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Subject: MOE Comments on PMH1 CEMP
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Attachments: MOE Comments on PMH1 CEMP letter June 10-2009.pdf

Good Afternoon Liz,

Please find attached our detailed comments on the CEMP. If you have any questions, let us know.

Best regards,

Cassandra Caunce (BSc)

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June 10, 2009

File: PMH1

Elizabeth Kovics
Environmental Manager, Port Mann Hwy 1
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Suite 900 - 1111 West Georgia Street
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Dear Ms. Kovics:

**Re: Submission of Ministry Comments on the Port Mann/Highway 1 Construction
Environmental Management Plan (CEMP)**

On May 15, 2009, the Ministry of Environment (MOE) received the Construction Environmental Management Plan (CEMP) for the Port Mann /Highway 1 Project which is subject to a 30-day review and comment period, defined under the environmental certificate for the project. Cassandra Counce, Joanna Hirner and John Kelly of MOE have completed a review of the document and have the following detailed comments:

General Overall Comments

1. Lack of detail

There are many commitments made to complying with regulations, best management practices and such; however the important details on how this will be achieved are often left out. In some cases, these details are committed to in supplemental plans, such as environmental work plans, but without these plans in the CEMP itself, it is difficult to assess if the plans are sufficient and effective. Most of the CEMP would be much more effective and useful for implementation with a greater level of detail on how commitments and requirements will be achieved. Including these details will also increase the confidence of MOE (and likely other agencies) that project commitments and requirements are being appropriately achieved. It should be noted that this is the same comment that has been provided by MOE on previous EMP submissions for this project.

2. Key Performance Indicators

A key performance indicator (KPI) is what is used to measure/evaluate the success of implementing various aspects a plan, in this case the EMP. Indicators must be quantifiable, not qualitative, and tied to specific targets or objectives in order to measure success. Most of the KPIs are defined as development of various plans for environmental management. However, the KPIs should not be "development of plans"; instead, the KPIs should indicate how well the various plans have been implemented and how well the mitigation measures described in the plans achieve the objective of minimizing the environmental impacts of the project. . Simply developing a plan doesn't tell anyone how well the plan is working, which is what is important in the context of an EMP. Some KPIs identified in the EMP may be serving as a basis for performance in relation to the contract between TI

Corporation and Kiewit/Flatiron; however, they are not relevant to monitoring the actual performance and effectiveness of the EMP. It is strongly suggested that the definition of key performance indicators be re-evaluated.

3. References to contract obligations

There are multiple references to the contract obligations between the Owner (MOT/TF Corp) and the DB Contractor (Kiewit/Flatiron). Since the details of these contract obligations are not available to anyone other than the Owner and DB Contractor, the EMP should include those requirements instead of referencing them. It is difficult for outside agencies to assess whether the EMP is effective otherwise.

4. Additional reviewable plans

There are many supporting plans that have been identified as being "currently developed". Since these plans fall under the EMP requirement of the TOCA, MOE would like the opportunity to review and comment on these plans in advance of implementation.

5. Document control and management

Given the fact that there will be a large volume of documents that need to be shared with various agencies, it is strongly recommended that a SharePoint site (or equivalent) be set up to facilitate this process effectively. This method has been employed for the South Fraser Perimeter Road project and has proven to be quite successful (from MOE's perspective).

Section 1 – Introduction

Reviewed by Cassandra Caunce, Joanna Hirner and John Kelly

CEMP Scope and Function, p. 1-1:

- To fully encompass the purpose of environmental management, the policies and procedures outlined in this EMP would influence design as well, especially since a final design hasn't been produced. It should also include ancillary facilities even if located outside of the project footprint. To state that it is just restricted to construction activities isn't completely accurate and goes against what was committed to in TOCA.

As per TOCA 1.1: "*Develop, implement and maintain an Environmental Management Plan (EMP) for the Project to demonstrate how the design, construction and operation, including maintenance, of the Project...*" Environmental aspects are considered in the design of storm water management systems, soil management and placement, etc.

- Is the preparation, review procedure and timeline for environmental work plans (EWP)s defined somewhere? Are the review criteria defined? Can the EWP's be shared with agencies once approved?

Objectives, p. 1-2:

- KPIs are different than requirements. KPIs measure/evaluate success at implementing the requirements. Suggest stating something like: *The EMP will help achieve compliance by establishing project-wide environmental requirements and identifying the key performance indicators that will be used to measure performance in relation to those requirements.*
- Who will be monitoring the KPIs? How will they monitor them? What are the consequences of not achieving acceptable levels of the KPIs (and are acceptable levels of KPIs defined somewhere)?

Section 2 – Project Scope

Reviewed by Cassandra Caunce, Joanna Hirner and John Kelly

Number sequence is incorrect from s. 2.2 onward

Pot-holing, p. 2-5

- If pot-holing is done within the fisheries sensitive zone of watercourses or other environmentally sensitive areas, what mitigation measures would be applied?
- What would prevent pot-holing from being conducted outside the fisheries sensitive window?

Clearing, p. 2-5

- How will invasive plant materials be dealt with to prevent their spread on and off site?

Ancillary Facilities, p. 2-7

- Locations of all ancillary facilities should be provided. Also, please confirm that the requirements under the Environmental Certificate and EMP will apply to these facilities as well.

Section 3 – Environmental Management Program

Reviewed by Cassandra Caunce, Joanna Hirner and John Kelly

Organization Chart Figure 3-1, p. 3-2

- If possible, could the names of each of these people in the chart be provided to agencies? It may not be appropriate to do this within the CEMP but it will be useful to provide this information to agencies under separate cover and keep it updated.

Environmental Manager, p. 3-4

- Generally, there appear to be too many responsibilities for one person to deal with. Suggest that there should be multiple environmental managers and/or some responsibilities should be delegated to other members of the Environmental Management Team.
- *Bullet #4:* How will Environmental Manager integrate the environmental program into other design-build processes? This is much easier said than done, and is key to ensuring that environmental requirements are met in the best, most effective way possible.
- *Last sentence:* “*Liaison is expected to include regular teleconference calls and/or other mechanisms.*” Suggest that this liaison be formalized as much as possible with frequent, structured and regularly scheduled meetings and/or teleconferences, to ensure regular and frequent communication.

Environmental Quality Manager, p. 3-5

- There are some concerns around this role being filled by someone within Kiewit/Flatiron (KF), because this means that KF is essentially auditing itself, which could raise questions about impartiality. It would be better if audits were conducted by the Authority or some other independent body.

Environmental Monitors, p. 3-6

- *3rd paragraph:* Another important determinant of environmental sensitivity is the location (i.e. higher effort should be undertaken in areas with intact natural habitat and/or (potential) presence of fish and wildlife, especially species at risk).

Environmental Liaison, p. 3-8

- “Environmental liaison will respect overriding Project communication protocols” – Please clarify. Will these protocols be summarized in the EMP?

Environmental Reporting and Submittals, p. 3-9

- Will all of these documents be made available to agencies? There is a requirement under the TOCA to provide opportunity for agency review and comment for the CEMP and FWMCP, but not (as currently understood) a similar requirement for the other types of reports and plans. However, agencies will likely be interested in these other documents and would like access to them in a timely manner (i.e. before or early on in the activities for the EWP and EQMPs, and as soon as possible following activities for the various reports).

Environmental Permitting, p. 3-9

- Suggest that another important responsibility within this section be to ensure that construction personnel understand the requirements of the permits (i.e. not just distribution of permits, but also ensure that permit requirements are read and understood).

Environmental Quality and Environmental Auditing, p. 3-10

- What is the timeline for preparation of the EQMP? It seems appropriate that the EQMP should be prepared and in place before construction begins.

Environmental Compliance Objectives, p. 3-10

- Are the Environmental requirements of the DB Agreement going to be summarized in the EMP?
- Please include the corporate environmental policies of both Kiewit and Flatiron in the appendix as it is not available on either of the company websites..

Environmental Compliance Targets and Indicators, p. 3-10

- "General environmental compliance targets for construction..." – the wording here is weak. Wouldn't the general environmental compliance target be 100% compliance with all requirements, all the time, regardless of where the requirements came from (ie. Permit, EMP)?
- Reference to criteria in contract documents being used for KPI is irrelevant to the EMP unless those criteria are summarized in the EMP. Contract documents are not readily available to members of the IAERC or public.
- "...specific targets may be specified in permits." – Incorrect inference. Permits do not contain targets. They contain requirements that must be complied with.

Section 4 – Air Quality and Dust Control Plan

Reviewed by Cassandra Counce

Baseline Environmental Values, p. 4-2

- NO is Nitric Oxide (not Nitrous Oxide) and Nitrous Oxide is N₂O (not NO).
- Where it states that baseline air quality conditions were good; what are the baseline conditions exactly? Do you have average results for each of the CACs and GHGs? These numbers will serve as a base for the KPIs.

Potential Construction Impacts, p. 4-2

- Include hospitals, other health care facilities and daycare facilities as sensitive receptors.
- Consider adding signage along the highway in areas where traffic is expected to be congested for longer periods of times to ask drivers to not idle their engines - especially during summer months.

Environmental Management Strategy, p. 4-3

- Despite that there will be separate plans for each segment, there are over-arching requirements that will be in each plan. Details should be here to guide the formulation of the segment plans.
- Will there be a plan for the bridge segment which is slated to start construction in 2 weeks? Will that segment have its own plan or will it be covered off under this plan?

Key Performance Indicators, p. 4-3

- A plan being prepared doesn't give an indication of performance. KPIs could include # of complaints about dust, compliance with permits, % above/below standards for measured AQ parameters (eg. PM10), annual tonnes CO₂e produced, etc.

Equipment Emissions, p. 4-5

- What about frequency of vehicle maintenance? Checking for optimum tire pressures? Training on emission-friendly driving styles? Operating minimal amounts of equipment during off-peak hours on days with poor air quality (reduce load impacts)?
- How does the anti-idling protocol tie into cold starts? If the equipment needs to idle to eliminate "cold start" conditions, what are the parameters that gauge when this moves into an idling situation?

Monitoring Strategy, p. 4-5

- How frequent will the Environmental Coordinator and/or Environmental Monitor undertake qualitative air quality monitoring? How frequent will they be on the job site?
- How will the exhaust systems be checked? Visual opacity inspection? Please clarify.
- With respect to repairs being done in a reasonable time frame – who defines what is reasonable? Expectations should be more clear.
- The construction plan is likely somewhat figured out by now. The areas of intensive and prolonged activities are likely known and should be identified in this plan or the segment plans so that planning of appropriate ambient air monitoring can be carried out.

Section 5 – Archaeology Plan

Not Reviewed by MOE

Section 6 – Construction Health and Safety

Not reviewed by MOE at this time

Section 7 – Construction Waste Management Plan

Reviewed by Cassandra Counce

Preamble, p. 7-1

- It is specified that this plan will only cover non-hazardous solid waste however in section 7.8, liquid wastes are addressed. Please clarify.

Key Environmental Performance Indicators, p. 7-4

- KPIs would be:
 - volume/weight of materials recycled, landfilled or reused by type.
 - % compliance with EMP (% of successful inspections)
 - Materials used and recycle/reuse rates

BMP - Detailed Planning for Non-Hazardous Solid Waste Management, p 7-4

- Non-hazardous waste includes cured concrete. Limited pours are expected so what is the plan for dealing with excess concrete, if there is any?

General Non-Hazardous Solid Waste Management BMPs, p.7-5

- *Last bullet:* "Remove any non-hazardous solid waste material that is inadvertently dumped by construction personnel in or adjacent to watercourses or other environmentally sensitive areas and dispose off-site in compliance with applicable environmental requirements."
- This shouldn't be happening to begin with, especially in ESAs. Would suggest stepping up training on the importance of using waste receptacles and respecting boundaries of ESAs and watercourses. I understand that things do "happen" however the way this is written makes it sound like it's no big deal when it does happen. Are their consequences for personnel who don't follow site rules? What about the "environmental contract" workers sign when they are trained appropriately? Perhaps a bullet should be added regarding proper materials handling.

Continued, p.7-6

- The first bullet on the page referencing handling of used oil should be removed as it hazardous waste so it doesn't belong in this plan, per the scope.

Site Clearing and Excavation, p.7-6

- Recycling section - With regards to excess topsoil: if all soils in the ROW are deemed contaminated at II. levels, perhaps the reference here should be that all excess soils removed from site will be handled in accordance with the contaminated sites plan?
- How is managing contaminated soils a recycling measure?

Section 8 – Contaminated Sites

Reviewed by Cassandra Caunce and Alan McCammon

General Comments

- The EA Application project corridor screening information (i.e. preexisting soil/water/vapour characterization information; initial "Tier" classifications; etc.) should be combined with final design and proposed construction information (i.e. property acquisitions, areas of proposed soil disturbance/deposition, etc.) to develop this CSMP and any associated sub-plans as committed to in the TOCA as modified by MOE EA commentary. It is MOE's preference that this information be graphically presented on aerial photo base maps so that proposed soil/water/vapour characterization work can be conveniently evaluated against ministry statutes/regulations/guidance. We do not currently see this data compilation and accompanying analysis in this CSMP or the draft proposed "Geoenvironmental Site Assessment" dated May 28, 2009.
- Accompanying the graphical presentation of baseline information should be the proposal for supplementary investigation including details on sampling locations and media, analytes, QA/QC, etc. We request that the proposed supplementary work also be presented graphically with text description as necessary.
- The commitment to reassess "Tier" classifications following collection of supplementary information is presently missing from the CSMP.

Specific Comments

Introduction, p.8-1

- Why is surface water not being included here? At least on a basic level, possible surface water contamination can be identified visually and should be considered in the plan.

Baseline Environmental Resources, p. 8-3

- What are the results, to date, of the property assessments with regards to the Tier Ranking System? How many sites were identified in each level?

Environmental Management Strategy, p. 8-2

- The MOU does not apply to groundwater or surface water. It exclusively deals with zinc, lead, cadmium and chromium in soils.

Management of Soils/Groundwater on New Right-of-Way, p. 8-3

- How much land is being acquired and designated new right of way? MOE was under the impression that the project works within the existing ROW. This could have significant implications with to CSR and CSRA.
- What defines “designated” and “other”? This is not clear.
- “A more detailed plan will be developed to address site specific assessment (sampling) and remediation for Tier 1 and Tier 2 sites...” Is this the GSA that was submitted to MOE for review? Please clarify.
- The “more detailed protocol (that) will be developed to manage potential encounter with contaminated media...” should be included in this EMP.

Disturbance to Existing (Pre-Project) Right-of-Way, p. 8-3

- “Management of materials along the existing highway right-of-way will comply with the MOU.” This should read “compliance with Provincial legislation” as the MOU does not provide an exemption for the project to ignore the law. All the MOU states is that you will follow the law without getting tied up in legal process. Perhaps a section in this Contaminated Sites Plan should summarize the intent of the MOU to avoid confusion. There is concern that the MOU is being misinterpreted.

Continued, 3rd Bullet, p. 8-4

- In areas near watercourses, the freshwater standard should apply.
- MOE requests a list of the “appropriate off-site disposal sites” that are being considered for this purpose. The agreed preferred sites should be referenced in this plan.

Key Environmental Performance Indicators (KPIs), p.8-4

- Measurable KPIs would be Number of contaminated sites/areas encountered, % successfully remediated.
- Suggest re-ordering the two bullets. The requirements under Provincial law trump the MOU.

Best Management Practices, p. 8-5

- *2nd Paragraph:* Regardless of space constraints, if you don't know what you are dealing with, how can the soil be disposed of and transported appropriately? Perhaps moving it to another temporary location along the ROW (such as an interchange) would be more appropriate and cost effective?
- It should be noted that a landfill will not accept waste that has not be previously characterized. Soil must be characterized before it is sent for disposal.
- *3rd Paragraph:* Who decides what appropriate constituents of concern are?
- *5th Paragraph:* It is stated that the DB Contractor will promptly mitigate, remediate, document the newly created contamination. To be clear, perhaps adding that this should be done in accordance with the spill response portion of the EMP?
- Since contract documents are not generally available to all, please clarify what the follow up actions and timelines for those actions are.

Monitoring Strategy, p. 8-6

- If soils being imported are suspected as being contaminated, they should be sampled at the source before moving. If they are contaminated, a CSRA will be required. Any soils that are imported at IL level need to be documented as well. Also, it should be noted that some sites in the project

will have more stringent requirements for imported soil. Considerations of soil quality in areas for habitat compensation and vulnerable drinking water wells, for example.

Section 9 – Emergency Spill Response, Containment and Management Plan

Reviewed by Cassandra Caunce

Baseline Environmental Resources, p. 9-2

- What is the threshold for “a major spill that cannot be properly handled internally”?

Potential Construction Impacts, p. 9-2

- The text infers that the largest possible spill volume will be up to 100 L. Is this to say that the maximum amount of a substance contained in machinery or in storage is 100L? The generators used for the bridge pile driving hammer contain 5000L each. Also, how much water do the cofferdams hold? Should one of those be breached during a concrete pour, what are the implications?
- The extent of damage is also determined by the receiving environment. This should also be considered.

Environmental Management Strategy, p. 9-3

- *3rd Bullet:* At a minimum, all spills should be reported internally using a standardized reporting form. In addition to being environmentally responsible, it's valuable loss control information. These protocols should be included in the EMP.
- Where are the spill reporting protocols and what do they contain? How will they be enforced? This information should be in the plan.
- What are the detailed contingency measures, specifically for the Fraser River? Again, this is direct out of TOCA. The details of these plans should be included in the EMP.

Responsibilities, p. 9-4

- If operations are going to run 24 hrs a day, will a fully trained ER Coordinator be on shift for each segment at all times. Also, an alternate should be designated. Effective communication is critical.

Spill Response and Spill Clean-up, p. 9-5

- In the outline of initial spill response, ensure that the spill area is safe for the responder and personnel on site before entering the area. Suggest adding a bullet to the end of the list: Once spill has been dealt with, complete a written spill report and submit to the site supervisor.

Debriefing, p. 9-5

- What is the definition of a significant spill? Toxicity of substances spilled should define, in part, what constitutes a significant spill.

External Notification Contact Table, p. 9-7

- The MOE Conservation Officer Service does not need to be notified in a spill emergency. If the presence of a CO is needed, PEP will deploy. However, MOE staff (Cassandra Caunce and Joanna Hirner/John Kelly) who have been explicitly assigned to this project should be notified in addition to PEP in the event of an emergency.

Key Environmental Performance Indicators (KPIs), p. 9-7

- Spill frequency and severity are important KPIs.

Spill Kits, 9-8

- Adjacent to spill kits, post summary of spill response procedures to follow so that expectations are clear and reinforced.

Refuelling Marine Equipment, p. 9-9

- Given construction is imminent, these procedures should already be developed and be here in the EMP. More detail is needed. For example, river booms should be kept on site and boats designated for response should the booms need to be deployed. If visual inspection for hydrocarbon releases will be done on the river, how does this take into account the night time operations and fast flow of the river? These are the types of considerations that should be detailed in the EMP.

Section 10 – Environmental Monitoring Plan

Reviewed by Cassandra Caunce, Joanna Hirner and John Kelly

General Construction Monitoring, p. 10-1

- First paragraph: Most of the key performance indicators are about creation of plans, rather than implementation. It seems that the role of the Environmental Monitor is to monitor implementation in the field; someone else in the environmental management team should be monitoring whether or not the appropriate plans have been created.
- 4th paragraph: With respect to periodic site visits, this is vague. To ensure that the level of monitoring effort is appropriate and that monitoring is done on a regular basis, monitoring schedules and the criteria and conditions under which different levels of monitoring effort are required should be better defined.

Continued, p. 10-2

- Environmental Monitor duties - Field checks are a primary source of information for compliance. Shouldn't most of their time be spent in the field?
- Weekly monitoring reports should also include a summary of spills reported and inspections conducted per EMP. Perhaps an inspection checklist should be developed based on the commitments in the EMP and completed each week?
- Bottom of the page: Given this is a public project, wouldn't it be prudent to develop a SharePoint site (or something similar) where all environmental reports can be archived (after being approved) so that they are available on a self-serve basis for the IAERC? Utilizing SharePoint allows MOT/TI Corp to control access to the documents. This is being done for the SFPR project and is quite effective.

Monitoring Summary by Component Plan, p. 10-3

- Will the monitoring results from these component plans be included in weekly or monthly reports? What is the monitoring frequency?
- It would be useful to have a detailed summary of the actual monitoring that is going to be done and who is going to do it instead of copying text from the sub-plan. A bulleted list of what is being monitored would be more appropriate here for the purpose of clarity.

Example:

Air Quality

- Exhaust systems – pass/fail
- Monthly results for PM10, PM2.5
- AQ Complaints

Monitoring Summary by Component Plan – Noise, p. 10-6

- This component plan should also include the monitoring of noise and its effects on wildlife (eg. any active nests along the corridor), not just residents and schools.
- 2nd paragraph: “*Environmental monitors qualitatively (ie., subjectively) monitor effectiveness of construction noise mitigation...*” Does this just mean that although the monitor will not have equipment to quantitatively measure noise levels, he or she will make a judgment call about noise levels based on what he or she is hearing? Should a monitoring plan not be specific in its methods and be quantifiable?

Surface Water Quality, p. 10-7

- Note that some of the comments in the Surface Water Quality Plan apply to information in this section.

Section 11 – Environmental Training Plan

Reviewed by Cassandra Counce, Joanna Hirner and John Kelly

Commitment, p. 11-1

- It is expected that all subcontractors for the project will be expected to adhere to the requirements under this EMP. Will they be trained in accordance to this plan as well?

Regulatory/Institutional Requirements, p. 11-2

- The training is required as a component under the EA Certificate and TOCA so it is an explicit regulatory commitment.

Advanced Level Training, p. 11-3

- Why not include all environmental surveys and, if available, their results in this training? Also, in the training it may be of some interest and significance to include basic biology of at least species at risk in the area and their life history and basic habitat requirements as this would aid in the understanding of why it is so important to follow appropriate mitigation strategies, and could increase interest in these species which would simultaneously increase the desire strictly enforce and follow environmental guidelines.
- Last bullet: This part of the training is particularly key given the audience, and should include training and discussion on how to incorporate environmental values into design, and the importance and requirements to do so. A key point is that avoidance is the best way to reduce environmental impacts, and avoidance is done through design; no mitigation or compensation measure can 100% prevent or account for loss of habitat.

Basic Level Training, p. 11-4

- Under site orientation, there is a reference to environmental policy. Is this referring to Kiewit/Flatiron policy? If so, the policy should be included in the appendix of the EMP.
- Locations of sensitive areas should be shown in the field, not just shown on maps, to prevent confusion. The methods used to delineate and demarcate environmentally sensitive areas in the field should also be clearly communicated, and sources of confusion anticipated and prevented.
- Last sub-bullet under site orientation: Suggest specifying training for both non-hazardous and hazardous waste.

Advanced, Basic and Tailgate Level Training

- The name “tail gate training” suggests that this training will be conducted on site at the beginning of the day, to discuss site specific issues that can or will come up during that day. However, the example topics seem more general and less site specific, and in many cases more effectively delivered in a classroom setting. These two different types of training should be separated out.

Both serve important but separate purposes, and both types of training should be part of the environmental training plan and part of environmental training.

- There is nothing in the training section that addresses the identification of ESAs by employees or specific species identification. The Raptor Management Plan (p. 13, 2nd paragraph) states that in-house environmental sensitivity training will occur with construction personnel. The Raptor Management Plan also states that training will include a component on raptor nests and disturbance indicators. It is recommended that species identification be added and this should be included in this CEMP document as well. Training on ESAs should include how significant it is to have them well marked on design drawings and in the field so that all personnel fully understand where these areas are and why they are ESAs.
- In Section 12.7 (Key Environmental Performance Indicators: page 12-29) it states that "...targeted environmental training on protection of fish and fish habitat to supervisors and crews working in and around water" will be delivered. Who delivers this and why is it not listed in this training section of the CEMP.

Section 12 – Fish Habitat Management Plan

Reviewed by Joanna Hirner and John Kelly

Baseline Environmental Values, Table 12-1, p. 12-3

- Abbreviations used in Table 12-1 are not defined anywhere (i.e. fish habitat type, other fish presence).

Regulatory/Institutional Requirements, p. 12-20

- The provincial *Wildlife Act* also applies in terms of conducting fish salvages in advance of in-stream works (a fish collection permit is required under the *Wildlife Act*).
- Additional guidelines that apply to riparian revegetation are the Ministry of Environment's Riparian Restoration Guidelines (March 2008) and Tree Replacement Criteria (November 1996) (the latter is referred to in Section 12.6).

Environmental Management Strategy, p. 12-22

- Last bullet: Which BMPs will be implemented? Those listed in Section 12.5, and/or Section 12.8, or are there others?

Port Mann Bridge subsection, p. 12-24:

- 4th paragraph: Which BMPs are being referred to here?
- Last paragraph: Materials will be "*disposed of at a suitable location*" and the "*LAERC and affected municipalities will be notified*"...should this not read that they would be **consulted** rather than simply notified. Soils should also be handled in accordance with the Contaminated Sites Plan and Soil Stripping Plan.

Brunette River subsection, p. 12-24

- How will impacts to Nooksack Dace and their habitat be avoided or minimized? The Nooksack Dace recovery team and/or relevant experts should be consulted

General Riparian Requirements, p. 12-25

- Shoreline and riparian protection zones should also be clearly demarcated in the field, and steps taken to ensure that these boundaries are accurately defined and all construction staff understand these boundaries and how they are marked.
- How will it be confirmed that riparian habitat design will maintain pre-development flow regimes and surface water quality? Also, the words "where feasible" suggest that there may be additional

unexpected habitat impacts associated with situations where these things are not “feasible”. How will these additional habitat impacts be dealt with?

Culvert Extensions and Replacements, p. 12-25

- How will fish passage be maintained or enhanced where culverts are to be replaced or retrofitted on fish-bearing watercourses?
- Reference to Table 15-2 should be 12-2.
- All 5 of these bullets are verbatim from the TOCAs (12.31; 12.32; 12.35; 12.36; and 12.38) however, the 5th bullet is incomplete and should include the following: *3 years of post-construction monitoring and that if 90% of vegetation survival has not been achieved, the applicable regulatory agencies may require an additional monitoring period.*

Table 12-2 Culverts that Require Replacement for Fish Passage, p. 12-26 to 12-28

- Are the dimensions listed the current dimensions or the proposed dimensions of the culverts once replaced?
- The last three rows of the table are missing information provided for all other culverts in the table (p., 12-28).
- Also, several watercourses/culverts named for culvert replacement in TOCA commitment 12.11b are not listed here (all of the Section 4 culverts are missing from this table).

Key Environmental Performance Indicators (KPIs), p. 12-29

- 4th bullet: A better KPI would be some measure of the effectiveness of this training (e.g. number of incidents of clearing within riparian boundaries, number of incidents of sediments or other deleterious substances entering streams, etc.). These things presumably will be tracked as part of environmental monitoring and thus could be easily quantified.

Best Management Practices – Timing Windows, p. 12-30

- Last paragraph: Will a SDMP be developed for each stream crossing and ditch relocation? How far in advance of construction? Who will prepare and review these plans?

Best Management Practices, p. 12-31

- 1st and 2nd paragraph: What are the appropriate construction BMPs? Are the appropriate construction BMPs described in more detail somewhere else in the EMP? Please refer to where these BMPs are otherwise described. In particular, I assume that “water/sediment management” is described in more detail in Section 18.0 of the CEMP; please refer to this here.

Best Management Practices, Page 12-32

- 1st paragraph: What is the possibility of using a bubble curtain at all times? Are there issues with that as opposed to just using it when noise levels reach 30 kPa and above?

Monitoring Strategy, p. 12-32

- 4th paragraph: How long will monitoring occur? (eg. 3 years) Is a timeframe outlined in the DFO authorization?

Section 13 – Hazardous Waste Management and Spill Plan

Reviewed by Cassandra Caunce

Baseline Environmental Values, p. 13-2

- At the end of the paragraph, ESAs are specifically mentioned to be at risk from hazardous waste. Impacts to the environment, in general, and human health should be noted.

Regulatory/Institutional Requirements, p.13-2

- Incorrect reference to the *Waste Management Act*. This should be the *Environmental Management Act*.

Environmental Management Strategy, p. 13-2

- “*Field personnel will receive orientation-level training*”. Please use consistent terminology to avoid confusion. The Training plan identifies this as Basic Training.
- Please clarify what “*further hazardous waste handling training*” will be. Will workers be required to be certified in TDG for handling hazardous waste?

Key Performance Indicators, p. 13-3

- Re: Waste Stream Profile form --- a sample copy of this form should be included in the EMP to ensure consistency in recording information.
- “*Spills of hazardous materials must be remediated effectively...*” Who decides if something has been remediated effectively? What are the procedures?

Best Management Practices – Hazardous Waste Storage and Handling, p. 13-3

- All hazardous wastes should be in a centralized location that is secured.

Continued, p. 13-5

- There is a reference to the District Environmental Department that approves all hazardous waste vendors. Is this a department of Kiewit/Flatiron? It is suggested that for this project, that MOE can provide assistance here.

Section 14 – Marine Communication Strategy

Not reviewed by MOE

Section 15 – Noise Management Plan

Reviewed by Joanna Hirner and John Kelly

Preamble, p. 15-1

- “*The plan excludes consideration of noise mitigation design for operation...*” TOCA 10.6 states that noise mitigation measures are to address potential project-related operational noise impacts on residential areas.

Introduction, p.15-2

- “*...previously identified noise-sensitive enclaves*”. How and why were these areas chosen?

Environmental Management Strategy Noise Assessment, p. 15-4

- Will the model to predict construction noise take into account baseline numbers for current noise associated with the corridor (eg. hwy and rail noise) in conjunction with the predicted use of particular construction machinery? This may or may not affect final output of predictions.
- Last paragraph after the bullets: “*Construction noise mitigation may be constructed in advance of construction where the sensitive receptors listed....exceed Ld 80 dBA and Ln 65 dBA at the receptor.*” What are the factors facilitating the decision to construct in advance or not, mitigation measures...part of this statement implies that a threshold for noise has been identified, yet, there is no clear explanation as to why mitigation may or may not be constructed in advance at that threshold.

Key Environmental Performance Indicators (KPIs), p. 15-7

- 3rd bullet: Target training/awareness program should probably include all workers, not just night time workers (or at least those day-time workers using machinery exceeding the aforementioned thresholds for mitigation).

Best Management Practices (BMPs) – General Measures, p. 15-7 and 15-8

- Include noise mitigation measures in this bullet, as it is stated to be the noisiest activities.

Special Measures (Temporary Noise Barriers), p. 15-8

- It states that these measures may be considered. Why would these measures not be considered in highly sensitive areas, and if they are not considered, is this because a better measure has been designed?

Monitoring Strategy, p. 15-9

- *"An independent noise consultant will be retained...if required..."* What would determine if a consultant is required? Complaints; and/or on-going monitoring indicates noise has increased beyond the predicted or previously monitored result?
- 2nd paragraph: *"Environmental Monitors will qualitatively (ie. subjectively) monitor..."* A monitoring plan that follows a specific protocol measuring pre-determined variables will be better able to document data rather than having it subjectively designed.
- 1st bullet: *"...duration and timing of measurements will be sufficient to represent the conditions (eg. weather conditions) that would have most likely led to complaints..."* Please clarify this statement as its meaning is unclear.

Section 16 – Soil Conservation/Stripped Organic Material Management Plan

Reviewed by Cassandra Caunce

Environmental Management Strategy, p. 16-3

- The site specific EWPs that are to be developed should include provisions for contaminated soils as well. Important cross-reference.

Best Management Practices, p. 16-3

- For management of stripped materials, first bullet: What's the plan if it isn't possible to place materials > 30 m adjacent to ESAs and watercourses? Since the soils along the highway are being assumed contaminated with heavy metals at the IL level, this is important to consider.

Section 17 – Structure Demolition Management Plan

Reviewed by Cassandra Caunce

Potential Construction Impacts, p. 17-2

- In the bulleted list identifying waste materials that may be generated:
 - Was asbestos in asphalt considered?
 - Is paper and office waste truly a demolition waste?
 - Paint – Given the bridge was constructed in the 1960's, there is the possibility that PCB was used in the pigment for the paint. This should be considered.

Environmental Management Strategy, p. 17-3

- Other than the existing Port Mann, what other larger structures could be demolished?

Site Specific DMPs, p. 17-3

- DMP is not defined. Assuming it's "Demolition Management Plan"?
- Please provide a list of structures that are anticipated to be demolished at this time.

Key Performance Indicators

- A good indicator would be recycling rates.

Best Management Practices, p. 17-4

- 3rd bullet: How do you plan on identifying the hazardous waste in a structure?
- 6th bullet: "Mitigation plans will be developed to avoid soil erosion and shallow slope movement..." Theoretically, there should be an idea as to what this plan will be based on the current design proposal for the project. What is the status?
- Are there specific plans to prevent sediment-laden water from entering watercourses during demolition?

Section 18 – Surface Water Quality and Sediment Control Plan

Reviewed by Cassandra Cunnice, Joanna Hirner and John Kelly

Overall Comments

- Suggest careful reconsideration on the use of the term "waste water". Waste water should not be flowing/discharged from construction sites. Pollution is prohibited under EMA. Another option is to explicitly define "wastewater" in the introduction to be so that there is no confusion.

Potential Construction Impacts, p. 18-2

- With respect to water quality impacts, there is also a greater risk of contamination from fuels and lubricants used in the machinery located on the trestle and this should be mentioned.

Environmental Management Strategy, p. 18-4

- 1st bullet: Site-specific Sediment and Drainage Management Plans (SDMPs) should be provided to the IAERC for review and comment.
- 2nd bullet: Please clarify the second bullet – "two sets of pre-construction water quality sampling" will be conducted. What constitutes a set and when will they be conducted?
- 8th and 10th bullet: Where guidelines and objectives are mentioned, is this meant to be the BC Approved Water Quality Guidelines (British Columbia 2006)? MOE assumes that the guidelines for protection of aquatic life or drinking water criteria will be applied where appropriate? Please be as explicit as possible.

Key Performance Indicators, p. 18-5

- Is the "site by site" water quality monitoring plan complete yet? As a KPI this appears rather vague, the parameters used for the trend monitoring would be better suited as the KPIs to monitor water quality.
- Note that these environmental performance indicators (along with other water quality criteria) are better indicators of the effectiveness of environmental management than the key performance indicators defined here.

Table 18-1: Minimum Water Quality Requirements, p. 18-5

- Any water that has been in contact with uncured or partly cured concrete, has a pH outside the allowable range and is turbid greater than 25 NTU must be isolated for treatment prior to release.
- Regarding pH monitoring, if the pH should change +/- 1 unit, investigation into the reason why should be conducted and corrective actions initiated. This is particularly important when concrete pours are occurring (per MOE Standards for Instream Works, March 2004).

Best Management Practices, p. 18-6

- Recommend referring to excess water, rather than waste water. Discharge of waste water is prohibited under EMA without a permit. Perhaps changing the wording to "To prevent discharge to the environment of "wastewater"..." will clarify things here. I.e. calling it wastewater may be okay as long as you are clear that wastewater discharge to the environment will be prevented and wastewater will be treated as appropriate before any release.

Wastewater Management, p. 18-6

- How frequently will discharges be monitored?
- What other factors will be monitored in addition to TSS and pH?
- Please specify what the parameters are for wastewater that will be contained and treated.

Erosion Prevention and Control, p. 18-6

- The first word of each of the first 3 bullets is "minimize". Please explain how this will be done, even if only by example.
- *3rd Bullet:* In the event of high volume overland flow, what contingency measures will be put in place?
- *6th Bullet:* Clarify the type of seeding is going to potentially be used for stabilization. Also, ensure that stabilizers are free of particulate that could contribute to sedimentation. Disturbed areas should be covered as soon as possible (preferably immediately) following disturbance

Continued, p. 18-7

- *7th bullet:* In reference to soil stockpile areas and volumes, covers should always be used, especially during rainfall. Will stockpile sizes be monitored and controlled? When is a stockpile too big?
- *12th bullet:* How will isolation be conducted to prevent water quality impacts and impacts to adjacent areas where stream flow will be diverted to?
- *14th bullet:* Any replanting will obviously be done with native species specific to the local habitat conditions. This should be included here.
- *15th bullet:* Erosion control measures that are deficient should be corrected immediately where deficiencies are causing the release of sediment in to watercourses.
- *16th bullet:* How often will erosion control measures be inspected?
- *Second last bullet:* How will wheel washing be done given the broadness of the project?
- *Last Bullet:* "Maintain or reduce existing flow velocities to stop erosion at discharge points." How will this be done?

Concrete Works, p. 18-8

- Given the size of some the pours for concrete, is there a check that can be performed to ensure that the concrete is properly cured after 72 hours to ensure that it has been rendered inert?
- Open bags of concrete should be secured against rain as well.
- As the pours are taking place, what is going to be done to ensure that there are no impacts outside cofferdams and such? MOE BMPs also state that a pH change of 1 warrants implementation of emergency measures to protect fish and fish habitat
- Last bullet: Will containment facilities for these purposes (truck washing) be provided on site? These facilities should be used to wash all tools and equipment coming into contact with uncured concrete as well.

Marine Excavation, p. 18-9

- Please confirm that FREMP will be reviewing the dredging plan.
- The example mitigation measures should be applied, not considered, unless appropriate rationale can be provided for not applying them.

Site-by-Site Monitoring, p. 18-10

- Once monitoring sites are established, will they be mapped out using GPS or other methods? Where will this information be recorded and reported?
- Second last paragraph: "In some cases sampling may be done at multiple downstream stations.." When will these cases be? During turbid events? Please clarify
- Last paragraph: "Total suspended solids will be sampled and analyzed where necessary to supplement or confirm turbidity data." What is the specific trigger for taking a TSS sample?

