry:** a certificate of incorporation given by the registrar for a society or B.C. Company.
2. **A list of Directors:** a signed copy of the current list of directors on date of application.
3. **A signed resolution requesting funds:** a signed resolution from the company/society indicating its approval to request an advance of funds from Port Metro Vancouver under its Local Channel Dredging Contribution Program.
4. **Copies of third-party proposals and/or backup for estimates:** backup materials to support requested amounts for each category.