Trend Monitoring, p. 18-11

- Since only a limited sampling program will be done, what are the "selected areas" that have been chosen for this purpose? Please include a list of those sites here. Also, how is it determined to be necessary or not, and what is meant by limited?
- If trend sampling is only going to be done once per year, at what time will these samples be taken?
- A full data set of all the pre-construction monitoring results is requested by MOE.
- Monitoring parameters list: What are the other parameters? Metals? Salts? Oil and grease?

Section 19 – Terrestrial Habitat Management Plan

Reviewed by Joanna Hirner and John Kelly

Table 19-2: Animal Species at Risk in the Project Area, p. 19-4 to 19-6

- Peregrine Falcon: states historical use on Port Mann Bridge; however, we now know that Peregrines are using the bridge again this year, and therefore the table needs to be updated to reflect active use of nest on Port Mann Bridge.
- Need to have a gastropod section within the table and have Oregon Forest Snail (OFS) included. In the OFS management plan on page 7, it states that OFS was observed within the proposed ROW (Polygon # P114).
- Snowshoe Hare is included as potentially occurring in Burnaby Lake Regional Park; however, Snowshoe hare is definitely found in and around Burnaby Lake Regional Park. In addition, a recent compilation of recent (2000 onwards) occurrence records generated through roadkill records, animals brought to wildlife rescue centres, etc., suggests that snowshoe hare are found in several other areas adjacent to the Highway 1 corridor, including within the Still Creek and Brunette River watersheds, and in and around Colony Farms. The occurrence records are part of a draft report under review but MoE will try to provide relevant records to the PMH1 project as soon as possible.

Environmental Management Strategy, p. 19-8

- 1st paragraph following bullet points: Making sure that construction crews understand the meaning of visual markers in the field will be an important part of the environmental training and "tailgate" meetings.

Pre-Construction Confirmatory Surveys, p. 19-8

- Please provide more detail on what kind of surveys will be undertaken for which species, and/or refer to documents that provide this additional detail (various wildlife management plans, Fish and Wildlife Mitigation and Compensation Plan, etc.). Also, how is it determined when pre-construction surveys will be required?

Raptor and Heron Nest Surveys, p. 19-8

- The timing window listed here in the 1st paragraph (January 31 – August 15) for both raptors and herons should be changed. For Great Blue Herons (GBHE), the timing window is Jan 15 – Sept 15, and for specific Raptor species found along the ROW, see Raptor BMP page 22 (eg. the

above window would also cover Red-tailed Hawk). Please see the GBHE BMP Factsheet (attached).

Raptor and Heron Nest Surveys, p. 19-9

- Is the site specific nest monitoring program described in the heron mitigation and monitoring plan? If not, MOE would like to see a copy of the plan for the program and would like to see the data generated by this program.

Pacific water shrew, p. 19-9

- The reference "British Columbia 2007" is not in the references cited list. I assume you mean "Habitat suitability/capability modeling for Pacific water shrew" and/or "Species account and preliminary habitat ratings for Pacific water shrew (*Sorex bendirii*) using TEM data v.2"?

Migratory Bird Nest Surveys, p. 19-10

- The nest survey protocol in Appendix 8 does not reflect the comments that were provided by Joanna Hirner, MOE, made via email on April 29, 2009. The most concerning is with regards to the third comment about clearing being initiated as soon as possible following the last survey (i.e. within 24 hours) because allowing clearing to start later than this within the 10 day period greatly increases the chances that a bird will initiate nesting between the last survey and clearing, resulting in a violation of the *Wildlife Act* and/or the *Migratory Bird Convention Act*.

Timing of Construction, p. 19-10

- 3rd bullet: The timing window again for GBHEs is January 15 – September 15 and raptors is species specific (page 22 raptor BMP).

Listed Plant Species and Plant Communities, p. 19-10

- "*Unavoidable impacts will be mitigated in the field during construction*". What is an unavoidable impact and how can you mitigate in the field without proper consultation to decide if the mitigation measure is going to be enough for whatever this impact is. It is suggested that if there is indeed an unavoidable impact, that this impact be reported and mitigation measures for the specific area be reviewed.

Continued, p. 19-11

- 3rd paragraph: "...demands of the Project schedule may not always allow time for a confirmatory survey to completed prior to construction" "*When a field survey is not possible due to seasonality constraints, construction planning will rely on interim assessment by a wildlife specialist...*"

Given that at least some rare plants may be identifiable at the current time, it is possible that rare plant surveys should be going on right now to avoid the problem of construction timing conflicting with the timing of rare plant surveys, show due diligence, and fulfill commitment 14.2. An appropriately qualified professional should be consulted without delay to plan and conduct rare plant survey work for areas being cleared this year. An appropriately qualified professional is not a wildlife specialist as referred to in the EMP, but instead a field botanist with appropriate experience and regional knowledge of the flora, familiarity with plant taxonomy, familiarity with the need for seasonal coverage, and who will take the appropriate steps in plant identification (see the MOE recommended standard for rare plant surveys for more info: <http://www.geog.ubc.ca/biodiversity/flora/ProtocolsforRarePlantSurveys.html>). The approach outlined in the CEMP of establishing risk categories would only be acceptable if all steps had been taken to avoid conflicts between rare plant survey timing and construction timing, and only if a field botanist with recognized expertise in rare plants was employed in determining risk categories. MOE also suggests that a rare plant and plant communities management plan similar to those developed for wildlife should be developed by an appropriate QEP.

- Is the vegetation survey program completed?

Key Environmental Performance Indicators (KPIs), p. 19-11

- 6th bullet: Who is delivering the training on sensitive wildlife/vegetation features?
- 7th bullet: What are the construction procedures? If they are known sensitive areas and SAR in particular areas, these EWP's should be under review before construction commences.
- 8th bullet: Has an encounter protocol already been developed? If so, what is to be done in the case of encountering previously unidentified ESA and/or SAR. The protocol should be included with the EMP.
- Suggested KPIs: For training, the number of incidents of clearing within environmentally sensitive areas, number of incidents of sediments or other deleterious substances entering streams, etc. could be tracked.

Best Management Practices (BMPs), p. 19-12

There is a 2008 version of the Pacific water shrew BMPs. The primary difference in versions relates to the range map which has been updated to reflect recent captures so it is not really a problem to be using the 2007 version, but ideally the most up-to-date version should be referenced. The 2008 version is attached for your convenience.

Demarcating Known Sensitive Wildlife Sites, p. 19-12

- 2nd and 3rd bullet: Making sure that construction crews understand the meaning of visual markers in the field will be an important part of the environmental training and "tailgate" meetings. Crews should also be properly informed of any boundary changes.

Conduct Preconstruction Nest Surveys, p. 19-13

- What is the procedure to be followed should nests be observed during surveys?

Section 20 – Traffic Management Communications Plan

Not reviewed by MOE

Section 21 – Vegetation Debris Management Plan

Reviewed by Joanna Hirner and John Kelly

Potential Construction Impacts, p. 21-2

- What about the potential of improper management of vegetation debris leading to invasive plant species invading an area where it did not previously occur?

Environmental Management Strategy, p. 21-2

- 2nd bullet: "...maintain predominantly native component of riparian habitat compensation areas." Predominantly implies a majority but does not imply 100% and that should be the target. If it is the target, it then can be measured as an indicator of success (KPI).

Key Performance Indicators, p. 21-2

- These KPIs appear to be ones that could be further elaborated so that they can more easily be measured to assess success/failure of objectives.
- 1st bullet: What is an appropriate buffer zone and are there different methods of clearing and grubbing in ESAs (hand clearing as opposed to using a machine) and who checks to ensure that buffer zones are being respected
- 4th bullet: What is appropriate management of invasive species and how will one know if inappropriate management has been conducted?

Best Management Practices (BMPs), p. 21-3

- Bullets 2-4: Ensure that all construction personnel fully understand where these “no disturbance” and “vegetation to remain” areas are and the significance of these boundaries.

Monitoring Strategy, p.21-3

- Vegetation that goes down after a songbird nesting survey will be **promptly removed**. It is good to have it removed quickly, but a timeframe should be established (ie. within 24 hours).

Section 22 – Well Water Monitoring Plan

Reviewed by Cassandra Counce

Introduction

- How were these 65 wells identified? If the MOE well database was used, this is not sufficient as the database is incomplete. This is because drill records for wells were not required to be submitted – strictly voluntary. Reference the EA document and page number if necessary

Baseline Environmental Values, p.22-1

- Only 6 of the 65 are vulnerable to the project? How was this determined?

Table 22-1 Wells in Project Vicinity

- Where do these codes to identify the wells come from? The provincial well tag number should be used here, if available. Please include a little more detail on the approximate location.

Regulatory / Institutional Requirements, p.22-2

- The *Groundwater Well Protection Regulation* under the *Water Act* must be complied with as well.
- Should be referencing the APPROVED BC WQ guidelines, not “A Compendium of Working Water Quality Guidelines for British Columbia”.

Environmental Management Strategy, p. 22-2

- Use the terminology in the regulations. Wells are either closed or deactivated. All closures must be done in accordance with Schedule 3 of the regulations.
- Which wells are going to be closed or deactivated? Is the water supply/source going to be replaced somehow?
- “Residences that have their potable water adversely affected by the project may need to have a suitable supply of water provided.” Is this anticipated? If so, which wells are possibly going to be impacted and what is being done to ensure that their water is protected during construction? Does this take into account wells that will be closed as well?

Continued, p. 22-3

- “Shallow dug wells that are deemed vulnerable to ground water quality issues should have water quality monitoring done...” The language be more firm in that vulnerable wells will have monitoring done. When will this monitoring be completed and what parameters will be tracked? What is the frequency of the monitoring program? Who will be doing this work?

Key Performance Indicators, p. 22-3

- What are the details of the monitoring program? Which wells will be sampled and how frequently will they be tested? Please identify the parameters and summarize the results found in the EA application studies. Is there a communication plan in place to inform the well owners what is going on?

- Well closures must be done in accordance with regulations and submitted to MOE.

Best Management Practices, p. 22-3

- 3rd bullet: Please define what you consider to be a long duration.
- 4th bullet: How are flow rates going to be monitored? This is a costly process. Monitoring water levels monthly would be more appropriate. With respect to "finding alternate sources" – who is going to do this?
- 5th bullet: Will these vulnerable wells be marked? Who is going to inspect the area where the wells are to ensure that this will happen prior to construction? If a well seal is compromised, it must be repaired in accordance with GWPR.
- 6th bullet: How is the quality of fill going to be ensured? Fill around areas of wells should meet standards for protection of human health.

Monitoring Strategy, p. 22-3

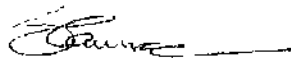
- In general, this section requires a lot more detail.
- "The necessity of water well monitoring will be determined by an appropriate specialist (e.g., hydrogeologist) providing assessment..."
 - When will this be completed? The information gathered in this assessment will guide what procedures need to be defined in the EMP to protect groundwater.
 - A Qualified Professional (PGeo or PEng) with expertise in hydrogeology or geotechnical engineering is an appropriate specialist. This is a requirement under GWPR.

Continued, p. 22-4

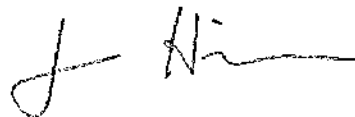
- "The monitoring of water well levels will be considered in accessible shallow dug wells..." The language here needs to be more firm. Monitoring of levels should be conducted, not considered.

Recognizing that there is a substantial amount of comments to address for the next version of the CEMP, the Ministry staff dedicated to the project would be happy to meet with you to discuss the comments in further detail. If you have any questions, please contact any one of us via email or phone as provided below.

Regards,



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Joanna Hirner, MRM, R.P.Bio
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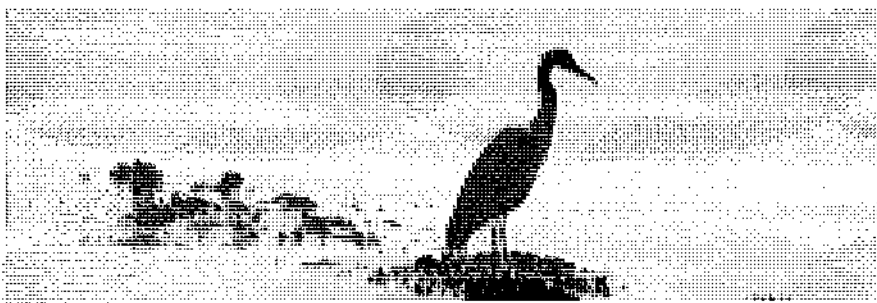
John Kelly, Ecosystems Biologist, john.kelly@gov.bc.ca, 604.582-5200

Attachments:

1. Great Blue Heron (GBHF) Best Management Practices Factsheet
2. Joanna Hirner (MOE) email dated April 29, 2009 regarding the nest survey protocol.
3. Pacific Water Shrew Best Management Practices, 2008 version.

Cc: Jennifer McGuire, Regional Manager, Environmental Stewardship, MOE
Aidan Ballantyne, Environmental Director, Transportation Investment Corporation
Robin Taylor, Environmental Manager, Transportation Investment Corporation

Develop with Care



Great Blue Herons

Fact Sheet #11

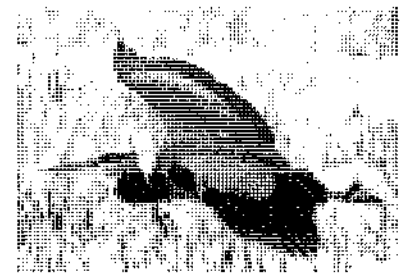
Environmental Guidelines for Urban and Rural Land Development in British Columbia

Are you planning any development on your property? If your property includes, or is near to, nest trees or feeding grounds of Great Blue Herons, this fact sheet will provide you with important information about complying with the law, protecting these birds and enhancing enjoyment of your property.

Great Blue Herons are found throughout coastal British Columbia and in the southern interior. They are a Blue-listed species, considered vulnerable because human activities, especially urban and rural development, are resulting in the loss of suitable nesting areas and disturbance to birds during their breeding season. The presence of people, even as far away as 250 metres, may cause herons to abandon their nests. You can help these magnificent birds by careful planning of any developments and activities near heron habitats. The good news is that protecting the natural environment on your property during subdivision and land development benefits you as well as the birds.

BENEFITS OF PROTECTING HERON HABITAT¹

- ☒ **Increased property values.** Properties with trees and greenspace are worth significantly more than those without.
- ☒ **Enjoyment!** People living near these large birds often derive many hours of pleasure watching them.
- ☒ **Compliance with government regulations.** Federal, provincial and local governments have laws in place to protect the natural environment and wildlife. Careful design and construction can help you to avoid the liability of environmental damage.



Two sub species of Great Blue Heron are found in B.C.: *Ardea herodias fannini* in coastal areas and *Ardea herodias herodias* in the southern interior
Photo: Ed Rohatson (www.edsnature.com)

See over for ways to protect herons and nest trees during land development.

¹ *Develop with Care* (see over) has detailed references on this research.

BIRDS, EGGS AND NEST TREES ARE PROTECTED BY LAW

It is an offence to possess, take, injure, molest, or destroy a bird or its eggs, or the nests of birds when occupied by a bird or egg. The nests and eggs of herons are protected year-round, whether or not the nest is currently active (B.C. *Wildlife Act*, Section 34). Herons and their active nests are also protected under the federal *Migratory Birds Convention Act*. If you wish to remove or modify heron nest trees, you must seek permission and obtain a written permit from the Ministry of Environment's Permit & Authorization Service Bureau (www.env.gov.bc.ca/pasb/applications/) AND you should check with Environment Canada (www.cws-scf.ec.gc.ca/enforce/index_e.cfm) to see if a federal permit is required under the *Migratory Birds Convention Act* regulations.



Heronry with young. Photo: Ross Vennesland

HERONS AND HERONRIES

- ♦ Great Blue Herons may nest individually, or in heronries (colonies) with tens or sometimes hundreds of birds. They typically return to the same nesting areas year after year.
- ♦ Herons lay 2–5 eggs, usually between February and April, which hatch in about 30 days. The parents share the duties of incubating the eggs and feeding the young. At two months old the young are able to fly and seek food.
- ♦ A heron's diet consists mainly of small fish, but they will also eat shellfish, insects, rodents, amphibians (mostly frogs), reptiles, and small birds.
- ♦ Herons may live to be 17 or more years old.

DEVELOPMENT GUIDELINES

More detailed guidelines for protecting herons and other environmental values during land development are provided in *Develop with Care: Environmental Guidelines for Urban and Rural Land Development in British Columbia*, prepared by the B.C. Ministry of Environment. For more information see www.env.gov.bc.ca/wld/BMP/bmpintro.html.

- ☑ **Identify and mark out a buffer area** around the heronry where there will be no activities (not even recreational trails). Naturally vegetated buffers shield the nests and young from human disturbance and predation by Bald Eagles, crows, and ravens. The Ministry of Environment recommends a buffer of at least 300 m in undeveloped areas, 200 m in rural areas, and 60 m in urbanized areas. An additional 200 metre 'no disturbance' buffer is recommended during the nesting season, especially for colonies not previously accustomed to people and their activities.
- ☑ **Design and locate your development to avoid disturbing heronries and feeding areas.** Talk to your local government about ways to concentrate development in areas with lower environmental values—for example through density bonusing or clustering development.
- ☑ **Time construction carefully.** Avoid any form of disturbance between January 15 and September 15 when herons are nesting. 'Molestation of wildlife' is an offence under the *Wildlife Act*, and even walking near the nest or loud noises from lawnmowers and leaf blowers may be

considered 'molestation' if this causes the birds to abandon active nests. Early in the season (January to June) nesting herons are particularly susceptible to people and noise and may abandon their nests and young.

- ☑ **Protect feeding and perching areas.** Avoid draining or filling wetlands or coastal marshes, and maintain shoreline habitats in a natural condition. Protect communal roosting (perching) sites such as jetties, log booms and coniferous trees.
- ☑ **Check with your local government** to see if they have a Development Permit Area (DPA) or other bylaw that protects nest trees and buffer zones in your area.



Green Herons (left) and Black-crowned Night Herons are also found in B.C., and protected under the B.C. *Wildlife Act*. Photo: Ed Robertson (www.edsnature.com)

Caunce, Cassandra ENV:EX

From: Hirner, Joanna ENV:EX
Sent: Wednesday, April 29, 2009 5:13 PM
To: 'Liz.Kovics'; 'Robinson,Andrew [PYR]'
Cc: 'Joel.Jacques'; 'Aidan.Ballantyne'; Taylor, Robin E GTWY:EX
Subject: RE: Draft Songbird Nesting Protocols PMH1
Attachments: 090413_SFPR Songbird Nest Survey Protocol 4thDRAFT JHComments.doc

Hi Liz,

No problem; please see attached. This version still has some tracked changes in it but I was informed that these changes would be accepted and the document considered "final" according to the SFPR team.

Joanna

From: Liz.Kovics [mailto:Liz.Kovics@SeaToSkyDBFO.CA]
Sent: Wednesday, April 29, 2009 5:03 PM
To: Hirner, Joanna ENV:EX; Robinson,Andrew [PYR]
Cc: Joel.Jacques; Aidan.Ballantyne; Taylor, Robin E GTWY:EX
Subject: RE: Draft Songbird Nesting Protocols PMH1

Hi Joanna,

Thanks for the comments, I will review and get back to you.

In the interim, could you please forward the SFPR protocols?

Thanks,
Liz

-----Original Message-----

From: Hirner, Joanna ENV:EX [mailto:Joanna.Hirner@gov.bc.ca]
Sent: Wed 4/29/2009 5:00 PM
To: Liz.Kovics; Robinson,Andrew [PYR]
Cc: Joel.Jacques; Aidan.Ballantyne; Taylor, Robin E GTWY:EX
Subject: RE: Draft Songbird Nesting Protocols PMH1

Hi Liz et al.,

I know that Canadian Wildlife Service is the lead on reviewing the bird nesting protocols (as per commitment 14.8 in the Table of Commitments and Assurances) so I will defer to Andrew to make final comments. However, I have reviewed these protocols and do have some comments/concerns (the most important/pressing is regarding Section 3.1):

Page 2 - Number of surveys required for vegetation dominated by shrubs is two (in the table). It seems to me that there may be some shrub dominated areas that could be quite dense and thus just as difficult to survey (if not more difficult) than tree dominated areas. To account for this, I think the protocols should give the QEP more discretion to

require more surveys in this type of situation, by changing the title in the table to read "minimum number of surveys required", and adding a sentence that recognizes the QEPs ability to require more surveys than the minimum if the local conditions merit it.

Page 3 - Section 2.6 suggests that a 20 m buffer will be sufficient for most songbirds. I'm not familiar with the literature or other forms of knowledge on buffer requirements for nesting songbirds, and I'm not sure what criteria were used to come up with 20 m as a suggested buffer, but I do know that the South Fraser Perimeter Road (SFPR) used 30 m as their buffer distance in their songbird nesting protocols. I'd ask that you consider a larger buffer (30 m or more) wherever possible. Also, similar to my previous comment, you could rewrite with 20 (or 30) m as a minimum buffer, and add a sentence giving the QEP discretion to make the buffer larger if a species or individual bird is considered particularly sensitive or is a species at risk.

Page 3 - Section 3.1: The way this is written suggests that clearing may be initiated at any time within the 7-10 day window following the last survey in the cycle. It seems to me that surveys should be initiated ASAP following the last survey cycle (i.e. within 24 hours) because nesting activities could be initiated between the last survey and the start of clearing if several days elapse. Not initiating as soon as possible seems like it could greatly increase the probability of contravening the Wildlife Act and Migratory Birds Convention Act. The SFPR protocols require clearing to begin within 24 hours, and require additional surveys if clearing is not initiated within 24 hours. The number of additional surveys depends on the number of days elapsed between the last survey and initiation of clearing; I'd be happy to forward the SFPR protocols if you like. The environmental monitors should also be on the look-out for any nesting activity initiated during clearing if clearing lasts several days. This may be part of their duties documented somewhere else, but documenting it here too would be helpful.

Please let me know if you have any questions or would like to discuss further.

Thanks!

Joanna

Joanna Hirner (MRM, RPBio)
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From: Liz.Kovics [<mailto:Liz.Kovics@SeaToSkyDBFO.CA>]
Sent: Tuesday, March 24, 2009 7:46 PM
To: Robinson,Andrew [PYR]
Cc: Joel.Jacques; Aidan.Ballantyne; Hirner, Joanna ENV:EX; Taylor, Robin
R GTWY:EX
Subject: Draft Songbird Nesting Protocols PMH1

Hi Andrew,

Please find attached Draft Songbird Nesting Protocols for the Port Mann
Hwy 1 Project (PMH1).

The intent of this Protocol is to meet bullet 7 of Reference 14.9 of the
PMH1 Table of Commitments. It is based on the historic Lower Mainland
peak songbird nesting season within an urban environment.

We would like to proceed with clearing utilizing these protocols, please
let us know if you have any comments or concerns.

Thanks,

Liz

Elizabeth Kovics, R.P.Bio., FFT, CCEP

Environmental Manager

Port Mann Hwy 1/Sea to Sky Hwy Improvement

Kiewit/Flatiron

Cell: 604-786-1800

P Please consider the environment before printing this e-mail

Best Management Practices Guidelines

FOR PACIFIC WATER SHREW IN URBAN AND RURAL AREAS



David Keppeler photo

September 2000

WORKING DRAFT

by
Vanessa J. Craig
and
Ross G. Vennesland



**BRITISH
COLUMBIA**

Ministry of Environment
Ecosystem Standards and Planning
Biodiversity Branch

DRAFT

Executive Summary

The Pacific Water Shrew is a semi-aquatic shrew that lives in aquatic and streamside (i.e., riparian) habitats in and around many types of watercourses and wetlands, preying mostly on invertebrates. The distribution of the species in Canada is limited to the Lower Mainland region of B.C. The Pacific Water Shrew has been designated as Endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and has been listed on Schedule 1 of the *Species at Risk Act* (SARA).

The Ministry of Environment, with the Pacific Water Shrew Recovery Team, has developed this document to provide planners, developers, and consultants with information about the Pacific Water Shrew, and guidelines on how to include Pacific Water Shrew in environmental assessments. This document suggests actions that municipalities, regional districts and developers can take to ensure the recovery of Pacific Water Shrew, and use of these guidelines demonstrates due diligence towards species protection and recovery.

All environmental assessments that occur within the range of the Pacific Water Shrew, and involve projects that will occur within, or result in habitat modification within 100 m of any waterbody (stream, creek, wetland, marsh, ocean, ephemeral or intermittent watercourse) should include Pacific Water Shrew. This document provides detailed guidelines for consultants to follow on when and how they should conduct an environmental assessment for Pacific Water Shrew.

Environmental assessments for Pacific Water Shrew should use a 2-prong approach that includes habitat sampling, followed by live-trapping for Pacific Water Shrew in select habitats. Where a Pacific Water Shrew is captured, or in areas of habitat rated as high or moderate capability for Pacific Water Shrew (based on ratings available from the Ministry of Environment), these guidelines recommend the implementation of a 100 m protective area around the habitat (e.g. a 100 m area on each side of a linear feature such as a stream, or a 100 m protective area around a more circular feature such as a wetland). Within the outer 40 m of the identified 100 m protective area, low-impact activities can occur, such as the construction of a small walking trail, which will increase the value of the area to the surrounding community.

In addition to guidelines for environmental assessments, this document also includes suggested actions for conservation organizations, and best management practices for habitat, including information on habitat protection, habitat rehabilitation, activities around crossings over watercourses or wetlands, recommendations for retention and addition of riparian vegetation or coarse woody debris, recommendations to help maintain habitat connectivity for Pacific Water Shrew, and information for municipalities on management options, such as the implementation of Development Permit Areas, Streamside Protection Zones, and Integrated Stormwater Management.

Preface

British Columbia is recognized globally for its exceptional wildlife, diversity of ecosystems and its rich natural resources. The Ministry of Environment (MOE) works to maintain these valuable natural assets, which are at the heart of many recreational and economic activities enjoyed by British Columbians in all regions of the province.

MOE has responsibility for the protection and stewardship of B.C.'s environment. To achieve this goal, the Ministry develops policy and legislation, regulations, codes of practice, environmental contracts and covenants (legal agreements). In addition, the Ministry sets science and results-based objectives and standards for activities that affect biodiversity. It monitors and reports on selected species and habitats, and acquires information on habitat and species health.

Clear goals, objectives, meaningful performance measures and science-based tools guide Ministry actions in improving environmental management. Regulatory frameworks allow headquarters and regional staff to set and report on standards for environmental quality, and for discharges and emissions to air, land and water. Regulatory compliance is addressed through policy development, enforcement and publicly reporting the results of compliance monitoring.

An Increasing Role for Stewardship

While the Ministry takes a leading role in the protection of B.C.'s natural resources, species, and habitats, environmental protection and stewardship is the responsibility of all British Columbians. Stewardship of natural resources is key to maintaining and restoring the province's natural diversity, and achieving the Ministry's important environmental mandate. A stewardship approach involves all British Columbians taking responsibility for the well being of the environment by acting to restore or protect a healthy environment.

The Ministry is actively pursuing opportunities for sharing the responsibility of environmental protection. As a Ministry, MOE looks to establish vital partnerships and move forward together to protect the environment and the health of all British Columbians. MOE is listening to and developing partnerships with governments, First Nations, communities, academic institutions, industries, volunteer organizations, and citizens. The involvement of these partners in the shared environmental protection and stewardship of B.C.'s resources is essential because of their local knowledge, resources and expertise. The environment will benefit as a result of an increased level of responsible environmental stewardship ethics, immediate and long-term improvements to environmental health and an increased awareness of ecosystem needs among the partners.

A Changing Process

Over the next several years, the Ministry will be making strategic shifts (changes in business practices) towards:

- Shared stewardship between the Ministry and other stakeholders;
- Clear roles for gathering environmental information and achieving environmental objectives;
- Integrated MOE program delivery based on the best available science and an ecosystem-based approach; and
- Clear, reasonable environmental outcomes, with discretion as to how to achieve these outcomes.

This document is an interim document and will change in the future. Changes to the delivery model of this information are also expected, through the movement towards Internet-based access.

What will this document do for me?

This document exists to help you act as a steward of the environment. The information you will find in this document will help you to ensure that your proposed development activities are planned and carried out in compliance with the various legislation, regulations, and policies that apply to your activity and relate to the Pacific Water Shrew. By understanding the standards your activities must meet, you can choose an appropriate set of best practices to help you carry out your activities to achieve the required standards.

This document also provides information regarding Pacific Water Shrew biology, environmental assessment and habitat restoration methodologies, and links to stewardship organizations and relevant literature.

Table of Contents

Executive Summary	i
Preface.....	ii
1 Introduction.....	5
1.1 Range of the Pacific Water Shrew	5
1.2 Species description.....	6
1.3 Habitat description	6
1.4 Threats to the species	8
1.5 Species status and recovery efforts	9
1.6 Results-based management	10
1.7 Current legislation.....	10
1.8 Implications of the <i>Species at Risk Act</i>	10
1.9 Recovery goals and objectives.....	11
2 Environmental Assessments.....	13
2.1 When to conduct an environmental assessment.....	13
2.2 How to conduct the environmental assessment	14
2.3 Habitat assessment.....	16
2.4 Nil habitat ratings.....	16
2.5 Survey for Pacific Water Shrew	17
2.6 Identification of Pacific Water Shrew.....	21
3 Best Management Practices for Habitat	23
3.1 Habitat protection.....	23
3.2 Watercourse & wetland crossings.....	24
3.3 Riparian vegetation & Coarse Woody Debris (CWD)	25
3.4 Connectivity of habitat.....	25
3.5 Management options.....	26
4 How These Guidelines Differ from Fisheries Regulations	28
5 Habitat Rehabilitation	29
6 Actions for Stewardship & Conservation Organizations.....	32
6.1 Education	32
6.2 Habitat protection.....	32
7 Additional Information: Links, Downloads & Literature Cited	34
7.1 Contacts.....	34
7.2 Background	34
7.3 Reporting of Pacific Water Shrew occurrences	35
7.4 Stewardship.....	35
7.5 Land value near to riparian corridors.....	36
7.6 Integrated Stormwater Management (ISM).....	37
7.7 Small mammal identification and sampling	37
7.8 Equipment suppliers.....	37
7.9 Development Permit Areas (DPAs).....	37
7.10 Additional reading and literature cited	38

1 Introduction

1.1 Range of the Pacific Water Shrew

The Pacific Water Shrew (*Sorex bendirii*) is sometimes also referred to as the Marsh Shrew. This small mammal inhabits aquatic and streamside (i.e., riparian) habitats in and around many types of watercourses and wetlands, preying mostly on invertebrates. The distribution of the species in Canada is limited to the Lower Mainland region of B.C. It is also found along the coast of the United States in Washington, Oregon, and northern California (Figure 1).

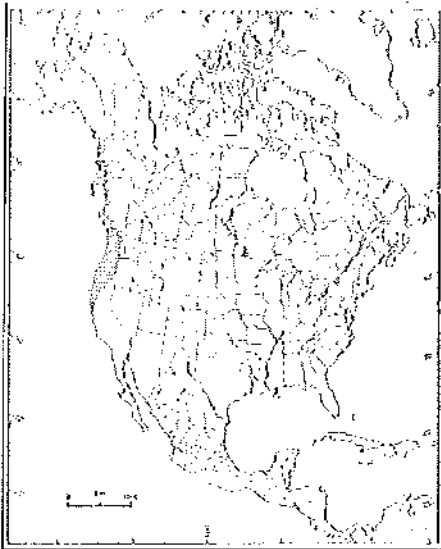
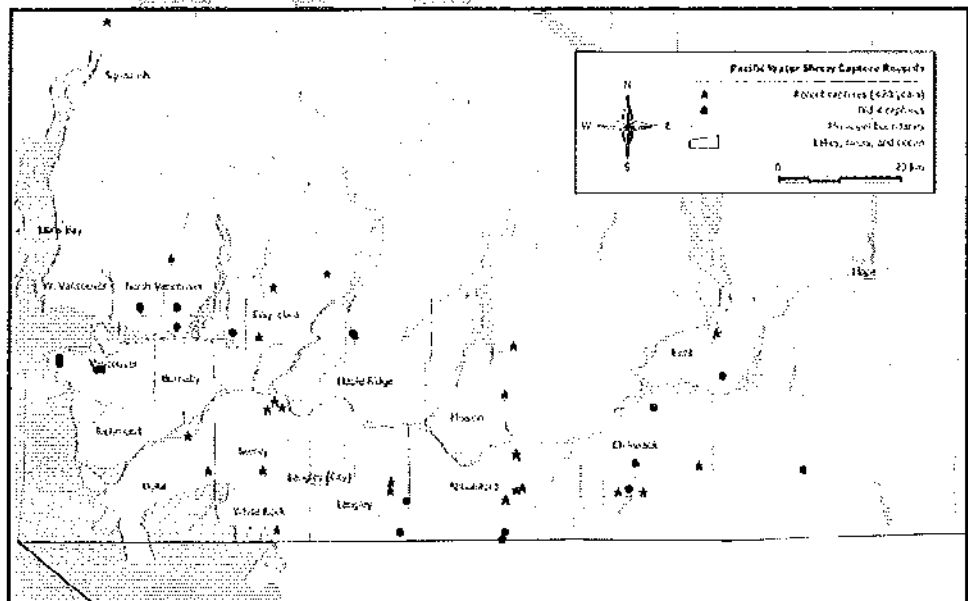


Figure 1. The global distribution of the Pacific Water Shrew is limited to a central region of the Pacific coast.

In British Columbia, the current known range of the Pacific Water Shrew is the Fraser Valley as far east as Hope and Howe Sound north to Squamish (the Squamish and Chilliwack forest districts) (Figure 2). Unconfirmed sightings suggest that the Pacific Water Shrew may occur further east and north including as far north as Whistler and sightings in the Skagit Valley suggest it may occur further east), and south to the U.S. border (Figure 2). The current known distribution of the species likely reflects sampling effort and the difficulty of capturing these shrews more than their actual distribution. Sampling for the Pacific Water Shrew has been extremely limited. During the last survey for the species in the Lower Mainland in 1992, only 3 shrews were captured at the 55 sites surveyed.

Figure 2. Location of Pacific Water Shrew captures in the Lower Mainland. Contact the B.C. Conservation Data Centre for up-to-date information about water shrew capture locations.



1.2 Species description

The Pacific Water Shrew is not a rodent; it is a member of the order Insectivora, along with moles. It is the largest shrew in B.C. (Figure 3, Figure 4). The overall body length of the Pacific Water Shrew averages 15.4 cm, 7 cm of which is tail. The average weight is 13.2 g. The fur is dark brown to black dorsally and dark brown ventrally (Figure 3, Figure 4a). The hind feet of the shrew have a fringe of stiff hairs to assist with swimming (Figures 4b, 11). See *Section 2.6* for a detailed description of Pacific Water Shrew in relation to other local small mammals.



Figure 3 The Pacific Water Shrew (*Sorex bendirii*) is the largest shrew in British Columbia. Denis Knopp photo.

1.3 Habitat description

The Pacific Water Shrew is a riparian, or streamside, specialist and is usually captured within 60 m of watercourses or wetlands, but shrews have been captured in moist forest up to 1 km away from standing water (these may be dispersing juveniles). Some ranges of these shrews are likely long and linear and follow the water's edge. This shrew forages on land and in the water. Soft-bodied aquatic invertebrates comprise about 25% of its diet. The interlocking stiff hairs on the feet create a web-like effect for more powerful swimming. Foraging bouts in water last up to 3 ½ minutes during which these shrews pry under rocks and debris looking for food. All food captured is carried to the shore to be eaten. On land this shrew primarily forages in leaf litter and in and under logs for prey such as earthworms, sowbugs, and centipedes.

Pacific Water Shrews have been captured along a variety of watercourses and wetlands including channelised watercourses with dense surrounding

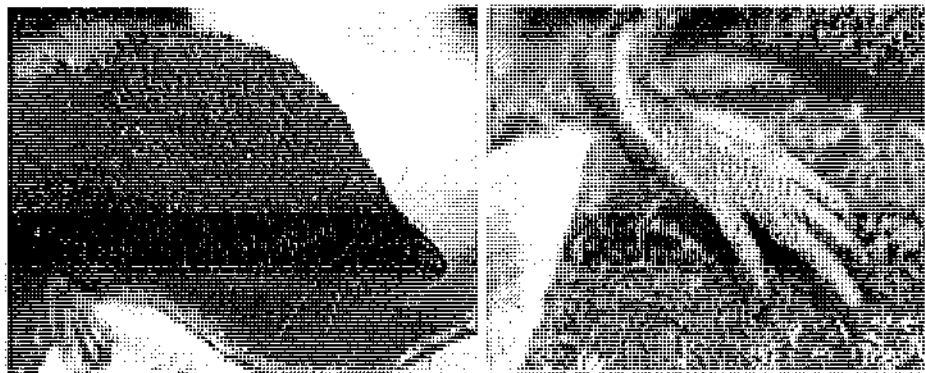


Figure 4. Close up views of Pacific Water Shrew showing a) fur colour (left) and b) stiff hairs on rear foot (right). Chris Schmidt photos.

vegetation, along the edges of lakes, ponds and beaches with dense vegetation, small ephemeral creeks, and at the edges of marshes and swamps.

*Based on the data available, the **best quality habitat** for the species is currently defined as:*

- *a riparian area around and including a permanent stream or creek (<10 m wide) or any size wetland (including swamps, marshes, lakes, ocean beaches, etc.) with a mature coniferous forest (structural stages 5-7) of western red-cedar and/ or western hemlock or a mature deciduous or mixed forest (structural stages 4-7); these sites should be rated as high or moderate in habitat capability mapping;*
- *habitat surrounding the stream or wetland sufficient to protect the normal functioning of the riparian ecosystem (i.e., a protective area).*

Other suitable and/or important habitats include:

- sites similar to those described above, but at younger structural stages (although the site might not be currently the most suitable, it is still capable of becoming suitable with time);
- non-forested sites around streams/wetlands with heavy shrub cover;
- ephemeral or intermittent waterways;
- streams 10-20 m (bankfull width) with suitable surrounding habitat;
- corridors for connecting habitat patches (preferably riparian habitat but potentially moist mature coniferous or deciduous forest); these sites may be rated high, moderate, or low in habitat capability mapping.

Site indicators of rich moist habitat (e.g., skunk cabbage, salmon berry, devil's club; see Craig 2007), indicate capable/suitable habitat. Dense riparian vegetation and downed wood are also valuable habitat components as they provide cover and travel corridors.

Two habitat models have been produced using the current definition of best quality habitat identified above: 1) habitat suitability/capability ratings have been assigned to habitat based on Biogeoclimatic zone site series (Terrestrial Ecosystem Mapping [TEM]; Craig 2007), and 2) habitat suitability ratings have been assigned to habitat based on characteristics of the stream and surrounding vegetation (Sensitive Habitat Inventory Mapping [SHIM]; Craig

2006). Please see these documents for a draft comprehensive review and rating system for Pacific Water Shrew habitat in the lower mainland.

These habitat definitions and models are subject to change based on continuing research – contact the Ministry of Environment for the latest information. Structural stages are used per *Describing Ecosystems in the Field* (see link in *Section 7.2*).

1.4 Threats to the species

The major threat to Pacific Water Shrew is the destruction or degradation of currently suitable or ultimately capable habitat. In addition, mortality from human sources, such as predation by domestic cats or mortality in fish traps, are potentially large threats to this species.

Because the Pacific Water Shrew is a riparian-dependent species that forages extensively in water, many of the guidelines for protecting fish habitat will also protect habitat for this shrew. Activities that result in the modification of stream channel structure or stability (e.g., improperly funnelled stormwater run-off, road building, cattle access to streams) or water quality (e.g., siltation, run-off from roads or agricultural areas, leaching from malfunctioning residential septic fields, removal or alteration of riparian vegetation) will affect this shrew's food sources.

The total channel length of natural rivers and streams in the Vancouver area has been reduced from > 120 km historically to < 20 km currently (Oke *et al.* 1992). Steyn *et al.* (1992) reported a 24% reduction in the area of natural riparian vegetation in the Greater Vancouver Regional District between 1986 and 1992. Approximately 15% of streams in the Lower Fraser Valley have been lost (culverted, paved over, or filled in; Fisheries and Oceans Canada 1999). An additional 23% of streams are threatened (have been affected by 1 out of 8 possible impacts that degrade riparian habitat and water quality), 48% are endangered (affected by > 1 impact criteria), and only 14% are classified as wild (not significantly impacted).

The three categories of habitat threats are:

- Habitat loss: including permanent loss of habitat, and the loss of useful habitat. Caused primarily by:
 - removal of riparian vegetation,
 - inadequate riparian buffers, and
 - loss of streams or wetlands that are not protected during development.
- Habitat degradation: including modification of the waterbody, water quality or the surrounding riparian vegetation. Caused primarily by:
 - altering or removing riparian habitat,
 - inadequate riparian buffers,
 - edge effects,
 - effects from run-off (including pesticides, heavy metals, salts, manure), siltation, and leaching among others, and

- encroachment (especially problematic in urban areas).
- Habitat fragmentation: including loss or degradation of habitat resulting in the inability of shrews to move among habitat fragments. The ability of the shrew to recolonize areas from which they have been extirpated and ensuring gene flow among populations is dependent on habitat connectivity. Habitat within the Lower Mainland is currently highly fragmented (Zuleta 1993).

Recovery of the Pacific Water Shrew in Canada is dependent on successfully addressing all of these threats. A brochure produced by the Ministry of Environment, Lands and Parks (currently MOE) provides an overview of the threats to the Pacific Water Shrew in B.C. (See link in *Section 6.2*).

1.5 Species status and recovery efforts

The Pacific Water Shrew has been designated as Endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and has been listed on Schedule 1 of the *Species at Risk Act* (SARA). It is also 'Red-listed' in British Columbia, meaning that it is a candidate for legal protection under the B.C. *Wildlife Act*. The reasons cited by COSEWIC when designating the species include: the limited distribution of the species, a continued decline in the quantity and quality of habitat, and fragmentation of the remaining habitat (and populations).

In October 2002, a recovery team was formed to guide work to maintain and restore Pacific Water Shrew in Canada. The team is composed of representatives from municipal governments, conservation organizations, B.C. Government ministries, First Nations, the federal government, the forestry sector and several shrew experts. The recovery team has written a draft recovery strategy and action plan for the shrew that together outline the recovery objectives and specific actions that will be used to ensure the long-term persistence of this animal. Once the strategy has been approved at the provincial and federal levels, it will be posted on the BC Ministry of Environment Recovery Planning webpage at: <http://www.env.gov.bc.ca/wld/recoveryplans/rcvry1.htm> and on the SARA Public Registry: <http://www.sararegistry.gc.ca/>.

The recovery team will be working to collect more information on the Pacific Water Shrew, including: 1) better data on the actual distribution of the shrew, 2) more cost- and time-effective methods of sampling for the shrew, and 3) more information on movement patterns and habitat requirements of the shrew. In addition, the team will be working with municipalities and conservation and stewardship organizations towards protecting, purchasing, or restoring habitat, and applying for funding for these activities. If you are interested in coordinating with the recovery team to protect or rehabilitate habitat, or to request the latest information on this species and recovery efforts contact the Ministry of Environment in Surrey.

1.6 Results-based management

This document uses the best available science and existing legislated requirements to define environmental objectives and performance targets to facilitate protection and recovery of Pacific Water Shrew. Users of this guide that meet these objectives and targets demonstrate due diligence in the protection and recovery of this species.

The intent of this document is to be 'results-based'. Local and regional governments and development proponents may choose approaches that suit their context as long as the overall goal of working towards species protection and recovery is achieved. The Best Management Practices are recommendations rather than requirements. They provide examples of how species protection and recovery might be met. Alternative methods should be vetted through the B.C. Ministry of Environment in Surrey.

Municipalities and Regional Districts are strongly encouraged to use the many tools within the B.C. *Local Government Act* and B.C. *Community Charter* that enable effective environmental protection. Most of the objectives and best management practices listed in this document could be integrated into official community plans, bylaws, development permit areas, density bonuses and other tools in the *Local Government Act* and *Community Charter*.

1.7 Current legislation

Pacific Water Shrews are protected year round and cannot be killed, collected, held in captivity or harassed without a permit under the B.C. *Wildlife Act*. The federal *Species at Risk Act* (SARA) also protects Pacific Water Shrews by mandating planning and implementation of recovery actions for this species, no matter where it occurs, and with specific prohibitions against harm to individuals, residences or identified critical habitat if terrestrial or aquatic areas under federal jurisdiction are included in the project area.

1.8 Implications of the *Species at Risk Act*

The federal *Species at Risk Act* (SARA) is designed to protect Canada's species at risk and their critical habitat. The *Act* came fully into force between June 2003 and June 2004. SARA directly protects listed individual organisms, their residences, and identified critical habitat on federally administered lands and for aquatic species and migratory birds wherever they occur. The B.C. Government agreed in 1996 to provide complementary protection to listed species under its jurisdiction through the national *Accord for the Protection of Species at Risk*, and plans to meet this objective primarily through the use of cooperative stewardship and existing legislation (e.g., as outlined above, the B.C. *Wildlife Act* already protects this species). SARA stresses that cooperative solutions with the involvement of all stakeholders should be attempted before the use of regulated solutions. Nevertheless, SARA can be applied directly to provincially and privately owned lands if it is demonstrated

that the laws of the province are not effectively protecting the individuals, residences or critical habitat of a listed species.

The *Canadian Environmental Assessment Act* (as amended by SARA) requires that a formal environmental assessment be conducted for projects that may affect species at risk or their habitat where the federal government has decision-making authority (as defined in the *Act* if the federal government is acting as a proponent, land manager, source of funding or regulator). Through the 1996 national *Accord for the Protection of Species at Risk*, the B.C. Government agreed to provide a similar process on lands under its jurisdiction. Guidelines to assist in deciding when an environmental assessment is necessary for Pacific Water Shrew are provided in *Section 2* of this document.

Success and failure in recovery is formally documented every five years when recovery strategies and action plans are updated and this information is made freely available to the general public through the SARA Public Registry.

The most up-to-date information on species at risk in Canada is available at Environment Canada's website: <http://www.speciesatrisk.gc.ca/> or at the SARA Public Registry: <http://www.sararegistry.gc.ca/>. For information on species at risk in British Columbia, visit: <http://www.env.gov.bc.ca/wld/serisk.htm>.

1.9 Recovery goals and objectives

The overall goal of the Pacific Water Shrew Recovery Team, as outlined in the draft Pacific Water Shrew Recovery Strategy (in review), is:

To halt the decline of Pacific Water Shrew and ensure a self-sustaining meta-population in Canada by: 1) maintaining current populations; and 2) restoring the species back to its historical range, where suitable habitat still exists or can be rehabilitated.

Specific short-term recovery objectives relevant to the scope of these guidelines (for the period from 2003 to 2008), as outlined in the draft Pacific Water Shrew Recovery Strategy (in review), are:

- *Reduce habitat loss* by protecting additional habitat (e.g., through protected areas, covenants, agreements, etc.), managing habitat (e.g., using these guidelines), and planning for both wildlife habitat use and human development at both local and landscape levels,
- *Identify important habitat* through the continued collection of habitat data at capture locations, applied research, and GIS modelling,
- *Decrease mortality* from introduced predators and incidental captures, and
- *Conduct recovery planning, implementation, and evaluation* to provide an effective administrative framework to the recovery process.

Although biologically feasible, complete recovery of Pacific Water Shrew populations in the Lower Mainland will be socio-economically difficult to achieve in this heavily developed region due to a general lack of protected urban and rural habitat, and the high cost of protecting additional habitat.

Therefore, the recovery process for this species must ultimately find a balance between conservation and development that is socio-economically feasible and will still allow for species recovery. With the cooperation of stakeholders, it is hoped that significant progress can be made over the period 2003 to 2008 in terms of addressing the short term recovery objectives listed above.

This document is not designed to force development proponents to act in a specific way; it outlines the best actions that proponents can take to reduce negative effects on Pacific Water Shrew populations from habitat loss and degradation. Proponents should undertake any feasible actions possible that will help to address the short-term recovery objectives listed above.

The success of the recovery process and associated guidelines and regulations will be regularly monitored to help guide the level of effort required to achieve recovery. The first review of progress is scheduled for posting on the SARA public registry (<http://www.sararegistry.gc.ca/>) five years after the recovery strategy is posted.

DRAFT

2 Environmental Assessments

2.1 When to conduct an environmental assessment

The *Canadian Environmental Assessment Act* requires that a formal environmental assessment be conducted for projects that may affect species at risk or their habitat where the federal government has decision-making authority (as defined in the *Act* if the federal government is acting as a proponent, land manager, source of funding or regulator). Through the 1996 national *Accord for the Protection of Species at Risk*, the B.C. Government agreed to provide a similar process on lands under its jurisdiction. Given that the B.C. Government has responsibility for private, municipal and regional lands through the B.C. *Local Government Act* and B.C. *Community Charter*, municipalities and regional districts have considerable authority to ensure that species at risk are included in environmental assessments.

The response of the development proponent or regulator to the findings of the assessment (*i.e.*, whether to protect habitat or establish areas of protective habitat) is not directly mandated by legislation. The process instead emphasizes the importance of cooperative stewardship by government, industry, private landowners and non governmental organizations to ensure that sufficient habitat is protected and /or rehabilitated for this species. This document suggests actions that municipalities, regional districts and developers can take to ensure the recovery of Pacific Water Shrew, and use of these guidelines demonstrates due diligence towards species protection and recovery.

A decision flowchart for identifying projects that should include an assessment is included in Figure 5. In general, an environmental assessment of potential effects on Pacific Water Shrew should be conducted if all of the following conditions apply:

- the proposed development occurs within the range of this water shrew, and
- the site is ≤ 1000 m in elevation, and
- the project is to occur within 100 m of any waterbody (stream, creek, wetland, marsh, swamp, ocean or ephemeral or intermittent watercourse, whether or not the site is fish-bearing), and
- the project will modify the vegetation within 100 m of the waterbody or modify the in-stream or wetland environment.

It is important during this initial phase of planning that the development proponent contacts the B.C. Conservation Data Centre (see link in *Section 6.2*) to determine whether there are any records of Pacific Water Shrews in

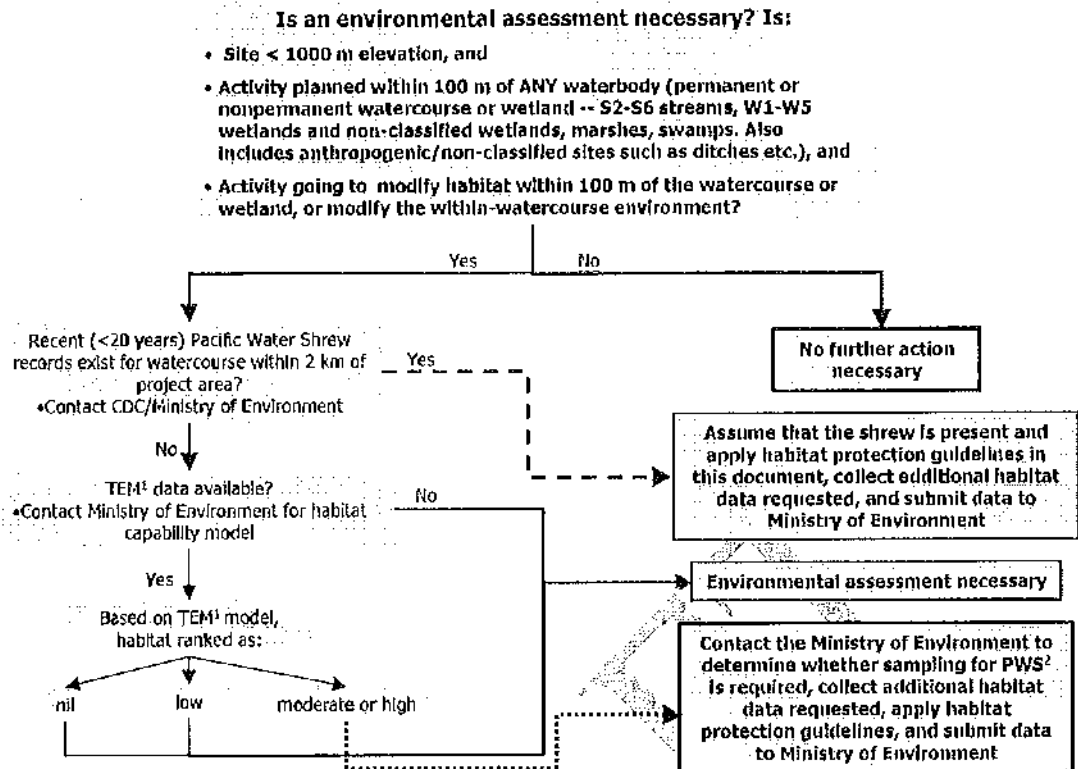


Figure 5. Decision flowchart to determine whether an environmental assessment is necessary. The results of any assessment should be submitted to the Ministry of Environment. ¹ TEM = Terrestrial Ecosystem Mapping, ² PWS = Pacific Water Shrew.

the area proposed for development. If there are, the habitat protection guidelines outlined in this document, including the establishment of a 100 m protective area around the record (see *Section 3* for more information) should be automatically implemented.

2.2 How to conduct the environmental assessment

Given the possibility that Pacific Water Shrews may be extirpated from areas with capable habitat, and the difficulty in capturing such a rare species, a simple presence/absence survey for the shrew is inadequate to assess the overall capability of the habitat. Instead, a two-prong approach to the assessment of habitat for the shrew should be implemented (Figure 6). In areas that qualify for an environmental assessment (no recent Pacific Water Shrew record for the area, and no TEM data available), a ground survey following the protocol outlined in *Describing Ecosystems in the Field* (see links in *Section 6.2*) should be performed first, to determine whether moderate or high

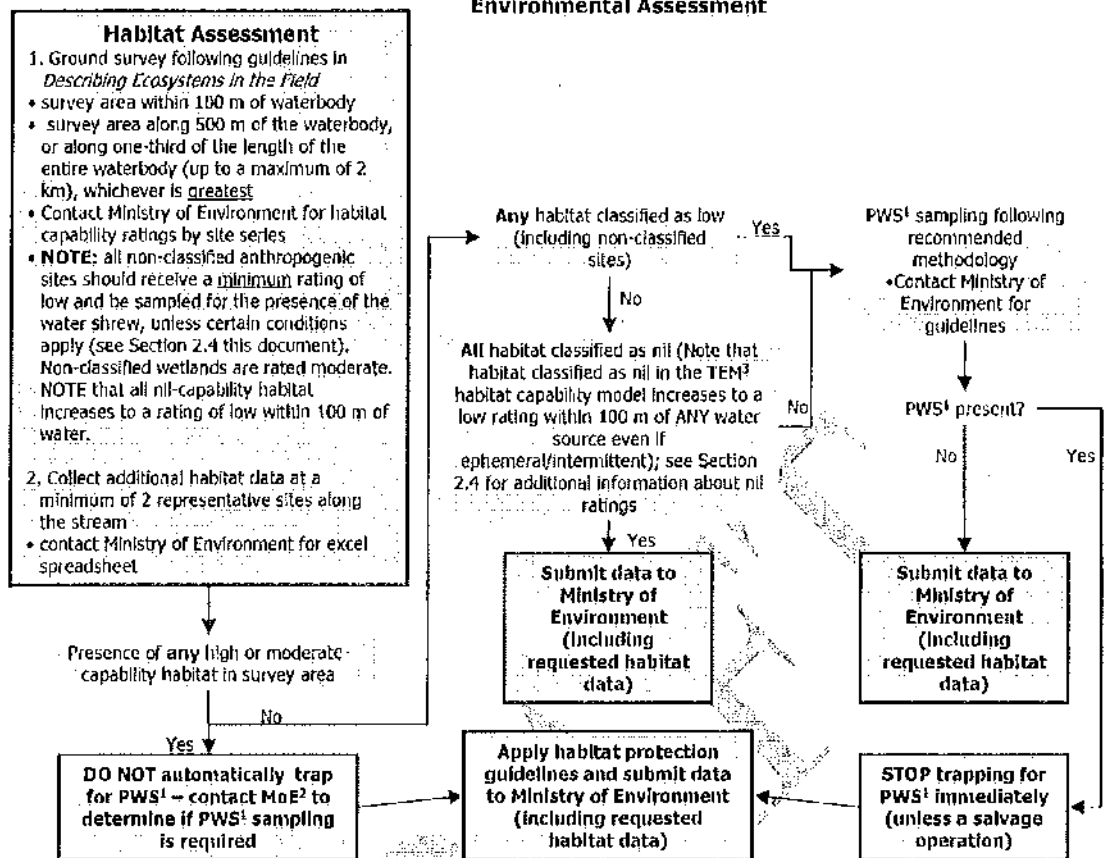


Figure 6: Recommended environmental assessment protocol for Pacific Water Shrew (PWS). ¹ PWS = Pacific Water Shrew, ² MOE = Ministry of Environment, ³ TEM = Terrestrial Ecosystem Mapping.

capability habitat is present (contact Ministry of Environment for habitat rankings; included in Craig 2007). Please note that the emphasis is on habitat **capability** (the potential of the site), **not current suitability**. A site with a current suitability ranking of low may become a moderate or high suitability site in time. If moderate or high capability habitat is not present, the site should be surveyed for the presence of the Pacific Water Shrew to provide some assurance that it is absent. The presence of either moderate or high capability habitat or an occurrence record of a Pacific Water Shrew should result in implementation of the habitat protection guidelines in this document, including defining a 100 m protective area around the habitat (Section 3). The Ministry of Environment (MOE) may require sampling for Pacific Water Shrew in some habitats ranked high or moderate capability; therefore, project proponents must consult with Ministry of Environment personnel prior to and after any habitat assessment to determine whether shrew sampling is required. All environmental assessments should be carried out by qualified consultants as required under the permitting conditions for

such work by the Ministry of Environment. Additional standard habitat measurements should be taken at 2 locations in the area at all sites (contact Ministry of Environment, Surrey for an excel spreadsheet of variables). Careful photo documents and records of all captured shrews (all species) needs to be kept and submitted to ensure appropriate identification. The results of all Pacific Water Shrew assessments should be submitted to the Pacific Water Shrew Recovery Team (Chair: Kym Welstead, Ministry of Environment, Surrey) to facilitate monitoring of the recovery process. Occurrence records of all red and blue listed species should be submitted to the Conservation Data Centre in a timely manner.

2.3 Habitat assessment

The capability of the site to support Pacific Water Shrews is much more easily assessed through a ground survey than by sampling for water shrews. The habitat within 100 m of the waterbody should be surveyed along at least 500 m of its length (or one-third of the length of the entire waterbody). This means that the results of a 500 m survey can only be extrapolated 500 meters either side of the trap line, e.g. if the area is 2 km long, then 2 trap lines are required. If any of the site series ranked as high or moderate capability for Pacific Water Shrew (contact Ministry of Environment for habitat rankings; included in Craig 2007) are found in the area, the site is considered suitable for Pacific Water Shrew and the guidelines in this document should be implemented. Typically, live-trapping surveys for Pacific Water Shrew should not be conducted in habitat areas ranked as high or moderate capability to avoid potential shrew mortality and undue distress to shrews, and disruption to habitat. However, MOE may require sampling in these habitats under certain conditions. Details on the results of the habitat assessment should be discussed with MOE to determine whether sampling for PWS should occur in areas rated moderate or high capability. At all project sites additional standard habitat variables should be collected at 2 sites along the waterbody at least 200 m apart (contact Ministry of Environment for spreadsheet of variables).

Non-classified sites such as anthropogenic habitats (e.g., constructed ditches) and wetlands frequently cannot be assigned a habitat ranking (contact Ministry of Environment for habitat rankings; included in Craig 2007). Non-classified wetlands default to a rating of moderate and all other potential habitat that cannot be rated will default to a low habitat suitability/capability. Habitat may be rated nil under certain conditions (see Section 2.4).

Results for all surveys (including TEM habitat surveys to determine habitat capability rating, additional habitat variables requested, and results of all trapping projects for Pacific water shrew regardless of whether a shrew was captured) should be submitted to the Ministry of Environment.

2.4 Nil habitat ratings

Habitat may be rated as NIL if:

1) The habitat is greater than 100 m from any waterbody (including permanent, nonpermanent and intermittent streams, and wetlands);

or if:

2) Any two of the following situations apply (excluding A and B together), or

3) Any three of the following situations apply (including A and B together).

If 1), 2) or 3) apply, the habitat can be rated as NIL, and no further action is necessary.

A) The habitat is heavily managed for a majority (> 75%) of the watercourse or wetland and on both sides of the watercourse or wetland. Heavily managed is defined as mowing of the watercourse or wetland banks and removal of stream substrate (e.g., digging, dredging) on at least an annual basis.

B) No riparian cover < 30 m from the top of watercourse or wetland bank for a majority (> 75%) of the watercourse or wetland. Cover can be from vegetation or other material that provides safety for shrews. Specifically, no cover is defined as 1) Structural Stage 1 non vegetated or sparse (defined as only non-vascular plants, < 10% cover of vascular plants, or < 5% total vegetation cover; Craig 2006), or 2) no non-vegetated cover material for shrews (cover examples here include coarse woody debris or other similar material). Cover material (vegetation or otherwise) must be > 1 m in width.

C) The banks of the watercourse or wetland are high (> 1 m) and steep (> 65 degrees) for a majority (> 75%) of the watercourse or wetland.

D) No connectivity to habitat rated as suitable (high, moderate or low suitability). Connectivity is defined as an available path for shrews under cover (vegetation, CWD, culvert, etc.) to suitable habitat within 100 m, or a path with no cover if suitable habitat is < 30 m distant. Culverts should be considered an available path for shrews only if < 30 m in length.

E) Linear length of watercourse is < 250 m. Culverts, or other similar barriers, should not be considered as breaks in the watercourse unless > 30 m in length. All wetlands that are not linear streams should be rated as moderate suitability. A meandering stream is considered linear – linear refers to a stream with an obvious channel.

If the project area does not contain moderate/high capability habitat but does contain low capability habitat, it should be surveyed for the presence of water shrews (Figure 6). The results of the assessment should be submitted to the Ministry of Environment to facilitate monitoring of the recovery process.

2.5 Survey for Pacific Water Shrew

The Pacific Water Shrew is an Endangered species; therefore, all sampling for its presence must use live-trapping methodology and requires a permit from the Ministry of Environment. Members of the recovery team will be conducting research on simpler less time-consuming methods to identify the presence of Pacific Water Shrews. For this reason, prior to

beginning a sampling program for Pacific Water Shrews, consultants should contact the Ministry of Environment to receive the latest sampling guidelines for this species. It is the responsibility of the consultant to obtain the most current guidelines and trapping methods. General guidelines for sampling small mammals also exist (available from Resources Inventory Standards Committee, RISC – see *Section 6.7*). Sampling for Pacific Water Shrew should always occur in habitat rated low capability – no sampling should occur in habitat rated moderate or high capability, unless the Ministry of Environment notifies the consultant to do so. For this reason it is the responsibility of the consultant to inform the Ministry of Environment of the habitat sampling results, and determine whether Pacific Water Shrew sampling in the moderate or high capability habitats is required. If a Pacific Water Shrew is captured, all trapping should cease immediately, unless it's a salvage operation.

The following is the suggested protocol for sampling Pacific Water Shrews:

All consultants conducting environmental assessments must follow live-trapping guidelines for sampling Pacific Water Shrews. Contact the Ministry of Environment prior to beginning sampling to receive the most up-to-date sampling protocol, and to request a trapping permit for the species. If federally administered lands or waters are included in the assessment area, a federal permit will also be necessary for projects including species at risk (see <http://www.sararegistry.gc.ca/default.cfm> for details). The results of all assessments should be submitted to the Ministry of Environment to facilitate monitoring of the recovery process.

1) All consultants must report to the B.C. Conservation Data Centre (CDC), and the Ministry of Environment all sampling efforts (whether or not a water shrew was captured) including dates trapped, number of traps, UTM's of areas trapped, etc. This will help in compiling an up to date distribution map and monitoring the recovery process.

All shrews captured should be identified in the field, photographed, measured and released alive. All reasonable efforts must be used to avoid accidental mortality. Measurements of all captured shrews (whole body length, tail length and length of hind foot) should be recorded to assist in verifying the capture of a water shrew. Any capture suspected to be a PWS should be carefully photographed with particular attention to documenting length of body and tail, colour of belly and underside of tail, as well as the presence of hairs on the hind feet. Age and breeding condition should be recorded if known. Consultants should fill out a Rare Vertebrate Animal Observation form (see link in *Section 6.3*) and submit it to the Conservation Data Centre and the Ministry of Environment. The local municipal government should also be informed of the occurrence. If dead, all specimens should be submitted to the Ministry of Environment.

2) At a minimum, sampling for the Pacific Water Shrew should follow these protocols:

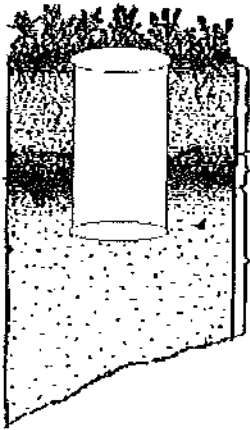


Figure 7. Pitfalls should be placed flush to the ground.

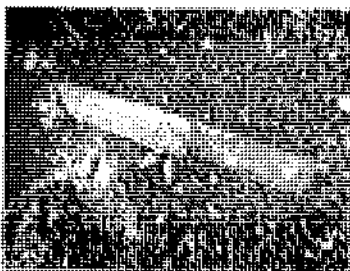


Figure 8. To funnel shrews into the pitfall, drift fences should be placed on both sides of the pitfall – running towards the water, and upland. EcoLogic Research photo.

- sampling for the shrew for 8 days using pitfall traps with drift fences (Figures 7 & 8), with traps open 24 hours a day (minimum 192 total trap hours, including 8 over-night sessions). All 8 days need not be consecutive, but when trap days are broken up, trapping should be conducted in sessions that are at least 2 consecutive trap days. See further in this section for detailed direction on trap set up and design. Those conducting trapping are expected to use their best judgement to avoid trap flooding and desiccation or starvation of trapped animals.
- traps should be checked regularly to ensure that shrews are not killed. From March 1 to November 1, traps should be checked every 8 hours (minimum). From November 1 to March 1, traps should be checked every 6 hours (minimum). If frost is expected or if heavy rainfall is expected, trapping should NOT occur. If temperatures are projected to drop to 3 °C or lower during the trapping period, trapping should NOT occur. This requirement is subject to change based on research; check with Ministry of Environment.
- If possible, it would be beneficial to break the 8 trapping days into 2 sessions of 4 consecutive 24 hour periods 3-4 weeks apart. Alternatively, trapping could be conducted in 4, 2 consecutive 24 hour sessions spaced over 3-4 months, or 3 consecutive 24 hour sessions (4,2,2 or 3,3,2) spaced 3-4 weeks apart.
- it would be beneficial to have at least 1 trapping session during or immediately after a rain event, because shrews might be more active when the ground is moist.
- it would be beneficial if at least 1 trap session occurred in late summer/early fall (August/September), when the population of Pacific Water Shrew is likely at its largest.
- traps should be equipped with at least 10 g of food (raw meat, invertebrates such as meal worms, or moist cat food).
- fluffy and insulating bedding should be used for added warmth. Recommended material is a cellulose fibre. Cotton, or other material that absorbs water and does not insulate when wet, should not be used. Wood chips are also not recommended.
- pitfall traps with drift fences (Figures 7 & 8) should be placed every 15 m along a representative portion of the waterbody.
- trap lines should be a minimum of 500 m long, or long enough that a minimum of a third of the entire waterbody is covered, whichever is greatest (not limited to the section included in the proposed development). The results of the 500 m trapline may be extrapolated 500 m on either side of the line; therefore, areas >1.5 km long require >1 trapline.
- pitfalls should be buried flush with the surface (Figure 7). If sponges or other materials are added to the pitfall, the distance from the top of the added material to the top of the pitfall should be ≥ 20 cm. In areas with a high watertable, a few large stones placed on the edge of the can (placed

to minimize the obstruction to shrew movement) will weigh the can down. Alternatively, traps can be moved up to 5 m away from the waterline.

Table 1. Small mammal species that occur in the Lower Mainland.

Common name	Scientific name
Pacific Water Shrew	<i>Sorex bendirii</i>
Common Water Shrew	<i>Sorex palustris</i>
Wandering Shrew	<i>Sorex vagrans</i>
Dusky Shrew	<i>Sorex monticolus</i>
Common Shrew	<i>Sorex cinereus</i>
Trowbridge's Shrew	<i>Sorex trowbridgii</i>
Deer Mouse	<i>Peromyscus maniculatus</i>
Red-backed Vole	<i>Clethrionomys gapperi</i>
Townsend Vole	<i>Microtus townsendii</i>
Creeping Vole	<i>Microtus oregoni</i>
Long-tailed Vole	<i>Microtus longicaudus</i>
Heather Vole	<i>Phenacomys intermedius</i>
Townsend's Mole	<i>Scapanus townsendii</i>
Coast Mole	<i>Scapanus orarius</i>
Shrew-Mole	<i>Neurotrichus gibbsii</i>

- traps should be placed within 5 m of water, taking advantage of naturally occurring features that are important to shrews, such as logs, that might funnel shrews into the trap (place pitfalls adjacent to logs on the side close to the water and drift fences perpendicular to the log to funnel shrews to the trap). Where no logs are available, or where logs are parallel to the waterbody, drift fences should be placed on either side of the pitfall (towards water and upland) to funnel shrews into the trap (Figure 8).
- Use drift fences that are about 30 cm high and a minimum of 3 m long, and placed with the bottom against the ground (Figure 8). For ease of installation, drift fences can be made from any material sufficiently rigid to create a barrier. For example, use clear plastic sheeting stapled to wooden pegs or other support (Figure 8). In more visible locations, using dark material attached to thin wires will make the drift fences less visible.
- pitfalls should be ≥ 20 cm deep and ≥ 15.5 cm in diameter (Figure 7). The use of similar-sized traps will ensure consistent sampling effort across projects. The use of two #10 coffee cans duct-taped together provides a suitable pitfall (see Section 6.8 for supplier information). Use of alternate pitfall trap types that meet the minimum size requirements mentioned above are acceptable.
- if any rain is expected, at least one of the following methods should also be employed:
 - the pitfall should be sheltered from rain by placing some type of cover over the trap that is high enough that it will not deter animals from entering the trap,
 - the pitfall should be equipped with a small sponge in the bottom of the trap to absorb extra water (make sure the trap is deep enough), or
 - Both of the above.
- consultants are expected to make every effort to ensure that no Pacific Water Shrews are killed during the survey. **All traps should be immediately closed and/or removed if a Pacific Water Shrew is captured**, unless the operation is a salvage operation.
- the optional use of Longworth or Sherman live traps (Longworth-type traps preferred) in addition to the use of pitfall traps is encouraged. These traps should be equipped with both food and bedding and checked on the same schedule as the pitfall traps.
- Minnow (gee) traps are efficient at capturing Pacific Water Shrews, and consultants are encouraged to consider using these traps (modified) in addition to pitfalls. The traps should be modified so that the top of the trap is out of the water, and a platform is provided for shrews to get out



Figure 9. Voles (here a long-tailed vole) are heavier-bodied and have well-furred ears and medium-sized eyes. EcoLogic Research photo.



Figure 10. Deer mice have large ears and eyes. EcoLogic Research photo.

of the water. Food can be placed in a small plastic cup and tacked on to the platform. Contact MOE for instructions and illustrations on how to modify these traps. Shrews killed in minnow traps while sampling for fish should be recorded and reported to the B.C. Conservation Data Centre, and specimens submitted to MOE.

- These guidelines represent the minimum effort that should be expended in a sampling survey for Pacific Water Shrew.

2.6 Identification of Pacific Water Shrew

Consultants should access the small mammal ID guide (Nagorsen 2002), available from the Ministry of Environment (see link in *Section 6.7*). This key is the most recent for identifying small mammals in B.C.

There are 5 shrew species that overlap the range of the Pacific Water Shrew (Table 1), but Pacific Water Shrews are unlikely to be confused with most other small mammal species that are found within the Lower Mainland.

Shrews have a long narrow snout, small non-distinguishable ears, small eyes, and have small claws and palms (not enlarged) on the front feet; features which distinguish them from most other small mammals (Figures 3, 4 & 11).

Voles are heavier bodied with small (but larger than shrew), well-furred ears and medium-sized eyes (Figure 9), and mice have large, unfurred ears and large eyes (Figure 10).

The overall body length of the Pacific Water Shrew averages 15.4 cm, 7 cm of which is tail. The average weight is 13.2 g. The fur is dark brown to black dorsally and dark brown ventrally (the underside can be lighter in the winter).



Figure 11. Close-up photo of the hind foot of a Pacific Water Shrew. The fringe of stiff hairs is clearly visible. Leigh Evans photo.

The species is unlikely to be confused with most shrews that co-occur. *Sorex cinereus*, *S. monticolus*, *S. townsendii*, and *S. vagrans* (Table 1) are considerably smaller (average < 12 cm total length, and ≤ 7 g in weight), and lack the fringe of stiff hairs that are present on the feet of the Pacific Water Shrew (Figs. 4b, 11).

Pacific Water Shrews may be most easily confused with the Common Water Shrew, *Sorex palustris*, which is also a large shrew that has a semi aquatic lifestyle. The Common Water Shrew (average 15.2 cm length, 10.6 g) tends to be slightly smaller than the Pacific Water Shrew, but the diagnostic difference between the species is the dark grey to black dorsal fur with a white belly and bi-coloured tail of the Common Water Shrew (Figure 12).



Figure 12. *Sorex palustris* (top left – Richard Forbes photo) has a white belly and bi-coloured tail while *Sorex bendirii* (below right – Denis Knopp photo) is a more uniform brown/grey with a unicoloured tail.

3 Best Management Practices for Habitat

The following are suggested guidelines for maintaining Pacific Water Shrew habitat in the Lower Mainland. These guidelines should be implemented in areas with moderate or high capability water shrew habitat, or areas where a Pacific Water Shrew has been captured or positively identified.

3.1 Habitat protection

Leave 100 m wide areas of protective habitat wherever possible on either side of currently suitable or ultimately capable Pacific Water Shrew habitat, or in areas where Pacific Water Shrew is known to occur. Habitat suitability and capability can be assessed using a habitat ranking system developed for the recovery team (Craig 2007), and known occupied locations can be requested from the B.C. Ministry of Environment and Conservation Data Centre.

Within the protective area (100 m on either side of a stream, 100 m on either side of an occurrence, or 100 m area around a wetland), low impact activities such as the construction of a small walking trail (following guidelines outlined in the stewardship document "Access Near Aquatic Areas") can occur in the outer 40 m, increasing the value of the area to the surrounding community, with minimal impacts on the protective area. However, no significant construction or habitat alteration should occur anywhere within the protective area.

If low or nil suitability habitat occurs within 100 m of moderate or high suitability habitat, the habitat ranked as low or nil should be included in the protective area and restored to a suitable condition (unless naturally unsuitable).

Implementation of a large protective area has many benefits:

- Protection of habitat important for the long-term survival of the Pacific Water Shrew.
- Increasing habitat connectivity for Pacific Water Shrew.
- Protection of habitat important for a wide variety of species of animals, plants, birds (many bird species require large areas of habitat for it to be suitable), and fish (depending on the habitat protected).
- The long-term effective protection of the stream or wetland and all of its ecological processes and biodiversity.

In addition, recent studies and guidelines have reported that riparian greenways are highly valued by members of the community and property values in the proximity of greenways are higher than elsewhere (DFO/MELP 1994, Quayle and Hamilton 1999, Curran 2001). This benefit is then passed on to local governments through

higher taxes. Quayle and Hamilton (1999) reported property value increases from 10% to 15% - funds that might provide for a significant amount of green space preservation by local governments.

3.2 Watercourse & wetland crossings

Placing roads across streams and through wetlands destroys and fragments habitat by creating barriers to the movement of small mammals and other wildlife species. In addition, roads affect wetlands up to 2 km away (*e.g.*, through loss of native plant and animal species, increases in invasive species, *etc.*), although it may take decades to show the effects (Findlay and Bourdages 2000). The following suggestions should be implemented wherever possible to minimize habitat loss and fragmentation due to stream and wetland crossings (listed here from least damaging to most damaging).

- Move the crossing and all associated roadways and structures away from known or potential Pacific Water Shrew habitat.
- Use bridges over streams and wetlands instead of culverts. This ensures greater continuity of habitat below the bridge and the retention of natural vegetation. Bridges should be long enough to have no impact on the stream or wetland (including pilings) within a 30–60 m area of the bridge structure (most Pacific Water Shrews are captured < 60 m from a wet area). This will also minimize requirements for riprap and other interventions that limit bank erosion. Natural plant stock should be planted to replace any vegetation removed during bridge building within 100 m of the stream or wetland. In areas where plants cannot be established (*e.g.*, under wide, low bridges), pools or coarse woody debris (*e.g.*, logs) can be placed to increase cover and foraging habitat for shrews. See *Section 5* for further detail on restoration.
- If culverts are used, they should be large diameter (at least 2 m diameter) with open bottoms. Open-bottomed pipe arch culverts will increase the connectivity of habitat by maintaining a natural substrate. Closed bottom culverts should not be used. Natural plant stock should be planted to connect the remaining natural vegetation and create a pathway through the culvert. Debris pits should be avoided, because these discourage the use of culverts by small mammals. Culverts should not be longer than 30 m and should not have large drops that would impede water shrew (or fish) movement. On long culverts that are dark in the middle, consider the use of grates that will allow light and rain to enter.

Road Right-Of Ways (ROWs) should be minimized around bridges to maximize the amount of natural riparian vegetation. Areas around the bridge that have been modified should be replanted with advanced native tree and shrub stock. Shrews and other animals avoid travelling in the open; the placement of vegetation or other cover structures (such as logs) along the ROW will increase the connectivity and suitability of habitat (see *Section 5* for further detail on restoration).

The use of armouring of stream crossing structures, especially culverts, should be avoided as these walls can limit escape options for shrews in the

current. If armouring must be used, providing a variable structure (e.g., “biowalls”, imbedded rocks, vegetation, *etc.*) can allow shrews to escape the current.

3.3 Riparian vegetation & Coarse Woody Debris (CWD)

Pacific Water Shrews, fish, and other species are dependent on the presence of riparian vegetation and Coarse Woody Debris (CWD) along streams and wetlands. Planting of native vegetation and retention or introduction of CWD can increase habitat connectivity, improve the condition of the aquatic environment, and minimize erosion and sedimentation problems. Plantings should include shrubs to provide low cover for shrews and large trees for high cover and to maintain a moist micro-climate. CWD should include all types of debris that would naturally occur at a site, especially larger items such as downed mature trees. See *Section 5* for further detail on habitat restoration.

- Maintain native trees and shrubs and CWD in the riparian zone and in the ROW adjacent to the waterbody to minimize erosion and sedimentation effects.
- Restore native riparian vegetation and CWD along degraded waterways to improve water quality and the suitability of the habitat for many species. See *Section 5* for a detailed description of habitat restoration for this species.
- Plant and maintain native riparian vegetation (shrubs and trees) and maintain or introduce CWD along open watercourses (e.g., ditches) to create suitable habitat for many species, especially if the watercourse is connected to forested areas nearby. See *Section 5* for a detailed description of habitat restoration for this species.
- During municipal works, planting native riparian vegetation (shrubs and trees) and maintenance or introduction of CWD as soon as possible after the project is completed will provide important habitat for a variety of species, reduce the colonization of invasive and non native vegetation, and help to control sedimentation. See *Section 5* for a detailed description of habitat restoration for this species.

3.4 Connectivity of habitat

Habitat fragmentation is a threat to the ability of Pacific Water Shrews and other species to move across the landscape and recolonize areas from which they have become extirpated. To minimize habitat fragmentation:

- Consider the landscape context of development. Protection of habitat that appears to have limited value (e.g., non fish-bearing streams, small forest ponds, small areas of habitat, areas of low suitability) can maintain habitat connectivity between larger or more important habitat fragments (*i.e.*, serve as corridors).

- Expand protected areas. Increasing riparian protection around streams and wetlands adjacent to parks, riparian greenways, or other protected areas will increase the overall protective ability of the area, and increase its connectivity with the surrounding landscape.
- Minimize the effects of barriers to movement (such as roads) by creating crossing points (using either bridges or open bottomed culverts) for animals.

3.5 Management options

In areas where Pacific Water Shrew is known to occur, or in areas of potential Pacific Water Shrew habitat, the use of the 'habitat compensation' process by developers to gain approval for development should be avoided whenever possible.

In developments close to riparian areas, require the developer to include a fence and signage placed at the edge of the protective area. The fence will provide a clear limit of the development boundary and will limit encroachment. Fences also are useful to limit access by domestic dogs and cats into the riparian area.

Developments should use principles of Integrated Stormwater Management (ISM). In general, natural flow regimes and sensitive habitat should be maintained whenever possible. Further, stormwater should be cleaned and returned to ground at or near to the site of production and any detention facilities used should be minimized, be off line from the natural watercourses and not be placed near habitat for this species. Detailed information on ISM is available from the Ministry of Environment and Greater Vancouver Regional District, including Best Management Practices (see links in *Section 7.6*). ISM can be addressed within Official Community Plans (OCPs), Neighbourhood Concept Plans (NCPs) and/or Comprehensive Development Plans (CDPs). Planning in the early stages of development is important to avoid water quality and quantity issues associated with paved watersheds.

Consider pro-active protection of riparian habitat such as the establishment of Streamside Protection Zones or the use of Development Permit Areas (DPAs) around streams and wetlands. Development Permit Areas can ensure that work around riparian areas is guided by regulations set out in the DPA and the Official Community Plan (if one exists). The DPA could be used to establish a minimum buffer size (larger than the minimum required by Department of Fisheries and Oceans Canada) around all waterbodies. This will ensure that streams and wetlands that do not support fish or contribute to fish-bearing streams, but are important habitat features that support many wildlife and plant species, are maintained in the landscape.

The wording could be similar to:

- The Municipality/City of _____ considers the preservation of streams and wetlands to be important to the maintenance of local biodiversity and ecological processes. Therefore all areas within 100 m of

Best Management Practices for Habitat

wetlands and watercourses have been designated as Development Permit Areas, known as Watercourse Development Permit Areas (WDPA's).

- All development applications for projects that will occur within a WDPA must comply with the requirements for an assessment of the effects of the project on the Pacific Water Shrew, as outlined by the Pacific Water Shrew Recovery Team.
- Prior to commencing an environmental assessment, the developer must contact the Ministry of Environment to obtain the most current Pacific Water Shrew BMP guidelines.
- The developer is fully responsible for the costs required to assess the potential effects of the project on the Pacific Water Shrew.
- If sampling for the Pacific Water Shrew is necessary [see decision flowcharts in *Section 2*] the developer must follow the sampling protocol included in this document.

Additional information on development permits, and examples of wording of development permits is provided in *Section 6.9*.

Conservation covenants or stewardship agreements are a useful way of ensuring the long-term protection of urban habitat. Landowner education, site visits, and co-managing conflict issues are important components of covenants. Consider working with conservation organizations to inform the public about land stewardship options. See *Section 5* and *Section 6.4* for further information.

The success of restrictive covenants can be improved by including a landowner education and site visit component. Land Trusts or other conservation organizations can be appointed to hold and oversee covenants.

Predation by domestic cats is a potential threat to Pacific Water Shrews. In urban areas, consider programs to increase the awareness of the potential impacts of domestic cats. Encourage pet owners living near riparian areas to equip cats with belled collars and fence off suitable habitat.

4 How These Guidelines Differ from Fisheries Regulations

The primary difference is that Pacific Water Shrew BMP guidelines emphasize the importance of the riparian zone and the inclusion of non-fish bearing and isolated waterbodies (not connected to or discharging to fish habitat), as well as non-classified bodies (such as ditches).

The focus of fisheries guidelines and regulations (e.g., federal *Fisheries Act* and provincial *Streamside Protection Act* with its Riparian Areas Regulation), are the fish bearing and fish-food producing (connected tributaries) aquatic environments. Guidelines and regulations for buffer size and activities conducted around streams (e.g., road building) are designed to minimize impact on the in-stream habitat. Activities around waterbodies that are not connected to fish-bearing systems are not regulated. However, these types of habitat (e.g., swamps or marshes in or adjacent to deciduous or coniferous forest) are suitable habitat types for shrews.

Pacific Water Shrews live primarily in the riparian zone adjacent to streams and wetlands. Most often, they are captured within 60 m of water bodies. This shrew is a semi-aquatic species that forages extensively on aquatic invertebrates, which in turn are dependent on the presence of good quality aquatic habitat. This species also is dependent on the conditions associated with the riparian environment. Fisheries guidelines protect only a small portion of the riparian zone. In contrast, these guidelines emphasize the protection of the entire riparian zone. The 100 m protective area will buffer the riparian habitat and its microclimate in the long-term against edge effects, such as changes in light, temperature, wind, species presence, and presence of invasive species associated with removal of the surrounding forest, as well as potentially increased run-off of oil, water, pesticides, fertilizers and road debris which are associated with urban or agricultural land development and use. See Chen *et al.* (1993), Chen *et al.* (1995), Kelsey and West (1998), Findlay and Bourdages (2000) for some discussion of changes to the riparian zone associated with edge effects.

Development guidelines from the Department of Fisheries and Oceans require buffers as small as 5 m under certain conditions. Millar *et al.* (1997), however, suggested that even buffers 15 m to 30 m wide may be insufficient to protect even the aquatic environment over the long term, and instead proposed fisheries management zones at least 30 m to 50 m wide. The current guidelines do not provide sufficient protection for Pacific Water Shrew habitat (Galindo-Leal and Runciman 1994, Craig and Vennesland in review).

5 Habitat Rehabilitation

Fisheries rehabilitation efforts normally include improvements to the stream channel or wetland and surrounding riparian zones that can also benefit Pacific Water Shrew. However, it must be stressed that fisheries rehabilitation efforts are designed to maximize benefit to in-stream organisms, not riparian organisms. Extra efforts are thus warranted to ensure that the streamside area is immediately and ultimately suitable for organisms such as small mammals.

Habitat restoration should not occur where habitat is rated high or moderate suitability. This assessment should be done prior to any habitat restoration work commencing. Minor restoration works such as the removal of garbage may be warranted but should also be done with caution. Where the presence of Pacific Water Shrew is documented, no habitat changes should occur within a minimum of 100 meters of the occurrence.

Placing significant amounts of Coarse Woody Debris (CWD; e.g., logs or root balls) in the stream channel or wetland will create travelways for shrews and provide a substrate for aquatic macroinvertebrates to enhance foraging for shrews (Figures 12 & 13). Material can be placed to ensure it does not become a barrier to fish passage.



Figure 12. Creating habitat by placing logs to create pools and provide travel routes, and planting riparian vegetation to grow and shade the stream, will provide habitat for Pacific Water Shrews and fish. EcoLogic Research photo.

Placing CWD (e.g., stems ≥ 6 cm diameter minimum, but preferably logs ≥ 12 cm diameter with bark still attached) adjacent to the stream channel or

wetland will provide important cover (Figure 13). A properly connected network of logs and brush piles along the banks will provide secure travel routes. Connectivity should be emphasized – contiguous cover is an important attribute. Riparian plantings can also be used to help network travel corridors.

Plant advanced native plant stock alongside streams and wetlands, concentrating on the riparian zone within 30 m of the stream or wetland. A properly connected network of vegetation (and/or CWD) along the stream or wetland bank will provide secure travel routes. Connectivity should be emphasized – contiguous cover is an important attribute. CWD can also be used to help network travel corridors.

Becoming suitable habitat can take a long period of time to develop. In areas where habitat has been rehabilitated it is critically important to maximize retention and placement of CWD and riparian plantings to ensure adequate cover is available for small mammal travel. Lack of cover will result in higher rates of predation and will thus, at least partially, nullify restoration efforts.



Figure 13. This man-made fish spawning channel has lots of logs which are a benefit to shrews, but it was seeded with grass, and no riparian vegetation was planted, limiting its usefulness to water shrews. EcoLogic Research photo.

Creation of pools < 1 m deep (by placing CWD or rocks in the stream channel or wetland) will provide important foraging locations for water shrews (Figure 13).

Connecting adjacent marshes, swamps or streams by planting riparian vegetation, placing logs and other CWD, or by creating a water channel will increase the effective habitat area for water shrews.

Connect wet depressions alongside the stream channel or wetland by placing logs and other CWD and planting riparian vegetation to increase the amount of water flowing through.

If using grass seed mixture to stabilize slopes, make sure other species of plants are also planted to avoid ending up with a grassy slope with minimal native riparian vegetation (Figure 13). If retaining walls are necessary, consider the use of "bio-walls" (walls made of organic matter that plants can grow from).

Note barriers to water shrew movement such as roads and small culverts and determine whether it is possible to connect the habitat on either side of the barrier. Plant vegetation around culverts and road edges to provide cover for shrews and other animals.

Secondary dry culverts can be used in conjunction with wet culverts to increase travel corridor options for shrews. Such culverts should be a minimum of 500 mm diameter and have suitable substrate to mimic the natural environment. As above, grates can be used at intervals of < 30 m to allow light, rainfall and nutrients to enter the passageway.

Long culverts that already exist or must be installed for adequate technical reasons can be enhanced by the use of grates at intervals of < 30 m to allow light, rainfall and nutrients to enter the dark passageway.

With diversion, enhancement or compensation channels or wetlands (these must be authorized by an approving agency), biological recovery of new habitat can be enhanced if seeded with substrate containing benthic invertebrates and native vegetation (including large trees) salvaged from the channels or wet areas that are to be affected.

In areas where plants cannot be established (e.g., under wide, low bridges), pools or coarse woody debris (e.g., logs) can be placed to increase cover and foraging habitat options for shrews.

Some obstructions to fish passage are not barriers to water shrews (e.g., log jams, beaver lodges) and may create water shrew habitat by partially flooding the surrounding area or by creating pools. If obstructions are removed to enable fish passage, consider ways of maintaining at least some of the previous habitat by leaving some logs or creating a side channel to maintain the flooded area.

In areas where domestic predators are present (e.g., cats and dogs), consider placing fencing around riparian areas (up to 60 m from the stream or wetland) to exclude these potentially damaging animals from habitat suitable for these small mammals.

6 Actions for Stewardship & Conservation Organizations

Conservation and stewardship organizations are already working to preserve and restore habitat in the Lower Mainland. There are many opportunities for Pacific Water Shrew to be included in new or ongoing projects.

The Pacific Water Shrew Recovery Team is interested in developing partnerships with environmental organizations to work towards protecting and restoring riparian habitat. Please contact the Ministry of Environment if you are interested in working with the recovery team to preserve or restore habitat for Pacific Water Shrew.

6.1 Education

- When preparing information pamphlets, contacting landowners, or giving presentations, include the Pacific Water Shrew in the discussion. Most people do not realize that there is an Endangered species of water shrew that in Canada is found only in the Lower Mainland.
- Distribute these guidelines and the B.C. Government brochure on the Pacific Water Shrew (see link in *Section 6.2*). Create a link to the brochure on your website.
- Write articles to newsletters or to local papers informing people about the Pacific Water Shrew.
- Ensure that if any members of your organization spot a water shrew, the sighting is reported to the B.C. Conservation Data Centre, preferably using a Rare Vertebrate Animal Observation form, available from <http://www.cmv.gov.bc.ca/cdc/contribute.html>. Also, report the sighting or capture to the environment department of the local municipality for inclusion in their records. A list of B.C. municipalities is available at <http://www.civicnet.bc.ca/members/map.shtml>.

6.2 Habitat protection

- Encourage landowners to create conservation covenants to protect riparian habitat on their property.
- Apply for funding to purchase or rehabilitate important habitats.
- Educate landowners about the sensitivity of riparian areas and encourage them to use management practices that limit erosion and run-off into the

Actions for Stewardship & Conservation Organizations

aquatic environment. Inform landowners about the importance of properly maintaining septic fields.

DRAFT

7 Additional Information: Links, Downloads & Literature Cited

7.1 Contacts

For information on the Pacific Water Shrew or other species at risk in British Columbia contact:

Pacific Water Shrew Recovery Team

Chair: Kym Welstead
Ministry of Environment
10470 – 152nd St., Surrey, B.C. V3R 0Y3
Tel: (604) 582-5279
Kym.Welstead@gov.bc.ca

Wildlife Biologist

Ministry of Environment – Lower Mainland office
10470 - 152nd St.,
Surrey, B.C. V3R 0Y3
Tel: (604) 582-5200
Fax: (604) 930-7119

Small Mammal Specialist or Species at Risk Biologist

Ministry of Environment – Headquarters office
4th floor - 2975 Jutland Rd.
PO Box 9338 Stn Govt
Victoria, B.C. V8T 5J9
Tel: (250) 387-9500
Fax: (250) 356-9145

7.2 Background

Download an electronic copy of the B.C. Government brochure on Pacific Water Shrew, or one of the over 40 other brochures on wildlife at risk in B.C., at <http://www.env.gov.bc.ca/wld/list.htm>. View other biodiversity publications by the Ministry of Environment at <http://www.env.gov.bc.ca/atrisk/reports.html>.

For more information on species at risk and the *Species at Risk Act*, visit the Environment Canada/Canadian Wildlife Service species at risk website at <http://www.speciesatrisk.gc.ca/>, or the SARA Public Registry:

Additional Information: Links, Downloads & Literature Cited

<http://www.sararegistry.gc.ca/>. At these sites you can also view approved species status reports, recovery strategies and recovery plans.

For more information on the Committee on the Status of Endangered Wildlife in Canada, visit the COSRWIC website at <http://www.cosewic.gc.ca/index.htm>. The national status report is available at this site.

The Ministry of Environment Biodiversity website has information about programs to conserve biodiversity in B.C., including information on recovery teams and recovery strategies/plans: <http://www.env.gov.bc.ca/wld/bio.htm>.

The Endangered Species in B.C. website provides links to information on species at risk in B.C. The site includes a link to the Species Explorer, which is a searchable database containing information about all documented species in B.C. Go to <http://www.env.gov.bc.ca/atrisk/>.

The B.C. Conservation Data Centre tracks occurrence data for species at risk in B.C. All sightings or captures of Pacific Water Shrews should be reported to the Conservation Data Centre on a standardized observation form (See link in *Section 6.3*). This information is important for monitoring of populations and the recovery process. Up-to-date data on local occurrences of the shrew can be obtained from <http://www.env.gov.bc.ca/cdc/>.

The manual *Describing Ecosystems in the Field* should be used for documenting habitat and is available here: <http://www.for.gov.bc.ca/hfd/pubs/docs/mr/Mr074.htm>. The standard instructions for a ground inspection of habitat are available at: <http://ilmbwww.gov.bc.ca/fisc/pubs/teecolo/fmdtc/deif.htm>.

7.3 Reporting of Pacific Water Shrew occurrences

All occurrences of Pacific Water Shrew should be reported to the B.C. Conservation Data Centre on standard data sheets. The relevant data sheet is the Rare Vertebrate Animal Observation form, which can be downloaded from: <http://www.env.gov.bc.ca/cdc/contribute.html>.

The municipal government where the Pacific Water Shrew was observed should also be notified of the occurrence. A list of B.C. municipalities is available at <http://www.civicnet.bc.ca/members/map.shtml>.

7.4 Stewardship

The B.C. Stewardship Centre has many excellent guides on a variety of topics. All of the guides are available for download at: <http://www.stewardshipcentre.bc.ca/stewardshipcanada/home/scnBCIndex.asp>.

Specific documents of interest include:

- Access near aquatic areas
- Community greenways: linking communities to country, and people to nature
- Land development guidelines for the protection of aquatic habitat
- Stewardship bylaws: a guide for local government
- Stewardship options for private landowners in British Columbia
- The streamkeepers handbook: a practical guide to stream and wetland care
- Stream stewardship: a guide for planners and developers
- Landowner contact guide

Fisheries and Oceans Canada also has many useful reports available for download, including reports on the topics of legislation, policy, guidelines, educational resources, brochures, newsletters, scientific papers and reports. Now available at the B.C. Stewardship Centre website (link above).

The Land Trust Alliance of B.C. has information about conservation covenants, numerous stewardship documents, and links to local Land Trust and conservancy organizations that can help with conservation covenants and stewardship agreements. Go to: <http://www.landtrustalliance.bc.ca/>.

A Wetland Evaluation Guide aimed at planners and developers is available at: http://wlapwww.gov.bc.ca/wld/documents/WEG_Oct2002_s.pdf. The guide provides an overview of wetland functions, and includes a workbook that helps identify wetland functions and values that will be affected by development, and assists in assessing trade-offs.

Information on the B.C. *Fish Protection Act* and Riparian Areas Regulation, which emphasize the protection of fish habitat and the importance of local government in environmental planning, is available at: http://www.cmv.gov.bc.ca/habitat/fish_protection_act/.

7.5 Land value near to riparian corridors

Land values increase when in proximity to a riparian greenway (DFO/MBLP 1994, Quayle and Hamilton 1999, Cutran 2001). Read one study here:

<http://www-heb.pac.dfo-mpo.gc.ca/publications/pdf/241452.pdf>

Quayle, M., and S. Hamilton. 1999. Corridors of green and gold: impact of riparian suburban greenways on property values. Prepared for: Fraser River Action Plan, Dept. of Fisheries and Oceans, Vancouver, B.C.

7.6 Integrated Stormwater Management (ISM)

Information on ISM is available at the Ministry of Environment website:
<http://www.env.gov.bc.ca/epd/epdpa/mpp/stormwater/stormwater.html>

Information from the Greater Vancouver Regional District, including Best Management Practices, is available from:
http://www.gvrd.bc.ca/sewerage/stormwater_reports.htm

7.7 Small mammal identification and sampling

The latest small mammal identification manual is available for download at:
http://wlabwww.gov.bc.ca/wld/documents/techpub/td_keys_s.pdf

Nagorsen, D.W. 2002. An identification manual to the small mammals of British Columbia. Ministry of Sustainable Resource Management, Ministry of Water, Land and Air Protection, and the Royal British Columbia Museum. Province of British Columbia. 165 pp.

The Resources Inventory Standards Committee sampling methodology for small mammals is available here:
<http://ilmbwww.gov.bc.ca/risc/pubs/tebiodiv/smallmammals/index.htm>

7.8 Equipment suppliers

Coffee cans (#10 cans which are 6 3/16" in diameter and 7" deep - about 18 cm) can be purchased from Wells Cans in the Lower Mainland. Tel: 604-420-0959. They cost approximately \$1.20 each (less if you order a large quantity). You need two cans per trap - remove the bottom out of one can with a can opener, and then duct tape the two cans together.

7.9 Development Permit Areas (DPAs)

Information about Development Permit Areas and development permits (including examples) are available at the links below.

- The Islands Trust
<http://www.islandstrust.bc.ca/lit/np/pdf/npbroenvironmentaldpafactsheet.pdf>
- Maple Ridge
http://www.mapleridge.org/municipal/departments/environment/building_near_watercourse.html
- Sechelt <http://www.district.sechelt.bc.ca/departments/landdp.php>
- Parksville
<http://www.city.parksville.bc.ca/cms/wpattachments/wpID47atID62.p>

df and

<http://www.rdn.bc.ca/cms/wpattachments/wp1D408at1D218.pdf>

Many municipalities already have Official Community Plans (OCPs), Neighbourhood Concept Plans (NCPs), Comprehensive Development Plans (CDPs), or may use Development Permit Areas (DPAs), but the information may not be available on the web. Check with the local City Hall to access this information.

7.10 Additional reading and literature cited

Chen, J., J. F. Franklin, and T.A. Spies. 1993. Contrasting microclimates among clearcut, edge, and interior of old-growth Douglas-fir forest. *Agricultural and Forest Meteorology* 63:219-237.

Chen, J., J. F. Franklin, and T.A. Spies. 1995. Growing-season microclimatic gradients from clearcut edges into old-growth Douglas-fir forests. *Ecological Applications* 5:74-86.

Craig, V.J. 2006. Species Account and Preliminary Habitat Ratings for Pacific Water Shrew (*Sorex bendirii*) Using SHIM Data v. 2. Draft report prepared for the B.C. Ministry of Environment, Surrey.

Craig, V.J. 2007. Species Account and Preliminary Habitat Ratings for Pacific Water Shrew (*Sorex bendirii*) Using TRIM Data v. 2. Draft report prepared for the B.C. Ministry of Environment, Surrey.

Craig, V.J. and R.G. Vennesland. In Review: National Recovery Strategy for Pacific Water Shrew, 2003 to 2008. Draft report prepared for the B.C. Ministry of Water, Land and Air Protection and Department of the Environment.

Curran, D. 2001. Economic benefits of natural green space protection. Report published by The Polis Project on Ecological Governance and Smart Growth British Columbia.

DFO/MELP. 1994. Stream Stewardship – a guide for planners and developers. Published by Department of Fisheries and Oceans, B.C. Ministry of Environment, Lands and Parks, and the B.C. Ministry of Municipal Affairs. ISBN 0-7726-2237-X.

Findlay, C. S., and J. Bourdages. 2000. Response time of wetland biodiversity to road construction on adjacent lands. *Conservation Biology* 14:86-94. Scientific journal available at University and College libraries.

Fisheries and Oceans Canada. 1999. Lower Fraser Valley streams: Strategic Review. Lower Fraser Valley Stream Review, Vol. 1. Fraser River Action Plan, Habitat and Enhancement Branch, Fisheries and Oceans Canada. 487 pp.

Additional Information: Links, Downloads & Literature Cited

Galindo-Leal, C. and J. B. Runciman. 1994. Status report on the Pacific water shrew (*Sorex bendirii*) in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON.

Kelsey, K. A., and S. D. West. 1998. Riparian wildlife. Pp. 235-258 *in* R. J. Naiman, and R. E. Bilby (editors). River ecology and management: lessons from the Pacific coastal ecoregion. Springer-Verlag.

Millar, J., N. Page, M. Farrell, B. Chilibeck, and M. Child. 1997. Establishing fisheries management and reserve zones in settlement areas of British Columbia. Fisheries and Oceans Canada, Vancouver, B.C. Cat. No. Fs 97-4/2351E. 72 pp. Available here: <http://www.dfo-mpo.gc.ca/Library/213234.pdf>

Nagorsen, D. W. 1996 Opossums, shrews and moles of British Columbia. Royal British Columbia Museum handbook, ISSN 1188-5114. UBC Press, Vancouver, B.C. 169 pp. Available at libraries and bookstores.

Oke, T. R., M. North, and O. Slaymaker. 1992. Primordial to prime order: a century of environmental change. Pp 149-170 *in* G. Wynn, and T. Oke (editors). Vancouver and its region. University of British Columbia Press, Vancouver, B.C., Canada.

Steyn, D. G., M. Bovis, M. North, and O. Slaymaker. 1992. The biophysical environment today. Pp 267-290 *in* G. Wynn, and T. Oke (editors). Vancouver and its region. University of British Columbia Press, Vancouver, B.C., Canada.

Zuleta, G. A. 1993. Analysis of habitat fragmentation effects with emphasis on small mammals at risk. Unpublished draft report prepared for: Ministry of Environment Lands and Parks, Victoria, B.C. 24 pp.

Original text by

Vanessa J. Craig, EcoLogic Research (<http://www.ecologicresearch.ca/>)

and

Ross G. Vennesland, previously B.C. Ministry Of Environment, Surrey, and Chair, Pacific Water Shrew Recovery Team

Produced for the **Pacific Water Shrew Recovery Team** and **B.C. Ministry of Environment**.

From: Freyman, Liz ENV:EX
To: Hirner, Joanna ENV:EX
Cc: Shannon, Barb E CSD:EX; Warriner, Steffanie M ENV:EX; McGuire, Jennifer ENV:EX
Subject: FW: MOE08.039 / Port Mann/Highway 1 Expansion / Fees Paid!
Date: Wednesday, May 28, 2008 11:15:33 AM
Attachments: [issue_note_MOE08.039.doc](#)

Hi Joanna,

Your description for EPD concerns was perfect so I had nothing to add. I made a minor wording edit (shown in track changes in the attachment).

I did struggle with the last paragraph a bit as EPD would like to see much more detail in their EMPs prior to sign off for their certification - as I discussed with you earlier - but perhaps we won't mention it in this issue note since you already summarized our concerns so well in the background section.

As a side note: The Sea to Sky highway improvement project just sent us their detailed (but still draft) EMPs last month (!!!) This is why we have an issue about certifying EA applications with a lot of future commitments such as EMP development.

Thanks for drafting the note,
Liz

From: Hirner, Joanna ENV:EX
Sent: Friday, May 23, 2008 6:02 PM
To: Shannon, Barb E CSD:EX; Freyman, Liz ENV:EX
Cc: McGuire, Jennifer ENV:EX; Warriner, Steffanie M ENV:EX
Subject: RE: MOE08.039 / Port Mann/Highway 1 Expansion / Fees Paid!

Hi there everyone,

Attached is a draft issues note for your review. I've followed the template but I've never done this before.... In particular I'm not sure I've accurately described the concerns brought up by EPD and I'm not sure about my interpretation of MOE's position regarding the PMH1 project (see last paragraph of the issues note). I've also highlighted in yellow a couple of places where I need input.

Barb would like to send this FOI off by the end of next week, so please let me know what you think of this note as soon as you can (I'll be at the ESD agm Tuesday to Thursday).

Thanks!
Joanna

From: Shannon, Barb E CSD:EX
Sent: Thursday, May 22, 2008 11:56 AM
To: Hirner, Joanna ENV:EX; Freyman, Liz ENV:EX
Cc: McGuire, Jennifer ENV:EX; Warriner, Steffanie M ENV:EX
Subject: FW: MOE08.039 / Port Mann/Highway 1 Expansion / Fees Paid!
Importance: High

Hi Joanna, Liz

The fees have been paid by WCWC for this request, so we have to provide documents ASAP. Liz, you have already provided me with your package, so I will just have to get EPD sign-off by Steffanie.

Joanna, your preliminary status indicated approx 250 pages. Please get the records to me as soon as you can.

Plus I need to know who is going to write the issues note.

Thanks
Barb

Note there is also an **MOE08.069** (Internal Communications and Reviews of Env Assessment of South Fraser Perimeter Road) - Joanna - you've already provided prelim status form indicating approx 1300 pages = fee estimate has been issued.

There is also a new request **MOE08.091** (copies of all drafts of comments prepared by MoE biologists regarding impacts to wildlife, fish and plant species at risk from the proposed South Fraser Perimeter Road project and Port Mann Bridge/Highway 1 project, including any maps, plans figures or other diagrams). I've forwarded it to Jennifer and Steffanie, but you might not have seen it yet - I'm assuming you will be program contacts.

I'm starting to get my South Fraser - Port Mann and Hwy 1 Expansion requests mixed up.....

For now - I just need MOE08.039.

Thanking you again
Barb

From: Love, Sylvia CSD:EX
Sent: Thursday, May 22, 2008 11:38 AM
To: Shannon, Barb E CSD:EX
Subject: MOE08.039 Fees Paid!

Just to follow up...

Fees have been paid so you can gather your records and send them my way... as soon as possible.

Sylvia Love

<mailto:sylvia.love@gov.bc.ca>

(250) 387-9567

(250) 356-6677 (fax)

Information, Privacy, Security and Records

Information Management Branch

Supporting the Ministries of Agriculture & Lands

and Environment together with their associated agencies

PO BOX 9336 Stn Prov Govt

Victoria, BC V8W 9S1

MINISTRY of ENVIRONMENT

INFORMATION NOTE

Applicant Name:	IPR File #: MOE08.039
Organization:	BN/Clif # (if any):

I. Prepared for the Deputy Minister

Considerations related to the release of records in response to the Fol request regarding reports or review comments, including drafts and documents that have not been submitted (up to and including February 29, 2008), prepared by the Ministry of Environment (MOE) for the Port Mann Bridge/Highway 1 (PMH1) expansion Environmental Assessment (EA), due {insert}.

II. Issue:

Communications challenges that may arise from the release of records in response to the Fol request regarding reports or review comments, including drafts and documents that have not been submitted (up to and including February 29, 2008), prepared by the MOE for the PMH1 expansion EA.

III. Background:

Review comments and reports related to the PMH1 expansion EA were generated by Lower Mainland regional staff from the Environmental Stewardship and Environmental Protection Divisions (ESD and EPD). Water Stewardship Division did not provide comments, other than to advise that their interests will be addressed through the legal requirement of approval of in-stream works under Section 9 of the Water Act.

Some of EPD's comments cover contaminated sites issues and regulations, including comments on methods for assessing and dealing with contaminated sites. EPD's remaining comments relate to air quality, surface water quality, stormwater management, and environmental management planning. EPD's concerns around air quality include questions around the assumptions used for traffic volumes and vehicle emissions in the air quality modeling done by the Ministry of Transportation (MOT). EPD also expressed concerns about dust emissions associated with road construction and operation. Water quality concerns include requests to ensure that effective stormwater infrastructure is in place during road construction as well as operation, that the level of effort, time period, and methods used to sample and monitor water quality are inadequate, that descriptions of proposed mitigation are not detailed enough, and that Provincial Water Quality Objectives might be exceeded because of the project. Other general concerns expressed by EPD include a lack of detail in describing environmental management plans and mitigation, inadequate assessment of cumulative effects, and a concern that the project scope is too narrow and should include increased traffic and urban development associated with the project.

ESD's comments are focused on species at risk, and most of ESD's concerns are around the methods and level of effort used by MOT to inventory wildlife. The methods and effort are not considered adequate for providing information to

assess impacts, design appropriate mitigation and compensation, and monitor the effectiveness of mitigation and compensation. In addition, ESD asked for commitments to adaptive management and effectiveness monitoring. ESD also raised concerns regarding consideration of wildlife species at risk during fisheries compensation planning, and the fact that a Pacific Water Shrew (PWS) was found near the 162 Street Exit in an area proposed as 'critical habitat' by the PWS recovery team.

The Environmental Assessment review process for the PMH1 project is currently in its final stages (the final EA report has been referred to Ministers for certification). Therefore MOE's future opportunities to provide input on this project will occur post-certification.

Much of the public concern and media attention around the PMH1 project has been focused on greenhouse gas and air quality concerns. By comparison, water quality, contaminated sites, and wildlife and species at risk issues appear to have generated less concern.

IV. Discussion:

The applicant apparently stated in a fee waiver request that ~~he is~~ They are mainly interested in records relating to greenhouse gas emissions and air quality concerns.

The applicant may be looking for additional detail regarding the MOE's review of the PMH1 project beyond the comments publicly available on the EAO's website. The draft comments do not differ substantially in content from those publicly available, although some draft comments may provide more detail and differ somewhat in wording and tone from the final versions. Some of the emails which contain general descriptions of review comments describe aspects of the review process, such as difficulties in providing staff resources to the review and descriptions of who is involved in reviewing draft comments, which may or may not be of interest to the applicant. The fact that highway construction is occurring in an area proposed as 'critical habitat' for the PWS may also generate questions or concern.

The MOE's position regarding this project appears to be that commitments made by MOT during the EA review are sufficient to ensure that outstanding issues can be resolved during post-certification involvement of MOE with the project. To support MOE's continued involvement post-certificate, MOT has committed to provide funding to MOE for staff dedicated to the Gateway (PMH1 and South Fraser Perimeter Road) projects.

Fol Contact
Analyst:

Program area Contact
Name:

Prepared by: Joanna Hirner
Name: *the staff person who can provide technical support, usually the author (will this be Joanna or Jennifer?)*

Phone:

Div/Region/Branch:
Phone:

Branch/Region:
Phone:
Date:

1.0	INTRODUCTION	2
2.0	PROVINCIAL AND FEDERAL REVIEW OF PMH1	4
PART A: BACKGROUND INFORMATION		8
3.0	PROJECT DESCRIPTION	8
PART B: CONSULTATION.....		13
4.0	PUBLIC CONSULTATION	13
5.0	GOVERNMENT AGENCY CONSULTATION	17
6.0	FIRST NATIONS CONSULTATION AND INTERESTS	18
PART C: BIOPHYSICAL EFFECTS		29
7.0	WATER WELLS	29
8.0	FISHERIES AND AQUATIC RESOURCES.....	31
9.0	VEGETATION RESOURCES	51
10.0	WILDLIFE.....	59
11.0	SOIL CONDITIONS AND CONTAMINATED SITES	71
12.0	LOCAL AIR QUALITY AND HUMAN HEALTH.....	76
13.0	REGIONAL AIR QUALITY AND GREENHOUSE GASES.....	83
PART D: SOCIO-ECONOMIC EFFECTS.....		89
14.0	AGRICULTURE.....	89
15.0	ARCHAEOLOGY	92
16.0	NAVIGATION	98
17.0	RAIL CONSIDERATIONS.....	102
18.0	NOISE	105
19.0	SOCIO-COMMUNITY CONSIDERATIONS	109
20.0	TOLLING.....	118
21.0	TRAFFIC, TRANSPORTATION, AND ROAD USER ASSESSMENT.....	119
PART E: FEDERAL REVIEW REQUIREMENTS.....		123
22.0	CONSIDERATION OF ALTERNATIVES	123
23.0	EFFECTS OF THE ENVIRONMENT ON THE PROJECT	126
24.0	ACCIDENTS AND MALFUNCTIONS.....	128
25.0	CUMULATIVE AND RESIDUAL EFFECTS.....	132
PART F: OTHER REVIEW CONSIDERATIONS.....		137
26.0	ENVIRONMENTAL MANAGEMENT PLANNING	137

1.0 INTRODUCTION

1.1 Background

Highway 1 is the primary road connection between Vancouver, other points in the Lower Mainland and the rest of British Columbia (BC) and Canada. The Port Mann Bridge, located on Highway 1, links Vancouver and its inner suburbs on the north side of the Fraser River to industrial and population centres south of the Fraser River.

Highway 1 and the Port Mann Bridge were designed and constructed in the early 1960's, at a time when the population of Metro Vancouver was 800,000 and centred in Vancouver and Burnaby. While there have been some improvements to Highway 1, including the addition of high occupancy vehicle (HOV) lanes west of the Port Mann Bridge in 1999 and an additional eastbound lane on the bridge in 2001, most of the interchanges have not been substantially upgraded. The regional population now exceeds 2.1 million, and is forecast to reach 3 million by 2031. Development is also shifting eastward, a trend that is expected to continue as employment patterns disperse to regional town centres and business/industrial park developments south of the Fraser River. In response, commuting patterns are changing from a "hub and spoke" model focussed on Vancouver, to a more dispersed pattern with a significant and growing component of suburb-to-suburb commuters.

Both the population increase and shift in commuting patterns have led to increasing pressure on the region's transportation network, particularly along Highway 1 and across the Port Mann Bridge. The Port Mann Bridge has the highest daily traffic volumes per lane of all major water crossings in Greater Vancouver and is currently congested for 13 hours per day. Due to the congestion, there has not been bus transit service over the bridge for 20 years. During extreme congestion, it can take over two hours to travel the 29 km of Highway 1 between 200th Street in Langley and Willington Avenue in Burnaby, with up to an hour and a half spent queuing for the Port Mann Bridge.

1.2 Proposed Port Mann/Highway 1 Project

To address the growing congestion, the Ministry of Transportation proposes to construct a new (additional) bridge adjacent to the existing Port Mann Bridge, widen Highway 1, upgrade interchanges and improve highway access and safety on the 37 km section of Highway 1 between the McGill Interchange in Vancouver and 216th Street in Langley.

The Port Mann/Highway 1 (PMH1) project includes congestion reduction measures such as extension of HOV lanes, transit and commercial vehicle priority access and an electronic bridge toll that will both pay for the project and limit traffic growth over time. Future light rail transit will be accommodated on the new bridge. The reintroduction of bus service along Highway 1 will be facilitated by a reduction in travel times and an increase in predictability of trips. There will also be improvements to cycling and pedestrian networks along or in the vicinity of the corridor, including a bike lane on the new bridge (there is no bike lane on the existing Port Mann Bridge).

1.3 Regional Context

The PMH1 project (Figure 1-1) is one of three strategic road and bridge projects in Greater Vancouver that are sponsored by the BC Ministry of Transportation:

- South Fraser Perimeter Road;
- North Fraser Perimeter Road; and
- Port Mann/Highway 1

Together they comprise the Gateway Program (Figure 1-2).

The goals of the Gateway Program are to:

- Address congestion;
- Improve the movement of people and goods in and through the Greater Vancouver region;
- Improve access to key economic gateways through improved links between ports, industrial areas, railways, the airport and border crossings;
- Improve safety and reliability;
- Improve the region's road network;
- Improve quality of life in communities by keeping regional traffic on regional roads instead of local streets;
- Reduce vehicle emissions by reducing congestion-related idling;
- Facilitate better connections to buses, SkyTrain, cycling and pedestrian networks; and
- Reduce travel times along and across the Fraser River during peak periods.

Gateway Program road and bridge projects are based on predicted population and economic growth and associated transportation demands through to 2031, and will complement other regional road and transit improvements already planned or underway such as the Border Infrastructure Project, Richmond/Airport/Vancouver Rapid Transit Expansion and the Coquitlam Rapid Transit Expansion (Figure 1-1).

More information on the Gateway Program is available at www.gatewayprogram.bc.ca.

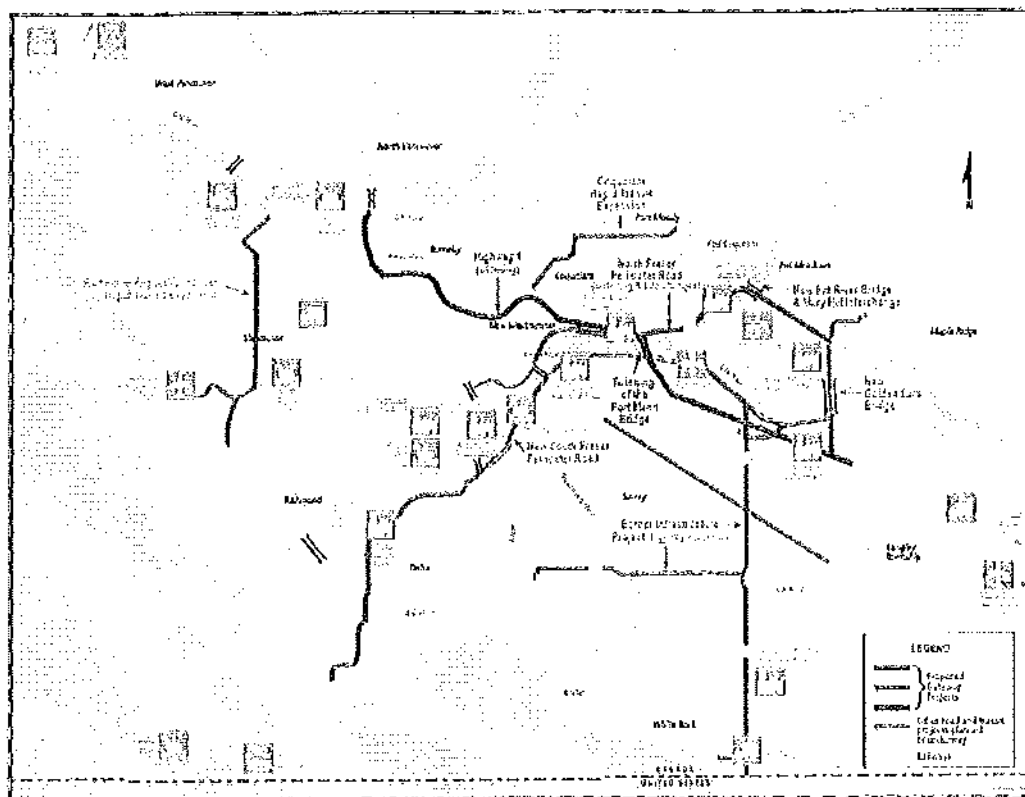


Figure 1-1: The Gateway Program and Other Road and Transit Projects

2.0 PROVINCIAL AND FEDERAL REVIEW OF PMH1

2.1 Cooperative Environmental Assessment

The PMH1 project (Project) is subject to review under both the British Columbia *Environmental Assessment Act* (BCEAA) and the *Canadian Environmental Assessment Act* (CEAA). In accordance with the Canada – British Columbia Agreement for Environmental assessment Cooperation (2004), a single harmonized review was undertaken.

2.2 Joint Environmental Assessment Report

This report is a joint provincial Assessment Report under BCEAA and a federal Screening Report under CEAA, and has been developed to meet the needs of both jurisdictions.

Under BCEAA, the purpose of the provincial Assessment Report is to:

- Report on the adequacy of the Proponent's public and First Nations consultations;
- Report on the potential environmental, economic, social, heritage or health effects of the Project; and
- Determine whether potentially significant adverse effects can be prevented or reduced to an acceptable level through practical means.

Under CEAA, the purpose of the federal Screening Report is to establish the significance of potential residual environmental effects that may result from the Project. The Screening Report:

- Identifies the potential environmental effects of the Project, including the environmental effects of accidents or malfunctions that may occur in connection with the Project and any cumulative effects that are likely to result from the Project in combination with other projects or activities that have been, or will be carried out;
- Identifies technically and economically feasible mitigation measures that are necessary to prevent significant adverse effects; and
- Determines the significance of the residual environmental effects after the application of mitigation measures.

2.3 BC Environmental Assessment Process

2.3.1 Basis for the Provincial Environmental Assessment

On May 11, 2006 the Ministry of Transportation (Proponent) submitted a Project Description to the Environmental Assessment Office (EAO).

On May 18, 2006 the Environmental Assessment Office (EAO) issued an order under section 10(1) (c) of the BCEAA stating that:

- The Project constitutes a reviewable project pursuant to Part 8 of the *Reviewable Project Regulations* (R.C. Reg. 370/02), as it involves the addition of greater than 2 lanes of paved highway over a continuous distance of greater than 20 km;
- An environmental assessment certificate is required for the Project; and
- The Ministry of Transportation (Proponent) may not undertake construction and operation of the Project until an environmental assessment certificate has been granted.

2.3.2 Scope of the Project and Environmental Assessment

On October 26, 2006 the EAO issued an order under section 11 of the BCEAA that outlines the scope of the Project and environmental assessment, as well as the procedures and methods to be followed by the Proponent during the Pre-Application and Application Review stages of the assessment.

Scope of the Project

The scope of the project includes the following on-site and off-site physical works, as well as the activities associated with construction, operation and maintenance of these works:

Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008

- (a) The works necessary to improve the existing Highway, including:
 - (i) any road development in a new right-of-way or road widening or relocation along an existing right-of-way,
 - (ii) the twinning of the Port Mann Bridge and modifications to existing structures,
 - (iii) modification of existing access roads to and from the Highway or to and from the Bridge (whether through reconstruction, relocation, elimination or other changes),
 - (iv) development of any new road-related structures such as ramps and interchanges and excavations, and/or modification of any existing structures and excavations (whether through additions, removals or other changes), and,
 - (v) modification of watercourses and modification or development of drainage structures within the Project area (whether through additions, removals or other changes);
- (b) Methods and locations for disposal of surplus material and other waste;
- (c) Construction, use and maintenance of new ancillary facilities such as equipment storage and marshalling areas and gravel borrow areas, and any use, modification or decommissioning of any existing ancillary facilities for Project-related purposes;
- (d) Ancillary road system modifications adjacent to the Highway or the Port Mann Bridge associated with construction, operation and maintenance of the Project;
- (e) All off-site facilities or other infrastructure services associated with and necessitated by implementation of the Project;
- (f) All activities associated with the construction, operation and maintenance of the Highway, the Port Mann Bridge and any approach roads, including ongoing maintenance and traffic management,
- (g) Any off-site environmental compensation works associated with and necessitated by implementation of the Project, if required; and,
- (h) Any other physical works or activities which, in the view of the Project Assessment Director, form an integral part of the Project.

Scope of the Assessment

The scope of the assessment for the project includes consideration of the potential for environmental, social, economic, health and heritage effects and potential effects on First Nations' aboriginal interests, and will take into account practical means to prevent or reduce to an acceptable level any potential adverse effects of the project.

2.4 Federal Environmental Assessment Process

2.4.1 Basis for the Federal Environmental Assessment

Under section 5 of the *Canadian Environmental Assessment Act*, a federal environmental assessment is required for the Project because:

- Transport Canada may issue an approval under paragraph 5(1)(a) of the *Navigable Waters Protection Act*; and
- Fisheries and Oceans Canada may issue a permit or license under subsection 35(2) of the *Fisheries Act*.

The Notice of Commencement of the federal environmental assessment was posted on the Canadian Environmental Assessment Registry webpage on May 24, 2007. Transport Canada and Fisheries and Oceans Canada are required to ensure that a screening assessment is conducted commencing on April 2, 2007. The Canadian Environmental Assessment Agency is acting as the Federal Environmental Assessment Coordinator for the screening.

2.4.2 Scope of the Project and Assessment

Scope of Project

For the purposes of the federal screening, the scope of the project includes the construction, modification and/or expansion of the Port Mann Bridge, including its pilings, footings, approaches, and any staging areas for the construction of these components. Additionally, stream crossings along the highway alignment between McGill Street in Vancouver and 216th Street in Langley will be included in the scope, as well as a 10 - 50 m zone of influence around the stream crossings as appropriate, and any stream relocation and/or infilling.

Scope of the Assessment

The factors considered in the screening, pursuant to section 16(1) of the CEAA, include:

- The environmental effects of the Project, including the environmental effects of malfunctions or accidents that may occur in connection with the Project and any cumulative environmental effects that are likely to result from the Project in combination with other projects or activities that have been or will be carried out;
- The significance of the environmental effects referred to above;
- Comments from the public that are received in accordance with CEAA and the regulations; and
- Measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the Project.

An environmental effect is defined by the CEAA as any:

- Change that the project may cause in the environment, including any change it may cause to a listed wildlife species, its critical habitat or the residences of individuals of that species, as those terms are defined in subsection 2(1) of the *Species at Risk Act*;
- Effect of any change referred to in the bullet above on:
 - Health and socio-economic conditions;
 - Physical and cultural heritage;
 - The current use of lands and resources for traditional purposes by aboriginal persons;
 - Any structure, site or thing that is of historical, archaeological, paleontological or architectural significance; or,
- Change to the project that may be caused by the environment.

PART A: BACKGROUND INFORMATION

3.0 PROJECT DESCRIPTION

3.1 PMH1 Reference Concept

The PMH1 reference concept (footprint 4.2, Rev. 1) contained in MoT's Application for an Environmental Assessment Certificate (Application) submitted September 5th, 2007 forms the basis for the EA review and this Assessment Report.¹ The MoT developed the reference concept over a three year period incorporating historical studies, research, analysis, and public and agency input.

The PMH1 reference concept proposes widening Highway 1, largely within the existing right-of-way, to improve overall operation of the corridor. Generally, one additional lane in each direction is planned from the McGill Interchange to the Port Mann Bridge. East of the Port Mann Bridge, two additional lanes in each direction are planned to 200th Street. One lane in each direction will be dedicated to high occupancy vehicles (HOV) between Grandview Highway and 200th Street. Between 200th Street and 216th Street, one additional lane in each direction is proposed.

The PMH1 reference concept proposes a new parallel bridge on the west side of the existing Port Mann Bridge, which will also provide cycling access and be designed to accommodate potential future light rail transit. One lane in each direction will be designated as an HOV lane.

Additional structures across the Highway are proposed to support the movement of municipal traffic, including pedestrians and cyclists, across the corridor and to alleviate congestion at current crossings. At certain locations the PMH1 reference concept includes the addition of dedicated on- and off-ramps or "priority access lanes" to facilitate movement of commercial vehicles and/or HOV, and transit.

¹ The reference concept titled "Port Mann Highway 1 Concept Plan Footprint 4.2, Rev. 1" dated January 2007 is provided in Appendix 4A of the Application.
Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008

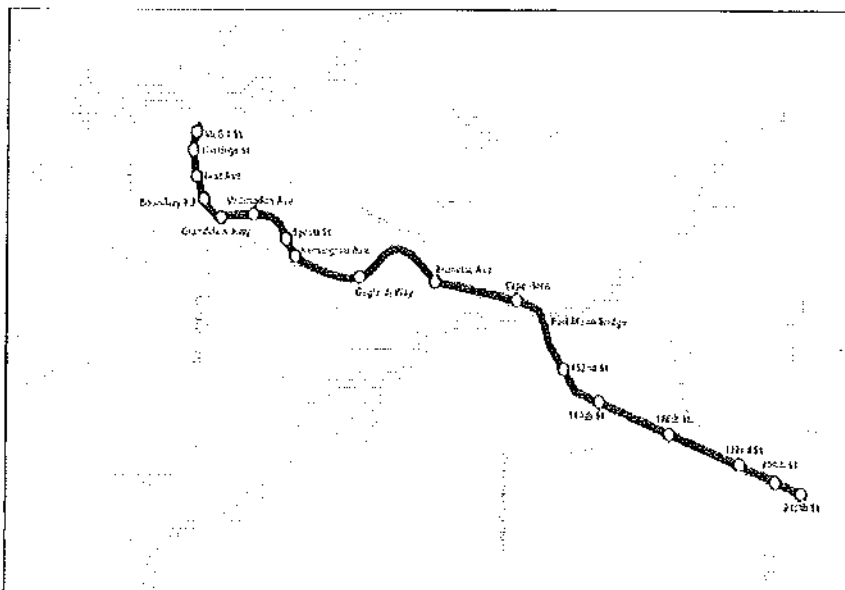


Figure 3-1: The PMH1 Project route

3.2 Main Project Components

Modification or replacement of a large number of structures (e.g., bridges, overpasses, interchanges, major culverts) is proposed as part of the PMH1. A complete list of proposed structures, design details and vertical profiles, are included in Chapter 4 of the Application and the Errata submitted October 16, 2007.

From west to east, the major components of the proposed PMH1 project include:

- McGill Street ramp modifications
- First Avenue ramp modifications
- Extension of Boundary Road on-ramp
- Reconstruction of Grandview Highway overpass
- Reconstruction of Willingdon Avenue Interchange
- Construction of a potential new overpass at Wayburne Drive
- Reconstruction of an overpass at Sprout Street and interchange at Kensington Avenue
- Reconstruction of an interchange at Gagliardi Way and overpass at Cariboo Road
- Reconstruction of Brunette Avenue Interchange and widening Brunette River Bridge
- Construction of a potential new overpass at King Edward Street
- Reconstruction of Cape Horn Interchange
- Partial widening of the existing Port Mann Bridge and construction of a new parallel Port Mann Bridge
- Reconstruction of 152nd Street overpass
- Reconstruction of 160th Street Interchange

*Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008*

- Reconstruction of 176th Street Interchange
- Construction of a partial interchange at 192nd Street
- Construction of a potential new interchange at 216th Street

3.3 Proponent Procurement Strategy

The MoT plans to deliver the PMH1 Project using a Design-Build-Finance-Operate (DBFO) model. If the Project receives an EA Certificate, MoT intends to grant a 40-year concession to a 3rd party to design, construct, operate, maintain, and finance the Project. Toll revenues will be used to pay the costs of project construction, operation, maintenance and rehabilitation.

The final project design and construction methodology may be different from that presented in the Application as a result of the DBFO delivery mechanism. The MoT does not expect these differences to be outside of the boundaries identified in the reference concept or result in effects of a greater magnitude than those described in the Application. The MoT does not anticipate the final project design and construction methodology will be materially different than those presented in its Application. Where any change exceeds these boundaries MoT will submit the relevant information to EAO for consideration.

3.4 Construction Activities

Construction activities for the PMH1 Project include: site preparation and clearing; preloading; construction of roads and structures; decommissioning of existing infrastructure; waste disposal, emergency service; traffic management; and workers accommodations and associated logistics.

The PMH1 alignment crosses two areas of low-lying terrain where preloading will be necessary: between Willingdon Avenue and Gagliardi Way in Burnaby and in the Cape Horn Interchange area in Coquitlam. These sites are underlain by extensive layers of weak and highly compressible peat and organic/fine-grained soils. Preloading in advance of highway construction at these sites will be required to provide adequate support to the pavement structure.

Dredging is not necessary for the purposes of material supply for the Project. Minor excavation is expected for construction of in-stream foundations for the new Port Mann Bridge. The MoT has confirmed that the PMH1 Project will not require the disposal at sea of surplus material.²

3.5 Potential Temporary and Ancillary Project Works

Ancillary Project components, typically involving off-site temporary works that occur away from the PMH1 right-of-way, are potentially required. These works include staging areas during construction (for equipment and storage/preparation of materials); stormwater management infrastructure; works associated with existing utility corridors; aggregate supply required for construction; works associated with repair and/or upgrade

² Confirmed in October 9, 2007 letter from Garry Dawson, MoT to Kristie Trainor, Environment Canada.

Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008

of municipal drainage systems; works associated with fisheries and wildlife compensation; and the management of potentially contaminated properties along the alignment.

The MoT anticipates the need to undertake ancillary works to protect or relocate approximately 800 to 900 utilities prior to, or during, the construction phase. Potentially affected utilities include water, sewer, gas, telecommunications, and both overhead and underground electrical lines. Utilities owned by BC Hydro, BC Transmission Corporation, Terasen Gas, Kinder Morgan, Shaw Communications, Telus, various municipalities and others, are located within the PMH1 corridor.

3.6 Land and Water Lot Requirements

Construction of the proposed PMH1 project is estimated to require the acquisition of all or part of 218 properties within the five municipalities of Vancouver (2), Burnaby (89), Coquitlam (51), Surrey (60) and Langley (16). The number of properties required does not include lands already owned by MoT, municipal road ends, utility rights-of-way, or private lands located off the PMH1 alignment that may be required for environmental compensation or relocation of utilities.

Approximately 35% of the land affected is owned by municipalities, 4% owned by provincial government agencies (other than MoT), 4% owned by railways, and 55% is privately owned. Most of the residential properties affected are vacant and few require relocation of residents.

To allow for the creation of a new water lot for the new Port Mann Bridge, a portion of the lease area of four existing water lots in the Fraser River will be needed.

3.7 Project Schedule

The MoT proposes the following schedule for various key activities and phases of project delivery. The proposed schedule is subject to change and is contingent on the issuance of an environmental assessment certificate, a decision under CEAA, and other environmental permits and authorizations (VFPA, NWPA, DFO Section 35(2)):

Table 3-1	Project Stage	Date
Pre-Construction		
Procurement		
Issue RFP		Summer 2007
Receive Proposals		2008
Select Preferred Contractor		Summer 2008
Execution of Project Agreement		Fall 2008
Design/Construction		
Key activities include: pre-loading, utility relocations, development/implementation of environmental mitigation and compensation, acquisition of permits and approvals, road and bridge construction, decommissioning as required, and environmental monitoring.		2008 - 2013
Operation		

Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008

Key activities include: routine operation and maintenance activities.

2014 -- ongoing

3.8 Estimated Capital Cost

The PMH1 Project capital cost presented in the Application is estimated between \$1.5 and 1.6 billion (\$2005). This estimate is based on the reference concept, including the right-of-way requirements.

3.9 Estimated Economic and Employment Benefits

The MoT estimates that during development and construction the PMH1 Project will generate approximately 8,500 person-years of employment and contribute more than \$800 million to the Provincial Gross Domestic Product.

Quantifying the impact of the Project on the region's future economic growth is difficult as the relationship between improvements in transportation infrastructure and various sectors of the economy is complex. The MoT anticipates that the project will contribute positively to long-term economic growth by:

- Reducing the cost and increasing the convenience and reliability of east-west goods transportation, within the region and across Canada; and
- Increasing the mobility of employees and customers, resulting in a larger effective labour pool for individual site locations.

The MoT provided the following estimate of costs and benefits of the Project in their Application:

Table 3-3 Summary of Discounted Benefits, Costs and Expenses

User Benefits and Costs	Present Value Over 35-Yr Operation Period (2005 dollars)
Travel Time Savings and Operating Cost Savings	\$4.5 billion
Safety Savings	\$0.5 billion
Total User Benefits	\$5.0 billion
Total Life Cycle Costs	\$1.2 billion
Benefit/Cost Ratio	4:1

3.10 Decommissioning

Highway 1 is a permanent route on the Lower Mainland transportation network and decommissioning is not planned.

In accordance with the reference concept many of the PMH1 interchanges will be reconfigured, and some interchanges and parts of the adjacent roadway will be

*Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008*

realigned. At these locations, some of the existing on- and off-ramps and sections of adjacent roadway may be decommissioned. In general, the development of the proposed alignment for PMH1 would require decommissioning of only minor areas of existing alignment.

PART B: CONSULTATION

4.0 PUBLIC CONSULTATION

4.1 Overview

The provincial *Environmental Assessment Act* (Act) and its Public Consultation Policy Regulation (Regulation) set out the requirements for public notification, timely access to information and consultation during the environmental assessment process. Those provisions that pertain exclusively to the Proponent are detailed within the October 26, 2006 order issued under Section 11 of the Act (S11 order), which sets out the scope of the Port Mann/Highway 1 (PMH1) project and environmental assessment, as well as the procedures and methods to be followed by the Ministry of Transportation (MoT) during the Pre-Application and Application Review stages of the assessment.

4.2 Notification and Access to Information

4.2.1 BC Environmental Assessment Office

In accordance with the Act and Regulation, notifications and documents pertaining to the review of the PMH1 Project are available on the electronic Project Information Centre (e-PIC) at www.eao.gov.bc.ca, including:

- Notices and news releases.
- BC Environmental Assessment Office (EAO) generated documents (procedural orders and letters).
- Proponent's letters to EAO.
- The Application Terms of Reference:
 - The draft Application Terms of Reference (ATOR) submitted for public comment.
 - Public, government agency and First Nations comments on the draft ATOR.
 - Proponent responses to comments on the draft ATOR.
 - The final version of the ATOR accepted by EAO.
- The Application for an Environmental Assessment Certificate (Application):
 - The Application and supporting studies submitted for public comment.
 - Public, government agency and First Nations comments on the Application.
 - Proponent responses to comments on the Application.

Information on the BC Environmental Assessment process is available on EAO's website at www.eao.gov.bc.ca, and was also provided to the public by EAO staff at the public open house meetings held during the formal public comment periods for the PMH1 Project ATOR and Application.

Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008

4.2.2 Ministry of Transportation

Prior to and throughout the environmental assessment process, MoT has provided public access to information on the PMH1 Project through the Gateway Program's:

- Website (www.gatewayprogram.bc.ca);
- Telephone information line (604-775-0471); and
- E-mail address (info@gatewayprogram.bc.ca).

Public access to information has also been provided through:

- The distribution of five PMH1 *Community Update electronic* newsletters (over 2006 and 2007) to households along the PMH1 corridor, as well as to the approximately 5,000 individuals and 110 organizations in the database of parties interested in the PMH1 Project and Gateway Program;
- Open houses and stakeholder meetings held in 2006 and early 2007 during the pre-design stage of the PMH1 Project (refer to Section 4.3);
- Open houses held during the EAO's public comment period for the Application (refer to Section 4.5); and
- The provision of paper copies of the Application to local libraries during the public comment period for the Application, to make the information available for those members of the public unable to access the electronic versions available on EAO's website.

Advertisements in community and regional newspapers were placed by MoT to notify the public of the:

- Open houses and stakeholder meetings held during the pre-design stage;
- Public comment periods for the draft ATOR and Application; and
- Open houses held during the public comment period for the Application.

The *Community Update electronic* newsletters, postcards, e-mails and telephone calls were also used during the pre-design stage to notify the public of opportunities to provide input.

4.3 Pre-Design Public Consultation

Since early 2003, the Ministry of Transportation has been consulting with local and regional governments to provide information about the Gateway Program and gather feedback. In 2004, the Ministry initiated a Communications and Consultation Program to support and advance the Port Mann / Highway 1 Project by ensuring timely and meaningful communication and consultation with municipalities, TransLink, Metro Vancouver, port authorities, railways, regulatory agencies, First Nations, community groups, stakeholders, communities, media and the general public in the Greater Vancouver area. With input from these groups regarding their specific concerns, issues and needs, the scope and alignment concepts of the project have been developed and refined. This dialogue will continue as the project proceeds through the preliminary and detailed design phases, as well as into construction.

Prior to submitting the Environmental Assessment Application, the Ministry invited area residents and stakeholders to participate in a comprehensive community consultation and information distribution program, undertaken as part of the PMH1 Project pre-design
Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008

consultation. During this period (February 2006 - February 2007), PMH1 Project staff consulted with over 4,500 people in open houses and stakeholder meetings, with more than 2,900 feedback forms completed and submitted to the Ministry for consideration. Consultation, including community meetings, open houses and web-based consultation was widely advertised, and summary reports detailing the results of the consultation are available on the Gateway Program website at: www.gatewayprogram.bc.ca.

Phase 1 pre-design public consultation was conducted in February, March and April 2006. This process sought public input on goals for interchange upgrades, congestion reduction measures such as HOV lanes, transit and commercial vehicle priority access to highway on/off-ramps, improvements to the cycling network and a proposed toll on the Port Mann Bridge. It consisted of a series of 50 stakeholder meetings and 13 public open houses in Abbotsford, Langley, Surrey, New Westminster, Burnaby, Maple Ridge, Port Coquitlam, Coquitlam and Vancouver. More than 3,400 individuals participated in the consultation program.

The Gateway Program conducted Phase 2 pre-design community consultation on Access and Interchange Improvements in September, October and November 2006 to obtain feedback on potential improvement options at specific interchange locations throughout the corridor. This consultation consisted of a series of 22 stakeholder meetings, as well as nine public open houses in Vancouver, Burnaby, New Westminster, Coquitlam, Surrey, Maple Ridge and Langley. More than 1070 individuals participated in the consultation program. A follow-up community consultation process was undertaken in December 2006 and January 2007 for the Cape Horn and Brunette interchanges. More than 350 stakeholder groups were notified of the meetings and approximately 80 individuals participated in the consultation program.

4.4 Public Comment Period for the Draft Application Terms of Reference

The EAO conducted a 30-day public comment period for the draft ATOR from November 9, 2006 to December 8, 2006. 26 written submissions were received by EAO and have been posted on EAO's website, as well as the Gateway Program's formal responses to the submissions. Where appropriate, the draft ATOR was revised to reflect the comments received.

4.5 Public Comment Period for the Application

The EAO held a 60-day public comment period for the Application from September 13, 2007 to November 13, 2007. During the public comment period, MoT conducted five public open houses, each 4 hours in length, in Langley, Surrey, Burnaby, Vancouver and Coquitlam. At each open house, members of the public were invited to review the proposed project and provide comments on potential environmental, economic, social, heritage and health impacts. Gateway staff and consultants provided project information, and EAO staff answered questions on the EA process. A one hour question-and-answer session with a panel consisting of MoT staff, consultants and representatives from EAO was held at the end of each open house.

Written submissions received from the public have been posted on the EAO website as well as the Gateway Program's formal responses to the submissions and a Public Comment Period Summary Report prepared by MoT.

*Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008*

In total, 313 people attended the 5 public open houses as summarized in Table 4-1.

Table 4-1: Attendance at the PMH1 Application Review Public Open Houses by Location

Date and Time	City	Attendance
Wednesday September 19, 2007 5:00 pm – 9:00 pm	Langley	103
Saturday September 22, 2007 10:00 am – 2:00 pm	Surrey	48
Tuesday September 25, 2007 5:00 pm – 9:00 pm	Vancouver	51
Thursday September 27, 2007 5:00 pm – 9:00 pm	Burnaby	84
Saturday September 29, 2007 10:00 am – 2:00 pm	Coquitlam	27
Total Attendance		313

Approximately 490 individuals participated in the consultation program, either through open houses, correspondence to the EAO or through the Gateway Program information line. 313 participants attended the open house meetings. The EAO received a total of 144 written submissions, which included 609 comments with the following key themes:

- **Project Alternatives**
109 comments (56 submissions), primarily related to support for rail and/or rapid transit instead of the project;
- **Wildlife/Vegetation**
56 comments (3 submissions), primarily related to effects that the Project could have on wildlife habitats and surrounding terrestrial environment;
- **Planning – Urban Growth, Sustainability and Climate Change**
52 comments (38 submissions), primarily related to alignment alternatives particularly at interchange locations, as well as a variety of specific questions about the new bridge;
- **Route/Alignment Design and Signalling**
52 comments (37 submissions), primarily related to preserving and mitigating existing damage to fish habitat from previous development;
- **Fisheries and Aquatic Resources**
42 comments (3 submissions), primarily related to preserving and mitigating existing damage to fish habitat from previous development;
- **Air Quality and Human Health Effects**

Comment [JH1]: It appears there is a mistake here in the description of what these comments related to.

40 comments (16 submissions), primarily related to greenhouse gas emissions and air quality related health costs, as well as future technology and emissions standards;

- **Project Rationale**
29 comments (22 submissions), primarily related to the effectiveness of the improvements in reducing congestion over the long term.

The Proponent's Consultation Summary Report and Response Table containing all comments submitted by the public during the public comment period as well as the Proponent's responses are provided in Appendix XX.

5.0 GOVERNMENT AGENCY CONSULTATION

5.1 Overview of Government Agency Consultation

5.1.1 Environmental Assessment Office

As part of the Environmental Assessment (EA) of the PMH1 Project, EAO created a Working Group that included representatives from the following federal, provincial, regional and local government agencies:

- CEA Agency, Environment Canada, Fisheries and Oceans Canada, Health Canada and Transport Canada;
- Agricultural Land Commission, Ministry of Agriculture and Lands, Ministry of Community Services, Ministry of Economic Development, Ministry of Environment, Ministry of Tourism, Sports and the Arts, and Ministry of Transportation, Integrated Land Management Bureau;
- Metro Vancouver, Fraser Health Authority, South Coast British Columbia Transportation Authority (TransLink) and Vancouver Fraser Port Authority; and
- City of Burnaby, City of Coquitlam, City of New Westminster, City of Surrey and Township of Langley. The City of Vancouver decided not to participate in the WG, but to continue working with MoT on Project design elements within the City.

During the pre-Application stage of the EA, the Working Group participated in the review of the draft Application Terms of Reference, and in the screening of the Application for completeness prior to its acceptance for formal review. During the Application review stage, two additional Technical Working Groups, made up of members from the main Working Group, were created. The Wildlife/Terrestrial Technical Working Group, Fisheries/Aquatic Technical Working Group and main Working Group provided technical analysis and advice during the review of the Application and the EAO's Environmental Assessment Report.

5.1.2 Ministry of Transportation

Since early 2003, MOT has been consulting with local and regional governments to provide information about the Gateway Program and gather feedback. In 2004, the

*Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008*

Ministry initiated a Communications and Consultation Program to support and advance the Port Mann / Highway 1 Project by ensuring timely and meaningful communication and consultation with municipalities, TransLink, Metro Vancouver, port authorities, railways and regulatory agencies. The scope and alignment concepts of the Project have been developed and refined with input from these groups. This dialogue will continue as the project proceeds through the preliminary and detailed design phases, as well as into construction.

During the pre-Application and Application review stages of the EA, MOT has consulted with the government agencies on an individual basis and collectively through the WG with respect to their issues and concerns, as required by the section 11 Order Issued to the Proponent by EAO.

5.2 Main Issues Raised by the Agencies and the Proponent's Responses

Key issues within the scope of the EA review are captured in the discussions under **Part C (Biophysical Effects)** and **Part D (Socio-Economic Effects)** of this report.

6.0 FIRST NATIONS CONSULTATION AND INTERESTS

6.1 Scope

EAO reviewed the past and proposed First Nations consultation program presented in the Application and approved the consultation program on May 02, 2007. This section summarizes the involvement of First Nations in the Project review and outlines the specific efforts of EAO and the Proponent to consult with First Nations. First Nations comments on the Application together with mitigation measures proposed to address concerns are described throughout this Report.

As required under CEAA, this section of the Assessment report addresses potential changes to the environment caused by the Project, and the effect of those changes on the current use of lands and resources for traditional purposes by aboriginal persons.

For the purposes of this Assessment Report it is important to keep in mind the scope of the Project as set out in Section 5 of the Application, *Scope of Assessment and Study Area*.

Aboriginal rights exist on a spectrum that varies with the degree of connection to the land. At one end are those Aboriginal rights that are practices, customs or traditions which, prior to contact with Europeans, were integral to the distinctive culture of the Aboriginal group claiming the rights. In the middle, there are site-specific activities which take place on the land and which may be intimately connected to a particular piece of land. At the far end is Aboriginal title. Aboriginal title is a *sui generis*, inalienable right in land and, as such, is more than the right to engage in specific activities which may themselves be Aboriginal rights. Rather, it confers the right to use the land for a variety of activities. Aboriginal title encompasses the right to exclusive use and occupation of land and the right to choose to what uses that land can be put.

During the review of the Project, the Ministry of Transportation (Proponent) and the Environmental Assessment Office (EAO) consulted with the following First Nations:
Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008

- Katzie First Nation (Katzie);
- Kwantlen First Nation (Kwantlen);
- Kwikwetlem First Nation (Kwikwetlem);
- Musqueam First Nation (Musqueam);
- Tsawwassen First Nation (Tsawwassen);
- Tseil-Waututh (Burrard) First Nation and
- Qayqayt First Nation (also known as the New Westminster Indian Band)

A summary of First Nations considerations and MoT's consultation with First Nations is included in Section 28 of the Project Application.

6.2 First Nations Setting

The Project is situated within the asserted traditional territories of the First Nations named above.

Much of the environment in which the PMH1 alignment is proposed is largely within the existing right-of-way, as described above.

Katzie First Nation (Katzie)

The Katzie First Nation's asserted traditional territory is a geographic area encompassing large portions of Garibaldi Park, Pitt River, the mouth of the Fraser River, and large portions of Coquitlam, Maple Ridge, Surrey, White Rock, Richmond, and Delta. The asserted territory extends south from the headwaters of Pitt River to encompass Pitt Lake, Pitt Polder, a portion of the Fraser River, south to the area surrounding Boundary Bay. The easternmost portion of the territory encompasses Alouette Lake, Rolley Lake and portions of Fort Langley and Hazelmore. The western boundary follows the height of land along the mountain range through Pinecone-Burke Mountain Provincial Park north to encompass all tributaries of the Pitt River system.

The Katzie community is comprised of 5 Reserves totalling 340.7 ha. Katzie IR #1 is situated on the north bank of the Fraser River south of the town of Pitt Meadows. Katzie IR #2 is located on the south bank of the Fraser upstream of IR #1. Katzie IR #3 is situated on the south shore of Barnston Island, while IR #4 is located at the lower end of Pitt Lake across the Pitt River from Grant Narrows. IR #5 is the Katzie cemetery located south of Lougheed Highway on 203rd Avenue. The Katzie's administration and office headquarters is located on the main Reserve (IR #1) in Pitt Meadows. There are 482 Band members (May 2006), with approximately 288 living on-reserve.

Kwantlen First Nation (Kwantlen)

The Kwantlen First Nation is the westernmost Sto:lo Nation Band and is the nearest of the Sto:lo Nation bands to the Project. Kwantlen's asserted traditional territory extends from Mud Bay in Tsawwassen in the south, to the northern end of Stave Lake to the north, east to Mission, and west to New Westminster. In the project area, Kwantlen overlaps with the Katzie, Kwikwetlem, Musqueam, Semiahmoo and Tsawwassen. The Kwantlen community is located on the Fraser River at Fort Langley and is comprised of 6 reserves totalling 556.3 ha. The main residential community is on McMillan Island (IR No. 6). Despite the number and relatively large size of the reserves, the Kwantlen has a

relatively small population: 191 members (May 2006), with approximately 62 living on-reserve.

Kwikwetlem First Nation (Kwikwetlem)

The Kwikwetlem have stated their traditional territory centers on the Coquitlam Lake Watershed, including the upper and lower Coquitlam River. The territory extends to the east side of Pitt Lake, and includes both sides of the lower Pitt River. To the west, the territory extends along Mossum Creek, across Port Moody Inlet to Stoney Creek, and across Sapperton Heights to the north arm of the Fraser River. The southern territory extends from the west end of Barnston Island to the east end of Annacis Island, and includes that portion of the Fraser uplands two kilometres south of the Fraser River. Kwikwetlem has indicated that as they have never undertaken a comprehensive Traditional Use Study, this description of their traditional territory is a provisional one, setting provisional or draft boundaries for the territory and, as such is subject to modification as further information becomes available or when a comprehensive Traditional Use Study is completed.

The Kwikwetlem have asserted that the proposed alignment of the PMH1 project passes through the core of the traditional territory of the Kwikwetlem. Within the larger area the Kwikwetlem have defined 'the Kwikwetlem territory of interest in relation to the project as 'that portion of the PMH1 project corridor between Cariboo Road in Burnaby and 104th Avenue in Surrey'.

The Kwikwetlem First Nation main reserve and office headquarters are located in Coquitlam. There are two reserves next to the Coquitlam River IR No. 1 (about 2.6 ha), at the mouth of Coquitlam River (where it drains into the Fraser River) is in Coquitlam and has approximately 25 residents. This reserve is the closest reserve to the PMH1 corridor. IR No. 2 (about 82 ha) is in Port Coquitlam (further up Coquitlam River), with a population of about 10 people.

Musqueam Indian Band (Musqueam)

Musqueam asserted traditional territory encompasses the Cities of Vancouver and Richmond and parts of Burnaby, Port Moody, North Vancouver, and West Vancouver. Musqueam's territory overlaps with that of the Kwikwetlem, Tseil-Waututh, Squamish, and Tsawwassen First Nations. The main Musqueam community is located in the Point Grey area of Vancouver B.C., near the Fraser River.

The Musqueam community is comprised of 3 reserves totalling approximately 254.2 ha. The main Musqueam community is located on the banks of the Fraser River (IR No. 2) in South Vancouver. The First Nation has 1162 members (May 2006), approximately 546 of whom live on-reserve. Approximately 760 non-Aboriginal people also live at Musqueam IR No. 2.

Qayqayt/New Westminster Indian Band (Qayqayt)

The Qayqayt office is located in New Westminster. Qayqayt has no reserve base and the boundaries of any asserted traditional territory are not known. There are 9 registered members.

Tsawwassen First Nation (Tsawwassen)

The Tsawwassen First Nation's asserted traditional territory includes lands throughout the Fraser River delta to Point Roberts and the Gulf Islands, and extends northeast along the Pitt River to the Pitt Lake area. Tsawwassen asserted territory overlaps with that of the Kwikwetlem, Katzie, Musqueam, and Semiahmoo First Nations. The Tsawwassen First Nation is comprised of one reserve of 273 ha situated in Delta along the shores of Roberts Bank, between the Tsawwassen BC Ferry Terminal and the Roberts Bank Port. The reserve is transected by Highway 17. Tsawwassen has 268 Band members (May 2006), 162 of whom live on-reserve. Approximately 270 non-Aboriginal people also live on the Tsawwassen Reserve.

Tsleil-Waututh First Nation

The Tsleil-Waututh First Nation's asserted traditional territory is a geographic area encompassing 720 square miles that reaches from the Fraser River in the south to Mamquam Lake in the north. The water and land area around Burrard Inlet and Indian Arm is the most heavily utilized part of this area. The Tsleil-Waututh First Nation's asserted traditional territory overlaps with that of the Musqueam, Squamish and Kwikwetlem First Nations. Tsleil-Waututh First Nation has three reserves totalling 110.7 hectares, the second smallest land base of the First Nations located within Greater Vancouver. The main community is located on Burrard Inlet IR 3, located on the north shore of Burrard Inlet, east of the Second Narrows Bridge in North Vancouver. Inlailawatash IR 4 and Inlailawatash IR 4A are located at the end of Indian Arm, 30 km northeast of Vancouver. There are approximately 426 Band Members (2006), 259 living on-Reserve, and approximately 965 non-Aboriginal people living on-Reserve.

6.3 Information Sources

Baseline information for the Project was collected from a variety of sources. First Nation background information was obtained from government websites and from the First Nations themselves (for example, through reports, recently completed traditional use studies and personal communication with First Nation representatives). In addition, during discussions with the various First Nations, information related to the traditional knowledge and the use of the lands and resources within the Project area has been sought by MoT on several occasions.

The Application summarizes the above information and describes historical traditional land by First Nations in the alignment area.

6.4 First Nations Involvement in the Environmental Assessment Process

EAO plans and conducts EA reviews so as to ensure meaningful consultation with First Nations whose interests could potentially be impacted by Projects for which application is made for a certificate under the *Environmental Assessment Act*. Consultation begins during the pre-application stage and continues through to the referral of a Project to Ministers. EAO encourages First Nation involvement in Project reviews to ensure that potential impacts on First Nations' interests are identified and addressed through meaningful consultation and accommodation (where appropriate) in accordance with applicable policy and common law requirements.

EAO provided opportunities for the First Nations identified above to participate in the Project's EA review. EAO invited all the First Nations to participate in the Project Working Group organized by EAO.

Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008

6.4.1 Pre-Application

Early in the Project review (June 2006) EAO issued letters to Katzie, Kwikwetlem, Musqueam, Tsleil-Waututh and the Squamish First Nation, as well as the Sto:lo Nation advising them about the proposed Project and the review process under the Act along with a request to indicate their interest in participating in the EA review as members of technical working groups.

On October 4, 2006 wrote to the Katzie, Kwikwetlem, Musqueam, and Tsleil-Waututh First Nations inviting them to comment on the draft Section 11 procedural order.

On October 4, 2006, EAO wrote to the Kwantlen, Qayqayt and Tsawwassen First Nations to advise them that the EA process for the Project had been initiated and to invite them to comment on the draft Section 11 procedural order. On October 17, 2006 EAO wrote to the Kwantlen and Qayqayt First Nations requesting to meet with the First Nation to discuss the EAO process for the environmental assessment of the PMH1 and the various opportunities for the Kwantlen and Qayqayt First Nations to participate in the process.

Throughout 2006 and 2007, all of the First Nations were invited to participate in working group meetings and attend site tours. Copies of all pre-Application materials were provided to First Nations as well as minutes from the working group meetings.

During the pre-Application stage, Katzie and Musqueam participated in Project Working Group meetings chaired by EAO to hear presentations on the Project and EA review process. As members of the working group, First Nations have been kept informed on an ongoing basis in relation to various project activities, associated timelines and opportunities to engage in the EA process.

On April 2, 2007, EAO wrote to the Katzie, Kwantlen, Kwikwetlem, Musqueam, Qayqayt Tsleil-Waututh and Tsawwassen First Nations advising that as part of the Gateway Program the Proponent had submitted an application for the PMH1 Project to the EAO for screening and that in addition to screening the Application, EAO was considering the adequacy of the consultation activities with First Nations conducted or proposed by the Proponent in relation to the Application. EAO asked the First Nations to provide comments on MoT's proposed consultation activities as described in the Application.

On May 2, 2007 EAO provided MoT a written assessment of the adequacy of the public and First Nations consultation programs that had been conducted to date. The assessment noted that the steps taken to date by MoT were consistent with the requirements of parts 8 and 13 of the procedural order issued by EAO on October 26, 2006, and that MoT had made reasonable efforts to date to engage First Nations, establish working relationships and provide information about the proposed PMH1. This assessment was posted on the website.

On September 13, 2007 EAO wrote to the Katzie, Kwantlen, Kwikwetlem, Musqueam, Qayqayt, Tsleil-Waututh and Tsawwassen First Nations advising that the Application was accepted for formal review.

6.4.2 Application Review

Throughout the EA review process, EAO provided to the First Nations a copy of all relevant documents, including draft workplans for impact studies, draft public consultation work plan, draft Application Terms of Reference, MoT responses to draft impact studies, approved Application Terms of Reference, and minutes from working group meetings. As noted above, EAO also invited First Nations to participate on the technical working groups.

Following the acceptance of the Proponent's Application EAO chaired 8 Project Working Group meetings with presentations from the Proponent and opportunities for First Nations to provide input on issues and concerns with the Project. Musqueam, Katzie, Kwikwetlem and Tsleil Waututh attended some of the working meetings held in the Application review stage. In addition to the Working Group, several meetings were held with Musqueam to discuss fisheries management.

As well as participating directly in working group meetings, the First Nations were provided funding by the Proponent to assist with their involvement in the EA review of the Project.

6.5 First Nations Involvement with the Proponent

6.5.1 Pre-Application

The MoT began a program of information sharing and consultation beginning in the spring of 2004, with the following seven First Nations identified as having potential Aboriginal interests in the PMH1 project:

- o Musqueam Indian Band;
- o Qayqayt (New Westminster) First Nation;
- o Kwikwetlem First Nation;
- o Katzie First Nation;
- o Kwantlen First Nation;
- o Tsawwassen First Nation;
- o Tsleil-Waututh (Burrard) First Nation.

Consultation with First Nations in relation to the overall Gateway Program has had two primary objectives since being initiated in spring 2004. The first objective has been to inform First Nations with a potential interest in the Gateway projects (South Fraser Perimeter Road, North Fraser Perimeter Road, Port Mann/Highway 1), of the scope and nature of the proposed improvements along the three proposed alignments and to effectively engage these First Nations in the related environmental assessment processes. The second objective has been to consult on, identify and seek to resolve issues related to any Aboriginal interests that may be potentially impacted by the various Gateway Program projects including the PMH1 project. As the Project scope and schedule have become increasingly defined, more directed efforts to involve these First Nations in various aspects of project planning and related stakeholder engagement were initiated.

For the PMH1 project, a specific and directed First Nation consultation program has been implemented by the Ministry of Transportation (MoT), the goal of which has been to

*Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008*

identify First Nation interests, issues and concerns related to the Project and to consider and address such interests, issues and concerns within the context of project planning, assessment and design.

The following considerations were identified by participating First Nations during the pre-application stage of the EA process:

- o The potential for impacts on archaeological/cultural resources;
- o Potential impacts on First Nation heritage values;
- o Potential impacts on fish, fish habitats and stream crossings;
- o Socio-economic/community impacts and opportunities associated with the Project.

In November 2006, MoT organized an initial tour of the proposed PMH1 alignment and all First Nations that had previously indicated an interest in participating in the review were invited to attend, along with the PMH1 Project team, key consultants from fisheries, archaeology and air quality. None of the First Nations invited were able to participate in the tour.

6.5.2 Application Review

As proponent of the proposed PMH1 Project, MoT, and EAO continued to consult with First Nations during the Application review stage of the EA assessment process. The focus of this effort was to further identify potential Project-related impacts on the First Nations identified interests, and to attempt to design appropriate mitigation measures to address any such interests.

Leading up to the submission of the EA Application, a number of specific interests and issues related to the proposed Project were expressed by participating First Nations. Discussions led to the negotiation and finalization of a number of agreements which formally document and define specific aspects of the ongoing relationship between MoT and participating First Nations and provide financial assistance to facilitate the First Nations further involvement in the EA review process. Currently, MoT has negotiated and signed such agreements with the Katzie First Nation, the Musqueam Indian Band, the Kwikwetlem First Nation and the Tsleil-Waututh First Nation. Similar agreements have been offered by MoT to the Kwantlen, Tsawwassen and Quayat First Nations.

6.5.3 Specific Consultation Activities

Katzie

The Katzie First Nation has been actively participating in the PMH1 environmental assessment process. MoT meetings with the Katzie First Nation to discuss aspects of the PMH1 project have occurred in:

- May 2004
- August 2004
- October 2004
- February 2005
- November 2005
- April 2006
- February 2007
- July 2007
- November 2007

*Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008*

- December 2007
- January 2008
- February 2008

These discussions have focused on broad range of issues as identified by the First Nation including potential concerns related to the archaeology, fisheries and economic components of the Project.

The MoT has negotiated separate Contribution Agreements with the Katzie in relation to the Gateway Program, to assist in facilitating their ongoing participation in the environmental assessment process and related review of the EA Applications; and to fund the Katzie to undertake a Cultural Impact Assessment (CIA) to assess the potential impacts of all Gateway projects on the defined interests of the Katzie. The CIA was completed and submitted to MoT in later summer 2007 and provided to EAO as part of the EA review. In fall 2007, MoT and the Katzie began a series of meetings to discuss and work towards resolving issues raised in the CIA. MoT and the Katzie have agreed to work cooperatively to address issues raised in the CIA study within the context and timeframe of the PMH1 EA review process. Meetings with Katzie First Nation have advanced discussions considerably and will continue through project planning.

Some of the concerns identified to date by the Katzie include: fisheries and water quality specific to the twinning of the Port Mann Bridge; potential impacts on noise and air quality; potential impacts on Katzie heritage sites during construction; and impacts to traditional use areas within Katzie traditional territory. The Katzie First Nation has also expressed interest in potential employment, training and contracting opportunities associated with the project.

Kwantlen

Since spring 2004 MoT has implemented regular and ongoing consultation and information-sharing measures with the Kwantlen First Nation. MoT discussions during the PMH1 pre-application phase occurred in:

- September 2004
- March 2005
- June 2006
- December 2006
- April 2007
- August 2007
- December 2007
- January 2008
- February 2008

During these meetings the Kwantlen expressed general interest in economic opportunities for their community, the potential for acquiring any Crown lands identified as surplus to the Project and in the fisheries and archaeology components of the Project.

In an effort to facilitate Kwantlen's involvement in the PMH1 review process, MoT has provided the KFN with copies of all relevant reports, offers of funding, ongoing project status updates and has continuously sought comments and feedback relating to the PMH1 project.

*Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008*

Application review meetings with the Kwantlen commenced in October 2007 at which time the Kwantlen indicated specific interest in discussing archaeology/heritage and fisheries components of the PMH1 project in more detail. In response to this request, MoT scheduled a meeting focused entirely on the fisheries and archaeology components of the project and has offered to arrange other meetings to respond to any informational needs or specific requests of the Kwantlen.

Recently the Kwantlen has articulated key interests/concerns related to the protection of archaeological, cultural and heritage sites within the PMH1 project area, the protection of land interests, Aboriginal rights and title interests, and potential economic development opportunities for Band members and businesses resulting from the project.

Kwikwetlem First Nation

The Kwikwetlem First Nation has been involved in an ongoing basis in all three of the since spring 2004.

Meetings between MoT and the Kwikwetlem, aimed at discussing specific aspects of the PMH1 project, have taken place in:

- July 2004
- April 2005
- October 2005
- February 2006
- March 2006
- May 2006
- September 2006
- February 2007
- July 2007
- August 2007
- October 2007
- November 2007

During these meetings the Kwikwetlem identified several issues of concern including:

- Potential impacts on cultural/heritage interests
- Issues related to the general increase in development within their territory
- Loss of privacy, increase in noise pollution / air quality impacts and other community impacts potentially associated with the project
- Potential fisheries impacts
- Project related opportunities for training and employment

In an effort to further identify and resolve issues of concern, MoT and the Kwikwetlem have negotiated and signed Contribution Agreements to further facilitate the ongoing participation of the First Nation in the EA review process.

It is MoT's current understanding that the general issues for Kwikwetlem that relate to the PMH1 project are:

- ❖ the Kwikwetlem's ongoing role in archaeological component of the project
- ❖ protection of watercourses within the project area that are of potential of traditional use importance

- ❖ fisheries – ongoing involvement in habitat planning and management
- ❖ potential employment and training opportunities
- ❖ continued / enhanced access to the Fraser River for fishing
- ❖ economic accommodation

Musqueam

MoT has met with the Musqueam Indian Band on a regular basis since spring 2004. The majority of the meetings during the Application Review period with the First Nation have focused specifically on the fisheries component of the Project. Two Contribution Agreements have been issued: one for EA participation; and another for supporting the First Nation's ongoing work with MoT related to fisheries and archaeology.

MoT meetings with the Musqueam have taken place in:

- September 2004
- March 2005
- February 2007
- March 2007
- April 2007 (2 meetings)
- May 2007 (3 meetings)
- June 2007 (2 meetings)
- July 2007
- August 2007
- October 2007 (2 meetings)
- November 2007
- December 2007
- January 2008
- February 2008

Based on input received to date, the Musqueam is most interested in the protection and enhancement of fish habitat and in the protection of any archaeology/cultural /heritage interests potentially impacted by the Project. The Musqueam have also expressed interest in economic opportunities associated with the PMH1 Project

Qayqayt

During the spring of 2004, project-related information was provided to the Qayqayt First Nation and invitations were extended on behalf of the EAO and MoT to participate in the working group that had been established for purposes of the review. Several offers were made by MoT representatives to meet to discuss the project, provide opportunities for the Qayqayt First Nation to participate in the EA process and to further identify potential interests or concerns related to the PMH1 project.

There has been no significant interaction between MoT and the Qayqayt First Nation. The MoT has continued to provide project-related information and to solicit feedback throughout the pre-application and application review phase of the project. However, there has been no response to date from the Qayqayt.

Tsawwassen

MoT met routinely with the Tsawwassen leading up to the submission of the Application and have continued to meet and provide Project updates to the First Nation. Meetings occurred in:

- May 2004
- September 2004
- January 2005
- February 2005
- March 2006
- July 2007

MoT did table a draft Contribution Agreement with the Tsawwassen, however they have indicated that their primary interest in Gateway relates to the SFPR project and they will likely take more of a monitoring role on the PMH1 project to confirm that aboriginal issues are being adequately addressed from their perspective.

Issues of interest to the Tsawwassen that have been raised to date (primarily within the context of the SFPR project) relate to fisheries, archaeology, protection of traditional use sites, economic development opportunities for Band members and businesses and ensuring treaty interests are not adversely affected by the project.

Tsleil-Waututh (Burrard) First Nation

Since spring 2004, MoT and Tsleil-Waututh First Nation have met and have corresponded through a variety of means regarding the PMH1 project.

In February 2008, the Tsleil-Waututh signed a Contribution Agreement facilitating their direct participation in the Application Review phase of the EA process.

In MoT's discussions with the Tsleil-Waututh potential interests/concerns related to the project which were identified included: protection of archaeological, cultural and heritage sites within the PMH1 project area, the protection fisheries interests, and potential economic development opportunities for Band members and businesses resulting from the project.

6.6 Aboriginal Rights Claimed by First Nations in the Project Area

To be included following review by First Nations.

6.7 First Nations Issues and Concerns

To be included following review by First Nations.

6.8 Summary and Conclusions

To be included following review by First Nations.

PART C: BIOPHYSICAL EFFECTS

7.0 WATER WELLS

Chapter 12 in Volume II of the Application describes the existing groundwater conditions and water wells along the proposed alignment east of the Port Mann Bridge, discusses the potential for the Project to affect groundwater quantity and quality in these wells, and proposes measures to mitigate potential effects.

7.1 Background

All properties along the Highway 1 alignment west of the Port Mann Bridge are serviced by municipal water supply, therefore the water wells assessment was conducted on the section of the Project alignment east of the bridge.

There are 65 active wells along the PMH1 alignment east of the Port Mann Bridge that are used for household, livestock watering, irrigation and in one instance, industrial purposes. The well types range from shallow, dug wells that derive groundwater from permeable lenses contained within surficial sediments, to deep, drilled wells that derive groundwater from the Newton Upland, Nicomekl-Serpentine and Clayton aquifers. Dug wells are subject to surface water influences, and their groundwater is characterized by lower pH and higher turbidity, bacteriological and nitrate concentrations than groundwater from drilled wells. Aquifers that are overlain by confining materials such as silts and clays are protected from surface contamination. Groundwater along the alignment is characterized by a range of major ion compositions, with no discernable trends related to aquifer, well depth or well type.

7.2 Potential Water Well Impacts

The potential for the Project to affect groundwater quantity and quality at local water wells east of the Port Mann Bridge is dependent on the existing groundwater conditions, well depth, effectiveness of the wellhead surface seal, and the degree of cuts and fills required. Most of the Highway 1 expansion east of the 152nd Street Interchange will be within the existing highway median, and will require cuts and fills ranging from 2 m to 4 m. More substantial cuts and fills are expected at the interchanges and on Johnson Hill, between the Port Mann Bridge and the 152nd Street Interchange.

Groundwater quantity impacts may occur in the areas with more substantial cuts, where the cuts are made below the depth of shallow, dug wells and drilled wells that are completed at shallow depths. Groundwater recharge, and therefore quantity, adjacent to Highway 1 may also be reduced due to an increase in impervious area.

Potential groundwater quality impacts are a concern for dug or drilled wells that are shallow, constructed without a proper surface seal, or are located in a water-bearing unit that lacks a cap of low-permeability confining material. For these wells, groundwater quality may decrease during:

- Construction due to increased sediment loads in surface runoff or incidental releases of hydrocarbons from construction equipment; and

*Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008*

- Operation due to a potential increase in concentrations of heavy metals, suspended solids, hydrocarbons and salt (from de-icing) in highway runoff.

Two active drilled wells used for household, garden and irrigation purposes are located within the proposed footprint of the 216th Street Interchange and will need to be decommissioned prior to construction. Six other wells may be vulnerable to highway construction and operation activities: four drinking water wells and one irrigation well are in close proximity to the 176th Street Interchange, and one drinking water well is near the 192nd Street Interchange.

7.3 Proposed Impact Avoidance, Mitigation and Compensation

The Owner's Table of Commitments and Assurances (Section 13.0) commits to the following measures to avoid and mitigate potential impacts on water quantity and quality in water wells adjacent to the Project footprint east of the Port Mann Bridge:

1. Implement sediment and drainage control measures in accordance with project requirements to reduce potential groundwater quality impacts to vulnerable water wells in the City of Surrey and the Township of Langley adjacent to the highway right-of-way;
2. Re-sample previously tested wells that are considered potentially vulnerable to groundwater quality effects immediately prior to construction, during construction, and if required, following construction to monitor for any changes in water quality;
3. Conduct water-level monitoring in accessible, shallow dug wells that are considered potentially vulnerable to groundwater quantity effects immediately prior to construction, during construction, and if required, following construction;
4. Decommission wells located within the highway alignment prior to construction by grouting to surface, to reduce the potential for these wells to serve as conduits for the subsurface migration of contaminants; and
5. Provide a suitable supply of potable water to affected residences if potable well water is adversely affected by the Project. Sampling water quality data will be provided to the local health authority.

7.4 Key Issues Raised by the Working Group and Proponent Responses

Key issues identified by the Working Group during the Application review and MoT's responses and commitments (in italics), as appropriate, are summarized below. Refer to the Biophysical Issues Tracking Table (Appendix XX) for an expanded description, and to Section 13.0 of the OTCA for the complete commitments.

Canadian Environmental Assessment Agency

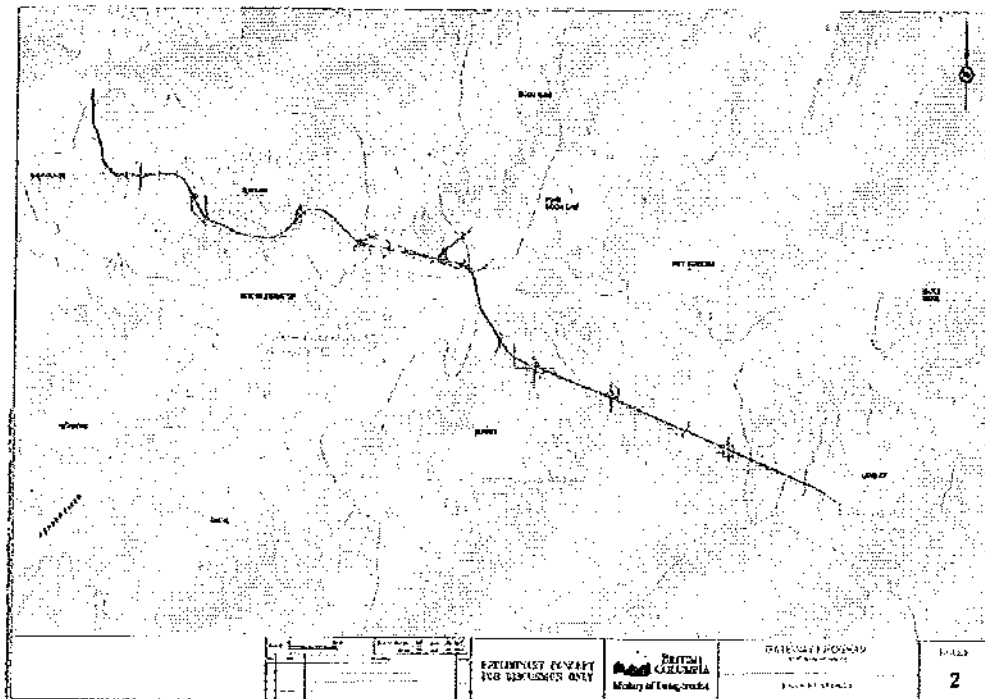
- Noted that the impact avoidance, mitigation and compensation measures proposed in the Application are recommendations, and that there are no guarantees that they will be put into place unless the Proponent is willing to commit.

The measures have been added to the OTCA.

7.5 EAO and RA Conclusions

Chapters 7.0, 11.0 and 13.0 in Volume II of the Application describes the fisheries and aquatic resources within the PMH1 project area, the potential Project effects, and the proposed impact mitigation and compensation measures.

Highway 1 between McGill Street in Vancouver and 216th Street in the Township of Langley, Highway 1 crosses seven major watersheds (Figure 8-1): Brunette River, Como Creek, Lower Fraser River, Serpentine River, Yorkson River and Salmon River. There are two major bridge crossings in the study area: Brunette River and the Fraser at Port Mann.



8.1.1 Study Area Fish Habitat

Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008

- 96 were classified as high productivity habitat for salmonids - they are inhabited or potentially inhabited by salmon and/or trout seasonally or year-round;
- 35 were classified as moderate productivity habitat – no salmonids were observed, but the watercourses contribute significant food and nutrients to downstream high productivity habitat; and
- 75 were classified as low productivity habitat – food and nutrient values are insignificant and there are no salmonids present.

Within the Project corridor, there are more than 100 culvert crossings for existing watercourses or drainage ditches. Of these, 73 are on watercourses classified as high productivity habitat for salmon, with seasonal salmon distribution.

8.1.2 Study Area Fish Species

Approximately 36 fish species are supported by the watercourses within the Project study area. 23 species are year-round residents, six are anadromous (live primarily in the ocean, but breed in fresh water), and the remainder are either migratory (in fresh water only) or transient within the lower Fraser River.

Two provincial red-listed fish species are known to occur within the PMH1 study area:

- The Nooksack Dace (*Rhinichthys cataractae*), also a Schedule 1 species under the federal Species at Risk Act (SARA), has been found in the Brunette River downstream of the Highway 1 crossing; and
- The White Sturgeon (*Acipenser transmontanus*) is a common species in the Lower Fraser River.

Two other red-listed fish species, four blue-listed fish species and three species of conservation concern potentially occur with the Project area, but were not observed during the project field surveys: the green sturgeon, Dolly Varden, pygmy longfin smelt, coastal cutthroat trout, bull trout, brassy minnow, eulachon and migratory interior Fraser Coho salmon and interior Chinook salmon. The Green Sturgeon is also listed under the federal *Species at Risk Act*, however this is a marine species and not likely to frequent the Project area. Red-listed species are native species that are extirpated, endangered, or threatened in BC. Blue-listed species are native species considered to be vulnerable in BC. Species of conservation concern are candidates for provincial listing.

The lower Fraser River, where the existing Port Mann Bridge and proposed new bridge are located, provides important habitat for over 25 species of fish, including seven salmonid species. The species of greatest commercial, recreational and cultural significance are Coho, chum, Chinook, sockeye, pink salmon, cutthroat, steelhead-rainbow trout, eulachon, smelt and white sturgeon. Most of these fish species use the lower Fraser River as an important corridor for migration to and from spawning grounds and for outmigration of juveniles after periods of rearing. Other non-migratory species (e.g. prickly sculpin, peamouth chub, carp, redbelly darter, northern pikeminnow) are resident species and rely on the local habitats from sloughs, backwater areas, and tributaries. The composition and diversity of fish species in the lower Fraser River has not changed dramatically in the past 30 years, while abundance has generally declined over this period.

Extensive surveys conducted below the Port Mann Bridge and around the Sapperton Bar of the Lower Fraser River found 18 fish species of which five were considered seasonal migrants (salmonids and eulachon) and the remainder residents (centrarchids,

Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008

Comment [MSOffice2]: The definition of blue-list has changed to "List of ecological communities, and indigenous species and subspecies of special concern (formerly vulnerable) in British Columbia." See: <http://www.env.gov.bc.ca/atrisk/glossary.html#b>

minnows, trout, coregonids, clupeids and flounders). The numerically most abundant species in these surveys included prickly sculpin, eulachon and northern pikeminnow, followed by starry flounder, chum salmon fry, lamprey and sticklebacks.

8.1.3 Water Quality

The proposed PMH1 project is located in an urbanized area, where the baseline water quality reflects chronic inputs of contaminants from surface runoff and atmospheric deposition, as well as short term (acute) events from poorly controlled construction sites, chemical spills and fugitive discharges.

Baseline water quality conditions in the Project area were assessed using existing historical water quality data supplemented by a one-time field sampling event.

Parameters tested were based on:

- Potential impacts to water quality from highway construction and operation (e.g., sedimentation, increased runoff, introduction of contaminants including hydrocarbons, PAHs, and metals);
- Regulatory requirements for other recent linear development projects (e.g., South Fraser Perimeter Road, Highway 10), and
- Existing land use and associated contaminants of concern (e.g., nutrients, coliforms, PAHs).

Combined, these data provide an indication of potential parameters of concern within the study area, and will be used to design monitoring, stormwater management strategies and other mitigation measures that will be implemented during construction.

Historical water quality data and the 2004 field survey results indicate that:

- Some parameters consistently met criteria for the protection of aquatic life, for example some PAHs, fluoride and chloride; while
- Some parameters did not, including DO, pH, TSS, nitrite, fecal coliforms, total metals (e.g. Al, Fe, Cu, Zn and Pb), some PAHs and hydrocarbons.

Exceedances in parameters were however highly variable, and likely reflect differences in study design between various data collection programs, differences in sampling location and timing as well as the different sources of contamination at a particular site.

8.2 Potential Impacts on Fisheries and Aquatic Resources

Potential impacts of the Project on fisheries and aquatic resources result from project design, construction and operation.

8.2.1 Potential Impacts Due to Project Design

Potential impacts due to project design include the:

- Loss of instream habitat and associated effects such as loss of habitat connectivity as well as habitat alienation due to the introduction of migration barriers. The potential habitat loss by watershed is presented in Table 8-1. Fraser River habitat losses are not included in the table. The predicted habitat losses are 40,711 m² of in-stream and 173,690 m² of riparian habitat. 74% of the in-stream habitat loss and 66% of the riparian habitat loss will occur in the Como Creek and Brunette River watersheds;

*Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008*

- Loss of riparian habitat and associated downstream effects such as increased water temperature, decreased dissolved oxygen and decreased nutrients;
- Alteration of in-stream habitat features due to changes in groundwater flow;
- Alteration of in-stream habitat features and reduction in channel stability due to an increase in impervious area and potential impacts on flow regime. The increase in total impervious area (TIA) in the watersheds will range from 0.5% to 2% as indicated in Table 8-2. TIA calculations are not available for the Lower Fraser River watershed, but are unlikely to be measurable given the very large size of this watershed. TIA is the primary indicator of watercourse health. In the absence of effective storm water management, an increase in impervious surface is positively correlated with increased runoff rates and volumes, and increased erosion and instability within natural watercourse channels, leading to property damage due to flooding during storm events. Significant impacts to watercourses may occur when TIA is equivalent to 30% to 50% of the watershed, while major impacts may result if TIA exceeds 50%. Table 8-2 shows that in 1996, the Brunette River and Como Creek watersheds had 50% and 54% TIA respectively, while the more rural Serpentine, York and Salmon River watersheds had 25%, 15% and 6% TIA. The largest increase in TIA due to the Project, 2%, will occur in the Como Creek watershed, which had 54% TIA in 1996;
- Loss or alteration of in-stream habitat for the Nooksack Dace, a provincially Red-listed and Schedule 1 SARA fish species, due to widening of the existing Highway 1 bridge over the Brunette River.

Table 8-1 Summary of Potential Fish Habitat Losses by Watershed

Watershed	Watercourse Classification	In-stream Habitat		Riparian Habitat
		Length (m)	Area Loss (m ²)	Area Loss (m ²)
Brunette River	High productivity	2,804	9194	53,742
	Moderate productivity	615	2,368	7,956
	TOTAL	3,419	11,561	61,698
Como Creek Lowlands	High productivity	3,833	18,414	51,846
	Moderate productivity	62	162	1,720
	TOTAL	3,895	18,576	53,566
Fraser River Tributaries (includes Yorkson River)	High productivity	1,107	5,813	22,787
	Moderate productivity	212	405	6,860
	TOTAL	1,319	6,219	29,646
Coquitlam River	High productivity	381	1,697	4,277
	Moderate productivity	0	0	0
	TOTAL	381	1,697	4,278
Upper Serpentine River	High productivity	58	97	2,082
	Moderate productivity	284	610	9,916
	TOTAL	341	707	11,998
Salmon River Tributaries	High productivity	166	584	5,459
	Moderate productivity	327	1,367	7,045
	TOTAL	493	1,951	12,504
TOTAL HABITAT LOSS		9,848	40,711	173,690

Table 8-2: Total Impervious Area by Watershed and Percent Change Due to the Proposed Project for the Como Creek and Brunette, Serpentine, Yorkson and Salmon River Watersheds

Watershed	Approximate watershed area (ha)	TIA (ha) (1996) ¹	Existing impervious area due to the PMH1 corridor (ha)	Increase in impervious area (ha) due to the proposed Project (ha)	%TIA (1996) ¹	% change with the PMH1 project
Brunette River	7,330	3,665	75	22	50	0.6
Como Creek	850	459	41	11	54	2.0
Serpentine River	14,840	3,710	42	21	25	0.6
Yorkson River (a)	2,590	389	4.3	1.8	15	0.5

Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008

Table 8-2: Total Impervious Area by Watershed and Percent Change Due to the Proposed Project for the Como Creek and Brunette, Serpentine, Yorkson and Salmon River Watersheds

Watershed	Approximate watershed area (ha)	TIA (ha) (1996) ¹	Existing impervious area due to the PMH1 corridor (ha)	Increase in impervious area (ha) due to the proposed Project (ha)	%TIA (1996) ¹	% change with the PMH1 project
Fraser River (Tributary)						
Salmon River	7,690	461	5.8	5.2	6	1.3

¹ Greater Vancouver Sewerage and Drainage District, 1999. Best Management Practices for Stormwater.

8.2.2 Potential Construction Impacts

Potential impacts due to construction activities include:

- Decreased water quality in watercourses from the introduction of sediments and deleterious substances;
- Disturbance of in-stream and riparian habitat during in-stream works and other construction works;
- Disturbance or alteration of in-stream habitat for the Nooksack Dace, a provincially Red-listed and Schedule 1 SARA fish species, during the widening of the existing bridge over the Brunette River;
- Exposure of fish in the Fraser River to damaging underwater overpressure effects during pile driving for the new bridge; and
- Temporary loss of over-wintering and rearing fish habitats in lowland areas requiring preloading of material, such as the section of highway adjacent to Burnaby Lake and in the Como Creek lowlands area west of the Cape Horn Interchange.

8.2.3 Potential Operational Impacts

During operation, potential impacts include;

- Decreased water quality in watercourses (from existing levels) resulting from an increase in the amount of sediments and deleterious substances discharged on a chronic and accidental basis.
- Disturbance of in-stream and riparian habitat during maintenance activities,

Acid rock drainage is not expected, as preliminary geotechnical information indicates that unweathered sulphide mineral-bearing bedrock is unlikely to be exposed during project construction.

8.3 Proposed Impact Avoidance, Mitigation and Compensation Measures

Planning, relocation and redesign strategies have been and will continue to be employed to avoid, mitigate and compensate potential design based impacts on fisheries and aquatic resources including:

- Ongoing review of relocation of highway and bridge improvements (highway widening, ramps and connectors, river crossings reconfiguration of interchanges) and where possible avoidance or reduction in potential encroachment of watercourses and fish habitats;
- Redesign and strategic reduction of side slopes through use of headwalls, retaining walls, and/or hangers to limit footprint and/or potential erosion stability effects on fish-bearing or high productivity watercourses and associated riparian habitat;
- Use of headwalls on culverts to minimize length or extensions on watercourses with high values and to maintain slope stability;
- Strategic opportunities for habitat banking in areas surrounding the PMH1 project and linked to potentially impacted watercourses and watersheds;
- Planning and implementation of stormwater Environmental Management Plans (EMPs) to minimize potential impacts due to increased highway surfaces and run-off; and
- Consultations to build effective project designs and habitat protection plans, where warranted, consistent with local or agency objectives.

Potential impacts of the Project on fisheries and aquatic resources will be specifically addressed through an Environmental Management Plan (EMP) that will be prepared by the contractor prior to construction. The EMP will have the following components:

- Fisheries and Wildlife Habitat Mitigation and Compensation Plan;
- Construction Environmental Management Plan (CEMP); and
- Operational Environmental Management Plan (OEMP).

The fisheries and aquatic impact avoidance and mitigation strategies of the EMP will be based on the recommendations in Chapters 11 of the Application (the Fisheries and Aquatic Resources Impact Assessment). The EMP will outline how these guidelines are to be implemented, and will describe environmental protection measures to be implemented by the contractor in response to planned work activities.

The CEMP for the PMH1 project will include various sub-plans that provide detail on specific components of construction activities. Those relevant to fish habitat include the:

- Contaminated Sites Management Plan;
- Emergency Spill Response, Containment and Management Plan;
- Environmental Monitoring Plan;
- Fisheries Mitigation and Compensation Plan; and
- Surface Water Quality and Sediment Control Plan.

Thirty-nine site-specific habitat compensation concepts are proposed to compensate for in-stream and riparian habitat losses. Five sites are located adjacent to Highway 1 on the east side of the Fraser River; the remainder are on the west side, predominantly in the Brunette River and Como Creek watersheds. The plans were developed based on watershed-based restoration and recovery objectives derived from input from community

groups and local experts, advice from DFO biologists, and observations made during field surveys for the Project. The proposed compensation strategy includes:

- Replacement of watercourses at a minimum 1:1 ratio (gain:loss);
- Use of "habitat banking" outside the PMH1 project area to minimize functional temporal effects. Habitat banking is the creation or improvement of fish habitat for future use as compensation, prior to the issuance of a subsection 35(2) Authorization under the federal *Fisheries Act*;
- Retention of existing aquatic habitat and riparian vegetation where possible;
- Enhancement of existing aquatic habitat, including:
 - Improvement to fish access and passage;
 - Installation of in-stream habitat features such as large woody debris;
- Development and implementation of operation and maintenance plans and techniques that will allow riparian growth and development in some areas;
- Enhancement of existing riparian areas through the removal of non-native invasive weed-plant species, replanting with native species and the planting of hedgerows or sheltered forests along stream edges; and
- Prescriptive plans consistent with watershed level objectives identified by stakeholders and regulatory agencies.

Approximately 54,594 m² of high productivity in-stream fish habitat and 134,595 m² of riparian habitat will be gained along the PMH1 project corridor. This represents a possible net gain through compensation of approximately 10,883 m² of high productivity in-stream habitat, and a potential net loss of 39,095 m² of riparian habitat. Additional areas of off-site compensation are also being considered for the Project, particularly in the Brunette drainage.

The riparian areas for many watercourses in the PMH1 project area are comprised by high densities of invasive vegetation such as blackberry, knotweed, and reed canary grass. Compensation plans propose the creation of 134,595 m² of higher value native riparian habitats, which is expected to result in an overall net increase in habitat quality and productivity.

Section 12.0 and 13.0 of the Owner's Table of Commitments and Assurances (OTCA) details the fisheries and water quality commitments that must be met by the Project contractor:

8.4 Residual Effects on Fisheries and Aquatic Resources

Residual effects on fisheries and aquatic resources are not anticipated. The federal *Fisheries Act* requires that there be no net loss of the productive capacity of fish habitat. The proposed PMH1 project designs, mitigation measures, compensation approaches and use of BMPs for riparian vegetation management have been developed to meet this requirement and will be a condition of the Section 35(2) Authorization(s) under the *Federal Fisheries Act*.

The fisheries compensation in conjunction with wildlife habitat compensation potentially could result in a net gain and upgrade in quality of in-stream and riparian habitats in the Project area. A net benefit may occur for larger watercourses in the Project area due to design improvements to ditching, stormwater management, culverts, bridges, headwalls and retaining walls that are associated with fish habitat.

Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008

8.5 Key Issues Raised by the Working Group and Proponent Responses

Key issues identified by the Working Group during the Application review and MoT's responses and commitments (in italics), as appropriate, are summarized below. Refer to the Biophysical Issues Tracking Table (~~Appendix XX~~) for an expanded description, and to the OTCA for a complete listing of commitments:

- Fisheries, OTCA Section 12.0;
- Water quality, OTCA Section 13.0; and
- Stormwater management, OTCA Section 5.0

8.5.1 Fisheries Issues

Fisheries and Oceans Canada (DFO)

- An understanding of existing culvert passage is required in order to predict the impacts of culvert extensions on fish passage, and a strategic culvert rehabilitation plan should be developed that addresses barriers on a watershed priority basis.

A supplementary Fish Passage Culvert Crossing Assessment has been completed that identifies priority areas.

- In consideration of the Fish Passage Culvert Crossing Assessment, DFO with the support of Transport Canada, has met with the Cities of Burnaby, Coquitlam and Surrey; the Kwantlen, Kwikwetlem and Musqueam First Nations; Environment Canada and the Canadian Wildlife Service. Natural stream integrity and function for fish bearing streams are to be restored through the culvert replacements identified in Appendix 1 of DFO's letter of March 14, 2008. The restoration locations have been identified by the above parties as they represent improvements to existing bottlenecks in habitat productivity for both fish and wildlife. To restore stream integrity and function for both fish and wildlife, replacement structure designs are to establish an open bottom width that is 50 % greater than the natural stream channel width (bank full width). It is DFO's opinion that the identified locations will enable the proposed PMH1 project to be consistent with DFO Policy for the Application of the Habitat Protection Provisions of the *Fisheries Act* to Existing Facilities and Structures, and to be in compliance with Section 20 of the federal *Fisheries Act*.

MoT response pending.

The issue of the strategic plan for culvert replacement is not yet resolved.

Further information will be added after the March 20th combined

Fisheries/Wildlife TWG workshop on fish/wildlife passage.

- To avoid impacts to important shallow zone fish habitats, placement of in-stream pier locations are to be located in water depths greater than 3 metres as measured during lowest low water periods.

MoT response pending.

The issue of pier location is not yet resolved. Further information will be added after the March 20th Fisheries/Aquatic TWG meeting.

- The location and design of the piers are to be supported by hydraulic modelling which demonstrates no scouring of and/or sediment deposition on the surrounding shallow zone fish habitats.
MoT response pending.
- Migration during construction is to include consideration of the following points:
 - (a) Timing restrictions to avoid impacts to:
 - Juvenile out-migrating and adult in migrating coho salmon along the north channel of the Fraser River in association with the Coquitlam River; and
 - Eulachon, spring chinook, and early sockeye migration and spawning;
 - (b) Bridge construction strategies which do not result in a restriction or partial restriction to fish migration and or commercial, recreational or First Nation fisheries.
MoT response pending.
- The Nooksack Dace, an endangered species under SARA, is present in the Brunette River. Designs that potentially impact Nooksack Dace habitats will require permitting under SARA prior to authorization under the Fisheries Act.
A supplementary report on the potential effects of the proposed widening of Highway 1 on Nooksack Dace in the Brunette River has been provided. The OTCA commits to design and construction of the Brunette River Bridge foundations to avoid or minimize impacts to Nooksack Dace and its habitat.
- Clarification of requirements for construction-related dredging for bridge piers in the Fraser River is required.
There will be localized excavation, not dredging, within the footprint of piers.
- Identification of those areas where the placement of pre-load material will affect fish and fish habitat is required.
A supplementary Surcharge Map -- Kensington Avenue to Gaglardi Way was provided that identifies locations where surcharge (pre-load) will be applied as part of the normal construction process.
- The Application contains little information on site-specific impacts and avoidance and mitigation recommendations. Project effects on watercourses are not known.
To the extent possible at this stage in planning, the Reference Concept avoids and minimizes possible disturbances to aquatic and riparian habitats. The Contractor will prepare designs from which the details of impacts on watercourses will be determined. The Application provides mitigation options by stream tier classification, which is intended to provide guidance to the Contractor regarding the environmental sensitivity of each watercourse and the range of mitigation options available. A supplementary table that clarifies impacts and mitigation measures by tier classification was provided to the Working Group.

- The final area for fish habitat compensation will be based on the final determination of impact areas, availability of compensatory options within project corridor and those works able to be built prior to site impact. Where appropriate, DFO shall consider the replacement of existing stream crossing structures which are barriers to fish passage, as appropriate fish habitat compensation applicable to this linear development. Where works are demonstrated to be technically feasible, and are constructed and proven biologically functional prior to the construction of the Project, DFO shall require compensation on a 1:1 area ratio. Where compensation is not delivered prior to project commencement, a 2:1 area ratio will be required.

MOT intends to proceed with habitat banking and wishes to have further discussions with DFO regarding:

- *Habitat scaling for different habitat types for example – quality and type of riparian habitat might be considered 1:1;*
- *Consideration to establish these ratios during EA review; and*
- *Clarification for habitat compensation ratios for habitat made newly accessible through removals of barriers to fish passage.*

The issue of compensation is not yet resolved. Further information will be added after the next Fisheries TWG meetings.

- DFO is reluctant to accept as compensation, riparian habitat conversion in areas currently dominated by invasive plant species, if these areas are located outside the area of fisheries impact. The success of such conversion is not well documented in the Application.

The issue is not yet resolved. Further information will be added after the next Fisheries TWG meetings.

- The Fraser River supports important commercial, recreational and aboriginal fisheries. DFO requests an overview of fish migration and fisheries timing at the Port Mann Bridge and the proposed bridge construction schedule.

A supplementary report on fish migration and fisheries timing at the Port Mann Bridge has been provided. The OTCA commits to provision of a bridge construction schedule that considers both the timing of the fisheries and fish migration.

- The fisheries at the Port Mann Bridge are important commercially as well as to First Nations, and DFO requests clarification that MOT will continue to consult with potentially affected First Nations regarding the potential project impacts on the health of the fisheries and potential temporal loss of commercial and aboriginal fishing access.

The OTCA commits that MOT will continue to work with participating First Nations to address any specific concerns identified by them during the EA review regarding potential fisheries impacts. The OTCA also commits to a bridge construction schedule that will work within these considerations.

City of Burnaby

- The spatial boundaries for the study area (30 metres) appear to be inadequate to capture the full impacts. Flowing water and aquatic life are not static to those regions and can be impacted further away from the highway corridor.

Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008

The spatial boundaries for the assessment were reviewed and accepted by regulatory agencies for the Project and are consistent with typical boundaries for this type of project. The methods and boundary for fisheries and aquatic resource assessment for PMH1 are consistent with other environmental impact assessments and permitting processes completed in the Lower Mainland.

- Marsh H1-139 in the northern cloverleaf at Willingdon Avenue has important flood cell value. When Still Creek floods in winter months, it backs into this cell. On-site mitigation should include a review of enlarging this pond / marsh cell.

Stormwater management contributions at the Willingdon Interchange will be considered during preliminary drainage design. MOT will continue to work with City of Burnaby to explore these options and ideas.

- The PMH1 Project extends for 15 kilometres through the Brunette / Still Creek watershed, and the cumulative impact could be devastating for the system. The City requests strong and enforced BMPs for water quality and sediment control and that larger perspective of the complete watershed be considered.

The OTCA commits to the development of Surface Water Quality and Sediment Control Plan that includes a stormwater management plan, an Environmental Monitoring Plan and a Fisheries Habitat Mitigation Plan. The percentage increase in impervious area contributed by the Project will be 0.6%, for the Brunette watershed and 2% for the Como watershed. To offset these increases, MOT has committed to no net increase in runoff rates from the Project site in areas with approved integrated stormwater management plans.

City of Surrey

- The current PMH1 median and ditches provide for infiltration and stormwater retention. Reduction of the median width will have an impact which will need to be addressed as part of the drainage mitigation works.

The OTCA commits to no net increase in runoff rates to discharge from the Project limits in areas with approved integrated stormwater management plans.

- The City of Surrey requires any parties doing construction within the City limits to obtain an Erosion and Sediment control permit for their project. The permit also has requirements for all phase sediment control plans and regular submission of monitoring reports.

The OTCA commits that the Contractor will obtain all Permits which relate to, or are required under Environmental laws in connection with the Project and the Project works. Where Project work is required on municipal lands, the Project will obtain all relevant Permits.

- The feasibility of proposed habitat compensation sites within Coquitlam must be evaluated with the City. Habitat compensation projects that may be proposed on or adjacent to the City's parkland will be supported if:
 - The lands are not required by the City for habitat compensation works for future City transportation infrastructure projects;

- A plan is prepared and approved by the City and senior agency responsible for compensation works that shows how the proposed compensation plans incorporate the existing or planned uses of the parkland or where there is insufficient land to accommodate the proposed compensation works and existing and proposed park uses, that additional adjacent land of sufficient quantity is provided at no cost to the City;
- Gateway provides adequate resources to cover the establishment period of the habitat compensation areas as determined by the senior agency responsible for approvals; and
- The habitat compensation works do not result in a net loss of functional active and passive park space, and do not pose a financial burden on taxpayers and that affected areas become community assets rather than liabilities.

MOT will continue to work with the City of Coquitlam to develop habitat compensation that is feasible and practical. MOT will continue discussions with respect to both habitat banking candidates that could be constructed in advance of the Project as well as habitat compensation works, that are dependent on the Project schedule and staging. Habitat compensation plans proposed for lands owned by the City of Coquitlam will be provided for review by the City to ensure that existing and planned uses of the parkland are accommodated and that lands are not required for future City transportation infrastructure projects. The PMH1 project will ensure that vegetation in riparian and aquatic compensation habitat areas has achieved 90% survival as established through a 3-year post-construction monitoring program prior to handback to the City.

- The Application recommends land acquisition that would provide strategic opportunities for habitat banking in areas surrounding the PMH1 project. The City is concerned that the broader needs of each watershed and whether or not there are more appropriate places to site habitat restoration and enhancement works are not being considered.
Habitat compensation will approximately correspond to losses in each watershed. Discussions regarding potential sites for habitat restoration and enhancement been taking place with municipal staff, stewardship groups and DFO since 2003 and are ongoing.

Vancouver Fraser Port Authority

- Please advise if proposed fish habitat and riparian habitat mitigation plans for the south side and north side of the proposed bridge crossing will encroach into the secondary channels. The VFPA does not permit proponents to plant compensation within port authority lands because it can render the land unusable for port use (in this case, the south side, within the CN Thornton Yards area. The north side already contains highly sensitive habitat features and functions, and is currently red-coded as outlined in the FREMP Habitat Colour Coding Classification System.
Habitat compensation concepts for the PMH1 project have not been proposed on the south side of the proposed Port Mann crossing. Concept 26 of Appendix 11F of the Application identifies a proposed concept for

the north side area under the Port Mann Bridge. No encroachment into the secondary channel is planned.

The Kwikwetlem First Nation

- The Kwikwetlem maintains a provincially licensed Fraser River salmon fishery in the waters between Douglas Island and the Pattullo Bridge. If construction or operation of the PMH1 project affects the Kwikwetlem's ability to fish in the Fraser River, such effects would carry a social and cultural dimension.
As marine users of the waters in the vicinity of the Port Mann Bridge, Kwikwetlem First Nation will continue to be invited to engage in discussions regarding their use of the waterway and potential Project effects. To date, the Project team has met with the Kwikwetlem First Nation on a number of occasions since 2003 and has provided the Kwikwetlem First Nation with draft and final impact assessments, including those for fish and aquatic habitat. The Project team has also met with other river users including commercial fishers and tug boat operators. MoT is aware of the importance of the Fraser River fishery to the Kwikwetlem First Nation and will continue to engage the Kwikwetlem First Nation in appropriate and related discussions.
- The mouth of Bon Accord Creek and associated wetlands, near the south side of the Port Mann Bridge, comprise an important traditional and contemporary aboriginal use area for members of the Kwikwetlem. Members of the Kwikwetlem and their technical consultants must be involved in the design and implementation of any habitat compensation plans and monitoring of construction that will take place in this area.
Habitat compensation works in the Bon Accord drainage will be undertaken as part of the South Fraser Perimeter Road. Where possible, impacts to the watercourse as a result of the PMH1 project will be avoided. Habitat compensation works in this drainage have been proposed, primarily because of the fisheries habitat enhancement potential. For any compensation works undertaken in this drainage, Kwikwetlem First Nation will be notified and invited to participate.
- The Kwikwetlem have experience and direct involvement in the enhancement of fish habitat, and act as guardians of fish habitat and fishing sites in the Coquitlam River and other watersheds within their traditional territory. The Kwikwetlem would like to be involved in the design, planning and monitoring of habitat enhancement projects in their traditional territory within the Project corridor.
MoT will continue discussions with Kwikwetlem First Nation regarding the potential for involving Kwikwetlem First Nation members in the process associated with the design, planning, and monitoring of habitat enhancement projects in their traditional territory along the PMH1 corridor.
- Whenever possible, fish habitat compensation should be developed in the location where the Project impact has occurred.
Habitat compensation will be developed in accordance with DFO requirements and will depend on feasibility and optimizing value to the

resource. For habitat compensation works in the Gagliardi Interchange, King Edward underpass, Cape Horn Interchange, Dawes Hill Creek, under the Port Mann Bridge, Bon Accord Creek and 160th Street and the 176th Street Interchange, Kwikwetlem First Nation will be notified and invited to participate, and as members of the PMH1 EAO Working Group, have been invited to provide comments on these compensation concepts.

Kwantlen First Nation

- The construction activities associated with the pier placement for the Port Mann Bridge should consider the need to provide "quiet times" for the migration of at risk populations of spring Chinook salmon migrating to the middle and Upper Fraser during the in-stream work window (March 1 – June 15).
MoT response pending.
- Construction activities may need to provide quiet times for local fishing activities that may involve Kwantlen (and other area First Nations) near and about the project area – targeting Chinook (late February – April) or Eulachon (April – June), Sockeye and/or summer Chinook fisheries (mid-July through August), as well as Chum salmon, late Sockeye and Chinooks (mid-October – November). Times and dates may vary according to management plans that are not completed.
MoT response pending.
- Kwantlen is on record opposing the continued fish passage impedance and loss of ecosystem connectivity caused by the original construction of Highway 1. Plans should be completed to provide ecosystem connectivity (including fish passage and wildlife) for all of the culvert crossings.

8.5.2 Water Quality and Stormwater Management Issues

Fisheries and Oceans Canada

- DFO storm water management guidelines (<http://www.dfo-mpo.gc.ca/Library/277957.pdf>) are to be used to meet the commitment to improve the existing water quality within the PMH1 corridor. The DFO storm water guidelines are the design criteria currently required of municipal governments within the Lower Mainland.
MoT response pending.
- DFO requests the development of a stormwater management and water quality management plan that clearly identifies a range of infrastructure conditions that may feasibly be applied by the Contractor. A monitoring plan that considers baseline water quality data, effectiveness of mitigation and BMPs during construction, and effectiveness of stormwater infrastructure post construction over the short and long term should be identified.
All stormwater infrastructure within the Project area will be assessed by the Contractor for its adequacy to perform under the post-construction conditions during the detailed design phase of the Project. The

*Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008*

Contractor will also prepare a stormwater management plan consistent with the requirements of the regulatory agencies and Project design criteria during the detailed design phase of the Project. Monitoring plans will be prepared and implemented by the Contractor as part of the Project requirements for construction and operation. During construction, an Environmental Monitoring Plan and Surface Water Quality and Sediment Control Plans will be required. During operations, the Environmental Management Plan will outline management of storm water and surface water runoff and maintenance of storm water management features and facilities. MOT will ensure that stormwater management infrastructure for the Project is designed, constructed and maintained, by the Contractor, in accordance with the most stringent design criteria and performance objectives outlined in the EAC Application, and the Contract Agreement.

- Clarification is requested regarding why mitigation is only considered for new or replacement structures, how water quality BMPs will be developed in conjunction with adjacent fish habitat compensatory works, and where and how water quality BMPs will be employed given limited land availability within corridor.

Given the majority of structures on the Project are identified as new or replacement, this represents a significant commitment for the Project and will result in improved handling of stormwater related to watercourses supporting fish habitat throughout the PMH1 corridor. As the design of the Project has not been determined, specific methods and locations that BMPs will be employed have not yet been confirmed. It will be a design requirement that a site not simultaneously act as both compensation and water settling, however it could serve as treatment during construction and as compensation during operation.

Transport Canada

- The Total Impervious Area (TIA) data for each watershed used in the Application is 10 years old, and since there has been significant development in some of these watersheds, the current TIA must be greater. There must also be a point reached within a watershed where the TIA is no longer sufficient to provide base flows for the streams. Has this point been determined for each of the watersheds and has this been assessed in determining current stormwater management conditions?

The review of effects on TIA was prepared using readily available, published information. Since it is likely that the TIA has changed in the last 10 years due to residential, commercial and industrial development occurring in each drainage, it would be expected that the effect of the Project, when compared to any updated TIA information on a percentage basis, would decrease. Regarding potential changes in base flows and water quantity, MOT has committed to no net increase in runoff rates from the Project site, in areas with approved integrated stormwater management plans.

- The residual effects for potential changes in base flows and water quantity should also be considered in the cumulative effects assessment.

Based on the commitment above, residual effects are expected to be short-term and reversible and therefore, were not identified as a VEC requiring assessment in the cumulative effects assessment.

Environment Canada

- The water quality data should be compared to appropriate reference sites in order to better quantify the effects of project related inputs to water quality.
There are no suitable reference sites for comparison to water quality data at any of the 26 sampling sites were not available given the urban location of the study area and the many factors that impact water quality. ~~MOE and EC are continuing discussions~~
- The Surface Water Quality and Sediment Control Plan (page 13-24) should identify requirements for additional water quality monitoring prior to and during construction to ensure preventative and mitigation measures can be taken as appropriate, and include a BMP maintenance plan to ensure BMPs implemented are functioning as expected and corrective actions are taken when required.
The OTCA requires that in addition to the requirements for the Surface Water Quality and Sediment Control Plan described in Chapter 27 of the EAC Application, the plan will also:
 - *Identify requirements for additional water quality monitoring prior to and during construction to ensure preventative and mitigation measures can be taken as appropriate, to avoid impacts to water quality;*
 - *Include a BMP maintenance plan to ensure BMPs implemented are functioning as expected and corrective actions are taken when required; and*
 - *Be submitted to Environment Canada and other relevant agencies at least thirty (30) days prior to start of construction activities for review.*
- EC requests that both construction and operational EMPs and any associated sub-plans be submitted to EC at least 30 days prior to the start of construction activities for review and acceptance.
The OTCA requires that EMP sub-plans for surface water quality and sediment control, environmental monitoring, emergency spill response, containment and management, and construction waste management be submitted to EC at least thirty (30) days prior to the start of construction activities for review.
- One of the project's performance criteria is "no stormwater discharge directly from new interchange or overpass structures into watercourses supporting fish and fish habitat, except in the case of events with a greater than 10 year return period". It is unclear whether existing structures will discharge directly to receiving waters, or how the stormwater from the interchanges and bridge deck will be incorporated into the overall stormwater management plan. EC requests

further clarification on this issue, as it appears that general performance criteria only apply to those areas requiring replacement.

Given the majority of structures on the Project are identified as new or replacement, this represents a significant commitment for the Project and will result in improved handling of stormwater related to watercourses supporting fish habitat throughout the PMH1 corridor. As the design of the Project has not been determined, specific methods and locations that BMPs will be employed have not yet been confirmed. These will be developed as part of the detailed design, in accordance with the specified design criteria.

Ministry of Environment Environmental Protection Division

- Mitigation measures are not outlined other than in general terms: implementing standard BMPs for stormwater. A more complete picture of what mitigation efforts will be undertaken needs to be provided.

The OTCA commits that MoT will ensure that stormwater management infrastructure for the Project is designed, constructed and maintained in accordance with the most stringent design criteria and performance objectives outlined in the EAC Application, and the Contract Agreement. MoT and Transport Association of Canada (TAC) standards will govern. Where the MoT and TAC do not have design criteria, and at the interface with municipal drainage systems, municipal design standards and guidelines will be used if applicable. Refer to commitments 5.1 to 5.3 of the OTCA for a complete listing of commitments.

- The post-construction monitoring period should be significantly extended. The Application refers to residual effects that may arise from a one year post construction monitoring period. The Project has the potential to significantly increase the number of vehicles utilizing this corridor not only from increased use of the highway but also as a result of increased urban development that is anticipated.

Urban growth is regulated by land use decisions, through municipal Official Community Plans and monitored by Metro Vancouver. No municipalities have advised that the impact of the types of improvements proposed for PMH1 will affect changes in land use planning. Traffic demand will be managed through a suite of congestion-reduction measures. Post-construction environmental monitoring and reporting will be conducted in accordance with the terms and conditions of the Environmental Advisory Committee and other regulatory permits, approvals and authorizations.

City of Burnaby

- While the increase in total impervious area is small when compared to the total Brunette River watershed, the greatest impacts will be to minor local streams and tributaries that may see increases in total impervious area of up to 25%. This applies in particular to those that draw all of their drainage from the freeway right-of-way that are not included in this study which only indicates "major" crossings.
The OTCA commits to the assessment of stormwater infrastructure for hydraulic effects on smaller streams and tributaries.
- The parameters for infiltration and detention should be clearly defined, since what is best for the local tributary may not necessarily be the best for the Brunette River (or visa versa), as the time of concentration varies greatly on these systems.
Performance criteria for stormwater management are discussed in the Application. The actual parameters for infiltration and detention are to be determined during detailed design. The OTCA requires the Contractor to comply with definitive performance criteria for runoff and stormwater management, including those for infiltration and detention facilities.
- Drainage reviews have indicated that MoT crossing culverts at Sumner Creek, Guichon Creek, Sprott Street, Ramsay Creek, Cedar Creek, and Lost Creek are all undersized for the 100-year design flows. All cross culverts should be reviewed as to capacity, condition, and fish passage. Extending undersized outlet controlled culverts will only further reduce the crossing capacity and restrict fish passage.
For new or replacement culverts, the OTCA commits the Contractor to take into account environmental commitments in relation to length, material, bottom treatments and current ability to pass fish and/or provide wildlife passage.
- As a part of the Environmental Management Plan, a Surface Water Quality and Sediment Control Plan will be developed. Clarification is required on whether the City will be provided with these plans for review and comment prior to implementation.
The OTCA commits that relevant agencies will have the opportunity to be involved in the review process for the proposed relevant Environmental Work Plans.

City of Surrey

- The increase in the PMH1 impervious area discharging to the Serpentine and Fraser River tributaries from the Highway widening is estimated to be 21% and 7% respectively. These increases will have effects on the receiving waterways. The City has documented erosion concerns in the receiving streams from the existing highway, indicating that volume and flow mitigation are required to prevent accelerated loss in downstream stream corridors.
The Project will continue to discuss site-specific concerns with the City of Surrey including those regarding drainage and erosion. MOT will ensure

that erosion is minimized by maintaining existing flow velocities at the discharge points, as stated in the Application.

- The increase in Total Impervious Area (TIA) over a whole watershed looks small, but on high-end local tributaries, the effects can be significant. The impact of TIA change on each tributary should be examined individually and appropriate measures taken to minimize impacts. There should be no, or minimal, net increase in runoff to any receiving waterway.

The Application states that the Contractor will be required to adhere to the following performance criteria: no net increase in runoff rates to discharge from Project limits for 5 year return period events for areas with approved ISMPs. However, the inclusion of any new ISMPs after the Project award will require further dialogue. Additionally, the Contractor will be required to consider the Master Drainage Plans and undertake appropriate assessments and measures to ensure that they are compliant with the criteria.

City of Coquitlam

- The City seeks assurances that BMPs to control runoff rates and water quality during construction and operations phases will be followed to ensure that water quality downstream of the highway infrastructure will not be degraded as a result of these works. It would be beneficial to try to separate and treat surface runoff from first flush rainfall events from highway surfaces prior to discharging runoff to receiving watercourses. This could be achieved by providing facilities for the retention of runoff from low intensity high frequency rain falls.

A stormwater management plan consistent with the requirements of the regulatory agencies will be prepared during the detailed design phase of the Project. The performance objectives for this plan, including BMPs, have been provided in the Application. All stormwater infrastructure within the Project area will be assessed for its adequacy to perform under the post-construction conditions. This assessment will be conducted during the detailed design phase of the Project. During operations, the Environmental Management Plan will outline management of stormwater and surface water runoff and maintenance of stormwater management features and facilities. Stormwater management plans will be provided to regulatory agencies and City of Coquitlam staff for review.

Kwikwetlem First Nation

- Best Management Practices should be utilized as guidelines in the development of the Stormwater Management Plan for the Project. Regular monitoring of the Stormwater Management Plan recommendations should be a commitment in the OTCA.

The OTCA commits that MoT will ensure that stormwater management infrastructure for the Project is designed, constructed and maintained in accordance with the most stringent design criteria and performance objectives outlined in the EAC Application, and the Contract Agreement. MoT and Transport Association of Canada (TAC) standards will govern. Where the MoT and TAC do not have design criteria, and at the interface

with municipal drainage systems, municipal design standards and guidelines will be used if applicable. Refer to commitments 5.1 to 5.3 of the OTCA for a complete listing of commitments.

Kwikwetlem First Nation

- The Kwikwetlem First Nation requests that no pre-load materials or aggregate be obtained for the Project from the Coquitlam River watershed quarry until the quarry operator has improved the on-site containment ponds. The quarry is contributing to sedimentation and degradation of fisheries habitat in the river system due to poor containment of pit runoff.

All work shall be in accordance with federal, provincial and municipal environmental regulations as well as MoT Standard Specifications. These commitments will be further specified in the Table of Commitments and Assurances. If the Contractor is in violation of the regulations then MoT has the ability to issue a stop work order and could decide on not accepting any gravel from that operation. Ministry pits have been identified in the contract for potential use by the Contractor. It is anticipated that the Contractor will use those Ministry pits rather than private sources because of the lower costs associated.

8.6 EAO and RA Conclusions

9.0 VEGETATION RESOURCES

Chapter 14.0 in Volume II of the Application describes the vegetation resources within the PMH1 project area, the potential impacts of the Project, and the proposed mitigation and compensation measures.

9.1 Background

Vegetation resources have been assessed within a 500 m wide corridor (250 m each side of the Highway 1 centreline) that extends the approximately 37 km between McGill Street in Vancouver and 216th Street in the Township of Langley.

9.1.1 Study Area Ecosystems

The ecosystems within the study corridor are a mix of:

- Urban vegetated areas (parks, golf courses and boulevards);
- Agricultural lands (pasture, crops and fallow fields);
- Grassland and shrubland (managed vegetation and disturbed sites within the Highway 1 RoW);
- Wetlands (natural and modified/man-made); and
- Forest (upland and wetland).

Six forested ecosystems (site series) were mapped within the PMH1 study corridor using Terrestrial Ecosystem mapping (TEM):

- Western red cedar – Sword fern;
- Western red cedar – Foamflower;
- Sitka spruce – Salmonberry;
- Western red cedar/Sitka spruce – Skunk cabbage;
- Western red cedar – Salmonberry; and
- Western red cedar – Black twinberry.

TEM is a mapping of capability or potential. Each ecosystem (site series) name reflects the climax ecological community that will exist after natural succession has run its course following a disturbance such as logging or fire. At present, much of the forest within the study corridor comprises broadleaf or mixed (broadleaf/coniferous) stands that are young, successional stages of the six climax coniferous forest ecosystems. Left to mature without disturbance, they will develop into the climax coniferous forest ecosystems.

The total areas of forested and non-forested ecosystems present within the PMH1 study corridor are presented in Tables 9-1 and 9.2. These are predominantly young and highly fragmented ecosystems.

9.1.2 Ecological Communities at Risk

The BC Conservation Data Centre (CDC) identifies ecological communities at risk, and their tracking list shows that nearly all of the climax forested communities within the lower Fraser Valley are either blue or red-listed. This is indicative of the relatively high level of urban, industrial and agricultural development in the region, which has reduced the occurrence of natural ecosystems. Red-listed ecological communities are extirpated, endangered, or threatened in BC. Blue-listed communities are native considered to be vulnerable in BC.

Within the PMH1 study corridor, ecosystems (not ecological communities) were mapped, and although the terms "ecological community" and "ecosystem" are often used interchangeably, they are not equivalent.

- An ecological community has a specific assemblage of vegetation, and is the stable, climax (or near climax) community that will exist after natural succession has run its course. It is named after two or three plant species that characterize or dominate the community. For each ecological community there is a description of the structure and species composition. There is always some variation, but for a given site, the vegetation species and structure must fall within the expected range of the ecological community before it is considered an element occurrence (EO) of that community.
- An ecosystem on the other hand, refers to the abiotic, biotic and ecological processes on a site, and represents the "habitat" for specific ecological communities at risk, which may or may not occur there.

Since TEM is widely used in resource management in BC, the CDC has adopted the nomenclature, and cross references ecological communities at risk with those ecosystems that provide the "habitat" in which they occur.

*Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008*

Comment [JH3]: The definition of blue-list has changed to "list of ecological communities, and indigenous species and subspecies of special concern (formerly vulnerable) in British Columbia." See: <http://www.env.gov.bc.ca/atrisk/glossary.html#b>

The CDC has identified the following six forested ecological communities as either red-listed or blue-listed within the lower Fraser Valley:

- Western red cedar – Sword fern;
- Western red cedar – Foamflower;
- Sitka spruce – Salmonberry;
- Western red cedar/Sitka spruce – Skunk cabbage;
- Western red cedar – Salmonberry; and
- Western red cedar – Black twinberry.

The sites within the study corridor that are mapped as forest ecosystems of the same name are not blue or red-listed, but represent habitat where these ecological communities at risk may occur.

Which forested sites (map units) within the study corridor are actually EOs of these ecological communities at risk? The most likely sites are those where the current assemblage and structure of vegetation falls within the expected range for one of the blue or red-listed ecological communities. The six blue and red-listed ecological communities are all mature coniferous forest; therefore sites with young to mature coniferous forest or mature mixed forest are the most probable candidates. Sites currently vegetated with broadleaf and mixed forests forest at the tall shrub, pole sapling and young structural stages are not likely to be EOs. They do however have the potential to develop into an ecological community at risk, and as such represent recruitment potential for the blue and red-listed coniferous ecological communities.

None of the non-forested ecosystems within the study corridor are ecological communities at risk.

9.1.3 Plant Species at Risk

One plant species at risk was found within the PMH1 study corridor during the field surveys. The blue-listed Nuttall's waterweed (*Elodea nuttallii*) was observed within the Como Creek wetland, east of Schoolhouse Street between Lougheed Highway and Highway 1 (Figure 14A-11, map unit 228 in the Application). Wedged between Lougheed Highway to the north, Highway 1 to the south, and commercial development to the west, the habitat for the Nuttall's waterweed consists of a grass/wetland complex, with the species located in the shallow confines of a narrow creek. Blue-listed species are considered to be vulnerable in BC. The population of Nuttall's waterweed is probably of negligible significance, as it is unlikely that additional, substantial rare plant populations exist within the mostly altered landscape along Highway 1.

No other blue or red-listed plant species were observed, likely due to the paucity of suitable habitats stemming from historic land disturbance and present land uses.

10.2 Impacts of Project Design

Project-related vegetation loss will occur primarily within the existing ROW, except at several interchange locations. Ecosystem impacts will be primarily related to the loss of wetlands in man-made highway ditches and drainage channels, and the loss of the forest edge along the alignment.

*Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008*

Comment [JH4]: This assessment of the sites that are EOs was confusing. A reference to Table 9-1 would be helpful. Are the rows highlighted in the Table are the "most probable candidates" to be EOs? According to the assessment in this paragraph, should the row with the young coniferous forest also be highlighted?

Comment [JH5]: See comment p. 52

Comment [JH6]: This statement and assessment of significance is subjective and doesn't make sense from a conservation perspective; if it is the only population then doesn't that increase its significance?

The PMH1 project will in general affect the edges of ecosystems, as opposed to cutting through and fragmenting units as is the case in new linear projects, and will constitute an incremental impact to that which occurred in the Lower Fraser Valley when Highway 1 was first constructed.

9.2.1 Forested Ecosystems

The potential loss of forested ecosystems due to the PMH1 project is summarized in Table 9-1. A total of 35.8 ha of forest ecosystems will potentially be lost comprising:

- 30.3 ha of broadleaf forest;
- 5.0 ha of mixed forest; and
- 0.5 ha of coniferous forest.

Of this, approximately 13.2 ha, located at the Grandview Interchange, Gaglardi Interchange, east side of the Port Mann Bridge, 160th Street Interchange, 192nd Street Interchange and east of 216th Street is considered to be good quality native forest.

Comment [JH7]: What is the definition of "good quality native forest"?

Table 9-1: Potential Loss of Forest Ecosystems due to the PMH1 Project

Ecosystem Name (=Site Potential)	Current Vegetation on Site		Total Area Present (ha)	Potential Loss (ha)
	Forest Type	Structural Stage		
Western red cedar – Sword fern	Broadleaf forest	Tall shrub	2.8	<0.1
		Pole sapling	57.6	5.1
		Young forest	366.2	22.5
Western red cedar – Foamflower		Young forest	0.3	0
Sitka spruce – Salmonberry		Pole sapling	2.7	0.4
		Young forest	16.3	0.6
Western red cedar/Sitka spruce – Skunk cabbage		Tall shrub	0.6	0
		Young forest	0.5	<0.1
Western red cedar – Salmonberry		Young forest	24.1	0.9
Western red cedar – Black twinberry		Pole sapling	0.5	<0.1
	Young forest	9.4	0.7	
Total Broadleaf Forest			480.8	30.3
Western red cedar – Sword fern	Mixed forest (broadleaf/ coniferous)	Pole sapling	1.7	<0.1
		Young forest	98.8	4.2
		Mature forest ¹	36.0	0.8
Western red cedar – Foamflower		Young forest	0.2	<0.1
Total Mixed Forest			136.8	5.0
Western red cedar – Sword fern	Coniferous	Pole sapling	<0.1	0
		Young forest	5.1	0
		Mature forest ¹	14.4	0.5
Total Coniferous Forest			19.6	0.5

- ¹ Potential for occurrence of blue-listed Western red cedar – Sword fern ecological community.

9.2.2 Non-forested Ecosystems

The potential loss of non-forested ecosystems due to the PMH1 project is summarized in Table 9-2, and includes:

- 113.6 ha of grassland and shrubland within the existing Highway 1 RoW;
- 2.4 ha of modified wetlands within the existing Highway 1 RoW. These wetlands have developed within man-made ditches and low lying areas and are not representative of natural ecosystems;
- 1.2 ha of urban vegetated areas; and
- 5.8 ha of agricultural land.

None are ecosystems at risk listed by the CDC.

Table 9-2: Potential Loss of Non-forested Ecosystems Within the PMH1 Study Corridor

Ecosystem	Type	Total Area Present (ha)	Potential Loss (ha)
Grassland and shrubland within the Highway 1 RoW	Grassland	254.9	Existing impacted areas from construction operation and maintenance of Highway 1
	Shrubland	90.9	
	Total Grassland and Shrubland	345.8	113.6
Wetland	Graminoid wetland	6.3	2.4
	Cattail marsh/ditch	5.2	<0.1
	Shrub swamp	4.7	0
	Canal	1.2	0
	River	2.1	<0.1
	Total Wetland	32.9	2.4
Urban Vegetated	Planted trees	2.88	0.7
	Urban park	16.1	0.5
	Golf course	13.9	<0.1
	Total Urban Vegetated	32.9	1.2
Agricultural Land	Mixed acreages/farmland	95.6	2.9
	General agricultural lands	45.2	2.4
	Fallow field	24.7	0
	Pasture	22.8	0.6
	Total Agricultural Land	188.2	5.8

9.2.3 Ecological Communities at Risk

Of the 35.8 ha of forested ecosystems that will be lost, those at the mature forest structural stage (1.3 ha in total) are the most likely to be EOs of a rare ecological community. These comprise:

- The 0.5 ha of Western red cedar – Sword fern ecosystem currently at the mature coniferous forest stage; and
- The 0.8 ha of Western red cedar – Sword fern ecosystem currently at the mature mixed forest stage.

Both are highlighted in Table 9-1

An element occurrence ranking would be required to assess whether the EOs are ecologically viable and have practical conservation value. Ecological viability is a function of size, landscape context and condition.

The remaining 34.4 ha of forested ecosystems that will be lost are at younger structural stages (tall shrub, pole sapling and young forest). Younger structural stages generally do not represent the at-risk ecological community, but may have the potential to develop into the community with time, and as such may provide recruitment.

9.2.4 Plant Species at Risk

In the vicinity of the Coleman on-ramp, there will be encroachment on the wetland habitat for the Nuttall's waterweed, which could adversely impact the local population.

9.3 Potential Construction and Operation Impacts

During project construction, there are four potential impacts of concern:

- Disturbance of ecosystems adjacent to the project footprint from construction activities;
- Windthrow along newly exposed forest edges;
- Reduction in water quality and/or quantity within natural ecosystems, particularly wetlands; and
- Introduction and spread of invasive plant species and noxious weeds, which compete with and displace native species, reducing the quality of natural ecosystems.

During the operational phase of the PMH1 project, the introduction and spread of invasive plant species continues to be a potential impact of concern. s.13

9.4 Proposed Impact Avoidance, Mitigation and Compensation Measures

Design based (footprint) impacts on native vegetation have been and will continue to be minimized through Project planning and design.

Potential construction and operational phase impacts on vegetation will be also be addressed through an Environmental Management Plan (EMP) and series of site specific Environmental Protection Plans (EPPs) that will be prepared by the contractor prior to construction. The EMP will have the following components:

- Fisheries and Wildlife Habitat Mitigation and Compensation Plans;

*Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008*

- Construction Environmental Management Plan (CEMP); and
- Operational Environmental Management Plan (OEMP).

The impact avoidance and mitigation strategies for vegetation in the EMP sub-plans will be based on the recommendations in Chapter 14 of the Application (the Terrestrial Resources Impact Assessment). The EMP will outline how these guidelines are to be implemented, and provide performance-based expectations that are to be met by the contractor. Site specific impact avoidance and mitigation measures will be provided in EPPs.

Greater than 100% of the 2.4 ha of modified wetlands (ditches) that will be lost within the existing Highway 1 RoW through ditch re-location and fisheries and wildlife habitat compensation.

Comment [JH9]: Insert "will be compensated for" here?

Mitigation for Nuttall's waterweed includes delineation of the footprint prior to clearing and grubbing, performing pre-construction surveys, salvage and replanting, and reporting to the Conservation Data Centre. The Coleman Ramps wetland habitat where this species occurs will be re-established through compensation measures.

Section 14.0 of the Owner's Table of Commitments and Assurances (OTCA) contains the following commitments:

- Preserve to the extent possible, native trees and understory plants in areas outside of the actual roadwork footprint where safety or infrastructure requirements are not of concern. Where trees must be removed, use close cut or no grubbing techniques where possible. Replant using native species to assist in the control of noxious and invasive weeds.
- Follow the design criteria outlined in the MoT Manual of Aesthetic Design Practice and MoT's Landscape Policy and Design Standards that form the landscape and site restoration design criteria for the project.
- Retain as much of the median greenspace as possible and consider opportunities to restore vegetation;
- Minimize potential impacts to native vegetation communities by implementing Best Management Practices for weed species management.
- For red- and blue-listed plants and plant communities:
 - Undertake site-specific vegetation surveys in accordance with the regionally supported *Protocols for Rare Plant Surveys*, to identify the presence and distribution of re- and blue-listed plant species and vegetation communities;
 - Provide information on the presence and distribution of such plant species to MoE for review, and use this information to guide final design and construction to avoid or mitigate impacts to these species;

- Develop a plan for salvaging plants and seeds, for review by MoE, where impacts to red and blue listed plant species cannot be avoided, and replant listed plant species, where feasible, at an off-alignment site;
- Drain stormwater and road runoff away from red and blue listed plant communities, and do not construct integrated stormwater management infrastructure in such habitat areas; and
- Avoid direct impacts to sensitive red and blue listed plant communities where possible, and adhere to construction exclusion windows determined by regulators.

Mitigation and compensation for Project impacts on fish (refer to Section 8.0, Fisheries and Aquatic Resources) and on wildlife species at risk (refer to Section 10.0, Wildlife Resources), which will include land acquisition and protection and habitat enhancement, will also mitigate potential impacts on vegetation.

9.5 Residual Impacts on Valued Ecosystem Components

Residual environmental effects are defined as those changes, either positive or negative, that remain and influence an environment after implementation of project mitigation and compensation measures. For the PMH1 Project, potential residual effects to vegetation resources with a potentially moderate to high ecological consequences were limited to:

- Nuttall's Waterweed. There could be a temporary loss of the Nuttall's waterweed colony in the man-made wetland near the Coleman on-ramp. Wetland compensation habitat will be constructed on-site, and the recruitment potential from a Nuttall's waterweed population in the adjacent Colony Farm Regional Park is considered high. Long term residual impacts are therefore not anticipated.
- Mature Mixed and Coniferous Forests. 13.2 ha of good quality forest will be permanently lost, 1.3 of which is mature mixed and coniferous forest, and the remainder young forest. Habitat compensation and maintenance measures will be used to re-establish areas of mature forests.

Comment [JH10]: Should note here that it will take many years before this mature forest is re-established (mature forest cannot be immediately created).

9.6 Key Issues Raised by the Working Group and Proponent Responses

Key issues identified by the Working Group during the Application review and MoT's responses and commitments (in italics), as appropriate, are summarized below. Refer to the Biophysical Issues Tracking Table (Appendix XX) for an expanded description, and to Section 14.0 of the OTCA for the complete listing of the commitments.

Comment [JH11]: Issue 93 in the Biophysical table raised by ESD falls into this section.

City of Coquitlam

- The City seeks assurance that it will commit to implement an invasive plant management strategy to ensure that the existing disturbed areas within the Project corridor are not adversely impacted.
The OTCA commits to implementing BMPs for weed species management.

- The City is concerned about the proposed habitat losses for red-and blue-listed plant communities.

Impacts to listed plant communities within the City of Coquitlam are anticipated to be minimal, and are predominantly restricted to between North Road and Brunette Avenue, north of Lougheed Highway and under the Port Mann Bridge. Section 14.0 of the OTCA commits to a series of impact avoidance and mitigation measures for listed plant communities.

- The proposed mitigation strategy for the blue-listed Nuttall's waterweed is inadequate.

Mitigation during construction for Nuttall's waterweed includes delineation of the footprint prior to clearing and grubbing, performing pre-construction surveys, salvage and replanting, and reporting to the Conservation Data Centre. The Coleman Ramps wetland habitat where this species occurs will be re-established through compensation measures.

9.6 EAO and RA Conclusions

10.0 WILDLIFE

Chapter 14.0 in Volume II of the Application describes the wildlife resources within the PMH1 Project area, the potential Project effects, and the proposed mitigation and compensation measures.

10.1 Background

As with vegetation resources (Chapter 10), the wildlife resources have been assessed within a 500 m wide corridor (250 m each side of the Highway 1 centreline) that extends the approximately 37 km between McGill Street in Vancouver and 216th Street in the Township of Langley.

Terrestrial wildlife habitat is assessed in this chapter. Aquatic and riparian habitat, and associated impacts, mitigation and compensation are discussed in the context of fisheries resources in Chapter 9.

10.2 Wildlife Resources

10.2.1 Wildlife Habitat

Within the last century, development has reduced the number and overall area of natural habitats in the Lower Mainland. Those habitats that remain are fragmented and adversely affected by adjacent land use, with varying consequences for wildlife depending on the type of adjacent land use and the adaptability of the species in question.

The wildlife habitat within the PMH1 study corridor is a mix of:

- Urban vegetated areas (parks, golf courses and boulevards);

*Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008*

- Agricultural lands (pasture, crops and fallow fields);
- Grassland and shrubland (managed vegetation and disturbed sites within the Highway 1 RoW);
- Upland forest; and
- Modified wetland.

s.13

Table 10-1 (forested ecosystems) and Table 10.2 (non-forested ecosystems) provide the hectares of the various habitat types present within the PMH1 study corridor.

The forest habitats within the PMH1 study corridor are predominantly young, and fragmented. Agricultural land and highly disturbed and modified grassland and shrubland communities dominate the non-forested areas along the alignment. Wetland ecosystems are not common within the proposed development corridor. Those that are present have typically developed in ditches where reed canary grass or cattails dominate.

10.2.2 Wildlife Species

In the Lower Mainland, within which the PMH1 Project is located, the reduction in number and overall area of wildlife habitats has reduced regional biodiversity, especially with respect to wildlife species that depend on older growth coniferous forest, mature riparian forests and wetlands. In general, those species that are able to use habitat edges and fragmented areas of young successional vegetation are doing well, while those that depend on specialized habitats or on larger, intact areas of mature vegetation such as mature coniferous forest have been significantly diminished, and in some cases locally extirpated.

The PMH1 wildlife assessment has documented the presence of a broad range of mammal, bird (raptors, passerines and water-associated birds), amphibian reptile and insect species within the Project study corridor. Included are seven provincial Red- and Blue-list species, which are listed along with their conservation status and location within the PMH1 corridor in Table 10-1. Red-listed ecological communities are endangered or threatened in BC. Blue-listed communities are native considered to be vulnerable in BC.

Comment [JH13]: See comment p. 52

Table 10-1: Wildlife Species at Risk Documented Within the PMH1 Study Area			
Occurrence	CDC/SARA Conservation Status	Highway Segment	Location
Listed Wildlife			
Red-legged Frog	CDC: Blue list SARA: Special concern	164	North of Highway 1 near the 160th Street Interchange
Great Blue Heron	CDC: Blue list SARA: Special concern	Outside project boundaries, but within Zone of	Coquitlam River WMA, near the Mary Hill Bypass
Green Heron	CDC: Blue-listed		North of the Cape Horn Interchange

Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008

Table 10-1: Wildlife Species at Risk Documented Within the PMH1 Study Area			
Occurrence	CDC/SARA Conservation Status	Highway Segment	Location
Peregrine Falcon	CDC: Red list SARA: Threatened	Influence (ZOI) of species.	East end of the Port Mann Bridge
Northern Goshawk	CDC: Red list	164-166	Between Highway 1 and Tynehead Drive, east of 168th Street
Pacific Water Shrew	CDC: Red list SARA: Endangered	164	Hjorth Creek at 160th Street Interchange in highway median
Autumn Meadowhawk (dragonfly)	CDC: Blue list	164	North of 104th Avenue and East of 160th Street on the north side of Highway 1
Anderson's Waterboatman (aquatic insect)	CDC: Red list	160 & Outside project boundaries but within ZOI of species	115A Avenue ROW

10.3 Potential Project Impacts on Wildlife

Potential impacts of the Project on wildlife resources from Project design, construction and operation include:

- Habitat loss;
- Reduced habitat connectivity, increased disruption of wildlife movements and increased road mortality;
- Increased sensory disturbance caused by an increase in the amount of noise and/or light encroachment into wildlife habitat.

10.3.1 Habitat Loss

The PMH1 Project will result in the potential loss of 35.8 ha of forested habitat, 2.4 ha of wetland habitat and 120.6 ha of anthropogenic habitat of lesser value for wildlife. The breakdown of potential habitat loss is as follows:

- 1.3 ha of mature forest habitat (0.5 ha of which is coniferous forest);
- 34.4 ha of young forest habitat;

- 2.4 ha of modified wetlands within the existing Highway 1 RoW. These wetlands have developed within man-made ditches and low lying areas and are not representative of natural ecosystems;
- 113.6 ha of grassland and shrubland within the existing Highway 1 RoW;
- 1.2 ha of urban vegetated areas; and
- 5.8 ha of agricultural land.

s.13

Of the 35.8 ha of forest habitat that will be lost, approximately 13.2 ha, located at the Grandview Interchange, Gagliardi Interchange, east side of the Port Mann Bridge, 160th Street Interchange, 192nd Street Interchange and east of 216th Street is considered to be good quality native forest.

The PMH1 Project will primarily affect habitat edge, as opposed to cutting through and fragmenting habitat units as occurs with new linear projects, and will constitute an incremental impact to that which occurred in the Lower Fraser Valley when Highway 1 was first constructed.

10.3.2 Reduced Habitat Connectivity, Disruption of Wildlife Movements and Increased Road Mortality

Highway 1 and its high speed traffic have disrupted habitat connectivity and wildlife movements for more than 40 years, and the highway widening and increased traffic associated with the PMH1 Project have the potential to result in incremental effects to habitat connectivity, wildlife movements and road mortality.

Key potential areas of impact will be where the existing Highway 1 fragments good quality habitat or isolates a specific food or water source such as:

- In the area of Burnaby Lake, between the Willingdon and Brunette Interchanges;
- Between the Port Mann Bridge east abutment and 160th Street; and
- East of 176th Street.

MOT's Wildlife Accident Reporting System (WARS) shows that for the 28 year period beginning in 1979 and ending in 2006, 93 wildlife fatalities, primarily deer and coyotes, were recorded within the PMH1 Project area. An analysis of wildlife accidents per highway section shows that collisions were concentrated in 3 contiguous sections east of the Port Mann Bridge:

- 18 between Glover Road and 264th Street;
- 34 between 264th Street and Bradner Road; and
- 19 between Bradner Road and Mt Lehman Road.

4 wildlife accidents were recorded between Lougheed Highway and Cariboo Road, which includes the Burnaby Lake area.

s.13

10.3.3 Sensory Disturbance

The PMH1 Project will potentially increase wildlife sensory disturbance in habitats adjacent to Highway 1 by increasing the amount of light or noise encroachment into wildlife habitat. Such sensory disturbance can result in wildlife avoidance of the site, modified behaviour patterns (e.g. breeding and feeding) and potentially increased road mortality.

Since the PMH1 Project is an expansion of an existing highway, sensory disturbance impacts on local wildlife due to an increase in traffic, will be incremental over existing levels, and over the past 40 years, most wildlife species have already either modified their behaviour or become habituated to noise levels and light levels from the roadway. Impacts from noise will be most pronounced during Project construction, when equipment is operating at noise levels above that of normal vehicle traffic. A significant increase or change in the level of lighting along the highway is not anticipated, other than from an increase in number of vehicle headlights in operation. There will likely be increased lighting at some of the re-constructed interchanges and at the new crossing of the Fraser River at Port Mann, which has the potential to affect birds at those locations.

Nine existing red-tailed hawk nests are located within 100 m of the roadway at several locations in the Burnaby, Surrey and Langley sections, and there is a potential for indirect disturbance to nesting birds during construction in those sections. The incremental impact of construction effects is difficult to estimate, given the existing roadway traffic and noise; however, impacts are likely to be of short-term duration.

10.3.4. Species at Risk

The PMH1 Project has the potential to impact several wildlife species at risk: the Pacific water shrew, great blue heron, red-legged frog and two aquatic insect species.

Pacific Water Shrew

The Lower Fraser Valley is the northern extent of the range for the Pacific water shrew (PWS), which is both on the provincial Red List and an endangered species under SARA. The existing PMH1 corridor extends through a highly modified landscape where potential habitat for PWS has been removed or highly altered from its natural condition, but there are few locations where populations have survived.

Remaining habitat for PWS within the Project area includes: small streams and adjacent riparian zones in the Burnaby Lake area and several streams and narrow riparian zones in Coquitlam Surrey and Langley. Some of these habitats still have contiguous forests, which provide broader habitat corridors for PWS dispersal. During the Project field survey, one PWS was captured at the 160th Street, indicating the presence of a local population. This capture is one of only 24 captures of the PWS in British Columbia in the past 20 years, and the area in which this shrew was captured has been preliminarily defined as one of 16 proposed 'critical habitats' for the PWS (Preliminary Partial Critical Habitat Identification for Pacific water shrew (*Sorex bendirii*) – DRAFT, Pacific Water Shrew Recovery Team, 19 October 2007).

PWS will potentially be affected by the loss or degradation of habitat from Project footprint impacts and disruption of dispersal patterns.

Great Blue Heron

There is an established nesting colony of great blue heron, a provincially Blue-Listed species and a species of special concern under SARA, at the Coquitlam Wildlife Management Area. There is the potential for Project related road and construction noise to affect the colony during the breeding season. During operation of the Project,

*Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008*

habituation to the incremental increase noise and light levels is expected, given the existence of this well-established nesting colony in proximity to the existing Highway 1.

Red-legged Frog

The red-legged frog, a provincially Blue-Listed species and a species of special concern under SARA, tends to inhabit moist forests and wetlands, and breeds in shaded ponds, lakes and slow moving streams. Red-legged frogs have small home ranges, and will potentially be affected by the loss or degradation of forest and wetland habitats from the Project. Populations within the PMH1 project footprint will likely be most impacted by the loss of 1.3 ha of mature forest habitat, which they may utilize outside of the breeding window. Wetland habitat impacted within the PMH1 footprint is not of high quality and likely provides limited breeding habitat.

Rare Aquatic Insects

The autumn meadowhawk, a provincially Blue-Listed dragonfly, and Anderson's waterboatman, a Red-Listed aquatic beetle, were both recorded within the Project study area, at a wetland pond in Fraser Glen Park. This park is not expected to be impacted by the Project, but there is the potential for these and other listed aquatic insect species to be present within other suitable wetland and watercourse habitat within the Project study corridor. The wetland complex under the east end of the Port Mann Bridge is considered high value habitat for rare aquatic insects and could potentially be affected by Project construction. Since these species have a short life cycle, any temporary habitat loss will likely have a greater impact on these species than on other wildlife species.

10.3.5 Proposed Impact Avoidance, Mitigation and Compensation Measures

Design based (footprint) impacts on wildlife habitat and wildlife species, including species at risk, have been and will continue to be minimized through Project planning and design.

Potential wildlife impacts due to construction and operation of the Project will be addressed through an Environmental Management Plan (EMP) that will be prepared by the contractor prior to construction. The EMP will have the following components:

- Wildlife Habitat Mitigation and Compensation Plan;
- Fisheries Habitat Mitigation and Compensation Plan;
- Construction Environmental Management Plan (CEMP); and
- Operational Environmental Management Plan (OEMP).

The impact avoidance and mitigation strategies for wildlife and wildlife habitat in the EMP will be based on the recommendations in Chapters 11 and 14 of the Application [the Fisheries and Aquatic Resources Impact Assessment (aquatic and riparian habitat) and the Terrestrial Resources Impact Assessment]. The EMP will outline how these guidelines are to be implemented, and will describe environmental protection measures to be implemented in response to planned work activities.

Section 14.0 of the Owner's Table of Commitments and Assurances (OTCA) details the commitments that must be met by the Project contractor. These include the development and implementation of a:

- Terrestrial Habitat Management Plan that:
 - Describes mitigation to avoid and minimize impacts to wildlife;
 - Describes detailed site-specific compensation design, BMPs and measures to avoid and, where necessary, mitigates potential impacts on vegetation, wildlife and wildlife habitat;
 - Provides detailed strategies and requirements regarding any additional pre-construction surveys, as well as habitat retention, protection, and compensation;
 - Identifies protocols for the survey and salvage of vegetation and Schedule 1 SARA wildlife as appropriate and required, and
 - Incorporates all relevant Commitments and Assurances;
- A nesting heron management strategy that includes monitoring of heron activities and development of a plan for environmental agency review, to identify acceptable construction activities during heron nesting season; and
- A complete mitigation and compensation strategy for Pacific Water Shrew that provides habitat mitigation at Hjorth Creek and where other opportunities are available, based on habitat quality, connectivity to surrounding habitat, and potential to support species at risk in the upper Serpentine tributaries within the Project limits.

The OTCA also commits to:

- Minimize disruption to wildlife movements by maintaining or enhancing existing wildlife passageways under structures, through culverts, or along riparian corridors. Where culverts are to be installed, replaced or retrofitted in areas known as having suitable habitat for species at risk on both sides of the corridor, design and implement wildlife passage features for these species in consultation with regulatory agencies and stewardship groups;
- Use hedge buffers and mowed roadway edges to deter wildlife, including owls, from roadways, and the use of barriers such as fencing and natural buffers (i.e. thicket) between roadways and compensations sites; and
- Consult with MOE during the design phase of the Project to develop fisheries compensation plans that avoid inadvertent impacts to species at risk and consider habitat requirements for other aquatic and semi-aquatic species; and
- Coordinate recommendations from both Nooksack Dace and Pacific Water Shrew recovery teams during compensation design along the Brunette River.

10.4 Residual Effects

Residual environmental effects are defined as those changes, either positive or negative, that remain and influence an environment after implementation of project mitigation and

*Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008*

compensation measures. For the PMH1 Project, potential residual effects to wildlife with a potentially moderate to high ecological consequences were limited to:

- **Wetland Habitat.** The wetlands within the Project footprint have all developed within man-made ditches and low lying areas, and are not representative of natural ecosystems. It is however recognized that these wetlands, regardless of their quality and origin, provide aquatic habitat attributes needed for certain plant and animal species. The Project footprint will result in the temporary loss of 2.4 ha of wetlands. It is expected that greater than 100% of these wetlands will be re-established through habitat compensation and ditch re-location. s.13
- **Mature Mixed and Coniferous Forest Habitats.** 13.2 ha of good quality forest habitat will be permanently lost, 1.3 ha of which is mature mixed and coniferous forest and the remainder young forest. Habitat compensation and maintenance measures will be used to re-establish areas of mature forests.
- **Pacific Water Shrew.** Potential residual effects on the PWS include temporary loss of localized Pacific water shrew habitats and disruption of dispersal patterns. This may be partially offset by advance construction of selected compensation works and mitigation to minimize impacts, which can provide higher quality habitats for Pacific water shrew. Overall, mitigation and compensation measures implemented during construction, including culvert replacements to provide safer access under roadways, are expected to minimize impacts on Pacific water shrew from the Project footprint and operation and maintenance.
- **Great Blue Heron.** Mitigation measures, which will include specific timing windows for construction and bridge pile-driving, are intended to minimize potential impacts during the breeding season. During operation, habituation to the incremental increase in noise and light levels is expected.
- **Raptors.** Disturbance to raptors during the breeding season will be mitigated providing buffers to reduce noise levels near nest sites. Long term habitat compensation is expected to provide a variety of conserved forest habitats for raptors. Given the present effective use of highway corridors and medians by raptors, habituation over time to incremental noise and light levels is expected.
- **Red-legged Frog.** As red-legged frogs have small home ranges and are not highly mobile, they will be affected by the loss or degradation of forest and wetland habitats from the Project. This may be partially offset by advance construction of selected compensation works and mitigation to minimize impacts. Improvement and re-establishment of forest and aquatic habitats adjacent to the highway during construction will provide high quality habitats for red-legged frogs. Mitigation and compensation measures implemented during construction, including culvert replacements to provide safer access under roadways, pre-construction salvage and translocation, and timing windows for clearing and grubbing in forest areas are expected to minimize impacts on red-legged frogs from the Project.
- **Rare Aquatic Insects.** Impacts to aquatic insects due to direct loss of aquatic habitat are expected to result in residual effects. Pre and post-construction

compensation in riparian areas, streams and wetlands will limit the long-term effects of habitat loss on many aquatic insects; however, since these species have a short life cycle, the temporary loss of habitat will likely have a greater impact on these species than on other wildlife species.

- **Wildlife Corridor Connectivity.** Project construction activities can result in temporary and permanent loss in habitat connectivity, which can impact small and medium size mammals through temporary disruption in patterns of distribution, dispersal and movement. Wildlife connectivity will be improved through site-specific measures such as restoration of decommissioned interchanges and roadways and re-establishment of linkages with forest and wetland habitats, day-lighting of streams, culvert replacement and improvements to facilitate safe passage, and compensation to connect terrestrial, riparian and aquatic habitats.

10.5 Key Issues Raised by the Working Group and Proponent Responses

Key issues identified by the Working Group during the Application review and MoT's responses and commitments (in italics), as appropriate, are summarized below. Refer to the Biophysical Issues Tracking Table (~~Appendix XX~~) for an expanded description, and to Section 14.0 of the OTCA for the complete wildlife commitments.

Ministry of Environment and Environment Canada

- Species at risk and associated requirements for additional pre-construction surveys, habitat mapping, mitigation and compensation strategies, construction monitoring, mitigation/compensation effectiveness monitoring and adaptive management.
The OTCA contains commitments that address these issues. A supplementary Wildlife Culvert Assessment was provided to supply baseline information for the development of a wildlife passage plan in coordination with the culvert replacement plan for fish habitat. The issue of wildlife passage has not yet been resolved. Further information will be added to this report after the March 20th Fisheries/Wildlife TWG meeting.
- Wildlife passage (and habitat connectivity) across Highway 1 needs to be maintained or enhanced.
The OTCA contains commitments that address this issue. The wildlife passage issue has not yet been resolved. MoT has prepared a Wildlife Passage Assessment that will be further discussed at the March 20th joint Fisheries/Wildlife TWG meeting.
- Cooperation between MOE and EC is needed in the development of the wildlife and fisheries mitigation and compensation plans to avoid inadvertent impacts on non-target, co-existing species at risk where habitats potentially overlap, for example the Nooksack Dace and the Pacific Water Shrew.
The OTCA contains commitments that address this issue. The issue has not yet been resolved. A joint fisheries/Wildlife TWG meeting will be held on March 20th, and this issue will be discussed there.

Comment [MSOffice23]: And DFO?

MoT is also preparing a conceptual framework for mitigation and compensation that will be discussed on March 20th.

- Mitigation is required for the potential increase in wildlife road mortality. Of particular concern are species at risk such as the Barn Owl, Western Screech-Owl and Northern Saw-whet Owl.
*The OTCA contains commitments that address this issue, and MoT has provided supplementary information from MoT's Wildlife Accident Reporting System (WARS) for all species reported between 1979 and 2000, as well as a technical memo on Owl Roadway Habitat, Mortality and Strategies for Mitigation (March 11, 2008).
The issue has not yet been resolved, and will be discussed at the March 20th joint Fisheries/Wildlife TWG meeting.*
- Zones of Influence (ZOI) for sensory disturbance;
This issue is not yet resolved. MoT is preparing information to be discussed at the March 20th joint Fisheries/Wildlife TWG meeting.

City of Coquitlam

- Impacts on local populations of Cooper's Hawks are a concern, and mitigation and monitoring plans are required.
The Application describes mitigation measures that will minimize effects on raptors including demarcating active nest sites, conducting pre-construction nesting raptor surveys, demarcating buffer zones around active nest and monitoring active nests during construction. These will become part of the EMP.
- The permanent loss of forested wildlife habitat and the residual effects that it will have on wildlife species are a concern.
The 35.8 ha of forest habitat losses will occur over the length of the alignment, predominantly along the edge of young and highly fragmented forest communities. Detailed mitigation strategies, including any required compensation, will be outlined during the Project design and construction phases.

City of Surrey

- Proponent should work with local government on habitat mitigation sites and preservations for long-term community benefits.
Where habitat mitigation is planned or proposed on municipal lands, MOT will continue to collaborate with local government regarding habitat mitigation and preservation for the long-term community benefits.

City of Surrey and the Kwikwetlem First Nation

- The Great Blue Heron colony in the Coquitlam River Wildlife Management Area could potentially be affected by:
 - Habitat clearing, site preparation or construction during the heron nesting season; and

Port Mann/Highway 1 Environmental Assessment Report
 March 14, 2008

- o Construction activities such as pile driving for the Port Mann Bridge piers, and the temporary diversion of traffic onto the Mary Hill Bypass during construction.

The OTCA commits to the development of a nesting heron management strategy as part of the PMH1 Wildlife Habitat Mitigation and Compensation Plan. Monitoring of effects on the heron rookery and raptor nests at the Coquitlam Wildlife Management Area (Mary Hill Bypass) will be incorporated into the Terrestrial Habitat Management Plan for the Project. Post-construction monitoring requirements will be detailed in the Terrestrial Habitat Management Plan, and will be the responsibility of the Contractor. Removal of some trees and overhead branching may be necessary to accommodate roadway expansion, within the MoT right-of-way, adjacent to the Wildlife Management Area (WMA). If this removal were to occur during the bird nesting season, then nesting surveys will be conducted. The WMA will not be directly affected by the PMH1 project; however, monitoring of Great Blue Heron nesting will be conducted to minimize potential disturbance from construction noise and lighting.

Kwikwetlem First Nation

- Wildlife habitat mitigation and compensation plans must be approved by the Kwikwetlem First Nation.
The OTCA commits to First Nations being provided with the opportunity to provide input to the PMH1 Wildlife Habitat Mitigation and Compensation Plan.
- Monitoring programs of three years duration are recommended for segments of the project area where vegetation has been re-established, and for habitat compensation sites. Adaptive management strategies should be used to re-establish vegetation where initial plantings were not successful. Wildlife monitoring programs are also recommended for the most significant Species of Special Concern, such as Great Blue Heron.
The Project team will work with the Ministry of Environment and Environment Canada to develop strategies to address potential adverse effects to wildlife. A nesting heron management strategy will be developed to monitor heron activities and to identify acceptable construction activities during the heron nesting season. Vegetation will be monitored to confirm that riparian and aquatic compensation habitat areas have achieved 90% survival as established through a 3-year post-construction monitoring program.
- Approximately 4.5 ha of red and blue-listed native forest habitat will be lost in the Bon Accord watershed on the south side of the Port Mann Bridge for which there should be habitat compensation.
Potential impacts in the Bon Accord drainage area are dependent on the bridge foundation locations, which in turn is dependent on the Contractor's bridge design, and bridge design type. Table 14-26 (p.14-87) of the EAC Application describes potential impacts, design mitigation, construction mitigation and operational mitigation for both red- and blue-listed plant communities.

- Based on the 'no net loss' policy for wildlife habitat, the Kwikwetlem requests that the Proponent identify where forest habitat will be replaced to compensate for loss of this valuable native forest habitat in Bon Accord Creek.

Locations of pier foundations on the south bank of the Fraser River will be confirmed during Project design. Once these locations are confirmed, effects to vegetation, including effects, if any, to forested habitat, will be confirmed, and appropriate mitigation developed.

10.6 EAO and RA Conclusions

11.0 SOIL CONDITIONS AND CONTAMINATED SITES

Chapters 7.0 and 10.0 in Volume II of the Application describe the soil conditions and potential for contaminated sites within the PMH1 Project area, the potential Project effects, and proposed mitigation and compensation measures.

11.1 Soil Conditions

11.1.1 Background

Existing surficial geology and soil conditions affect road and structural design and the type and duration of preparation works such as pre-loading. The nature of the soil deposits at the various highway sections is outlined in Table 11-1.

Table 11-1 General Characterization of Soil Deposits by Highway Section

Highway Section	Competent soils generally present near ground surface	Weak, compressible organic soils
1. McGill Street to Gagliardi Way	Most of area between McGill Street and Gilmore Diversion overpass (except near 1st Avenue), and near Douglas Road overpass	Near 1st Avenue and from east of Gilmore Diversion overpass to Gagliardi Way except near Douglas Road overpass
2. Gagliardi Way to King Edward Street	Much of the portion from Cariboo Road to Brunette Avenue overpass	East of Brunette Avenue overpass
3. King Edward to west bridge abutment	No	Over entire section
4. Port Mann Bridge	Only near east abutment	Near west abutment, south of Fraser River, and at depth over entire section
5. East bridge abutment to 157th Street	Over entire section	Possibly some (minor)
6. 157th Street to 800 m East of 216th Street	From 157th Street to east of 176th Street	From west of 192nd Street to east of 200th Street

Steep slopes exist in a few areas adjacent to the highway (Johnson Hill cut, the escarpment slope south of the Fraser River, the south riverbank slope at Port Mann, Cape Horn north of the Lougheed Highway and the cut slopes at Grandview Highway).

11.1.2 Impact Avoidance and Mitigation Measures Proposed in the Application

The Owner's Table of Commitments and Assurances (OTCA) (Appendix XX) commits to the following impact avoidance and mitigation measures:

*Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008*

- Work with municipalities during the design phase to identify geotechnical site-specific issues and identify potential specialized soil treatments for areas of organic soils or other geotechnical conditions.
- Develop and implement special measures to address areas of weak compressible soils.
- Construct retaining walls along applicable highway infrastructure to mitigate potential erosion and encroachment on fish and wildlife habitats at or near culvert crossings.

11.1.3 Key Issues Raised by the Working Group and Proponent Responses

Key issues identified by the Working Group during the Application review and MoT's responses and commitments (in italics), as appropriate, are summarized below. Refer to the Biophysical Issues Tracking Table (~~Appendix XX~~) for an expanded description, and to Section 6.0 of the OTCA for the complete list of commitments.

Fisheries and Oceans Canada

Fisheries and Oceans Canada requested clarification regarding the location of the surcharge area in the vicinity of Burnaby Lake.

MoT has provided a supplementary map for the Project area between Kensington Avenue and Gagliardi Way that identifies where surcharge will be applied as part of the normal construction process in soft soils.

11.1.4 EAO and RA Conclusions

During this cooperative environmental assessment, the EAO, Transport Canada (TC) and Fisheries and Oceans Canada (DFO) have considered the:

- Application;
- Government, First Nation and public comments on the potential effects of the Project;
- Responses from MoT to these comments; and the
- Discussions of the Working Group.

Based on EAO's consideration of this information, and the assumption that MoT will implement the actions described in the Table of Owner's Commitments and Assurances, the EAO is satisfied that the Project will not have significant adverse effects due to soil conditions.

11.2 Contaminated Sites

11.2.1 Existing Conditions

A total of 1,203 properties within approximately 100 m of the PMH1 Project corridor were investigated. Each legal lot was counted as an individual property; consequently the actual number of individual businesses or industries is significantly less.

A three tier classification system was used to categorize the probability of contamination on properties and their potential to impact the PMH1 improvement corridor. Tier 1 properties have the highest probability of containing contamination. Tier 2 and Tier 3 properties have progressively lower probabilities of being contaminated. Tier 3 sites primarily include residential and undeveloped lands as well as properties that are inferred to be down-gradient with respect to groundwater flow direction from the PMH1 Project. Of the 1,203 properties investigated:

- Eight (1 %) are classified as Tier 1. These eight legal lots comprise five different sites, four of which are service stations (refer to Table 11-2);
- 252 out are classified as Tier 2 sites; and
- 945 (80%) are Tier 3 sites. Of the approximately 1,203 properties reviewed, roughly.

Table 11-2: Tier 1 Contaminated Sites

Site Location	Site Activities
Canada Way at Willingdon Ave	Service Station
Canada Way at Willingdon Ave	Service Station
Lougheed Highway at Brunette Ave	Service Station
United Boulevard at Leeder Street	Waste Management Facility, Plastic Manufacturing Facility
United Boulevard at Shuswap Ave	Service Station

11.2.2 Potential Project Impacts

The disturbance of any existing contaminated sites poses the primary risk for entry of contaminated soils or materials into the environment around the proposed Project. The length of exposure to contaminants during construction of the PMH1 improvements is expected to be short-term. Short-term exposures may result from construction-related activities such as disturbance of surface soils resulting in dust or impacts to surface water bodies. Although these exposures can still have adverse impacts to human health and the environment, their short-term and localized nature and proximity to receptors reduces the risk of adverse effects resulting from the exposures. Long-term exposures will be limited to those that typically occur on highways such as the build-up of contaminants due to surface runoff and the seasonal application of winter de-icing chemicals.

11.2.3 Proposed Mitigation Measures

For pre-existing contaminated sites that may be affected by the Project, site-specific levels of contaminants will be determined prior to construction through investigation in accordance with the BC Environmental Management Act and Contaminated Sites Regulation.

- For Tier 1 sites, additional intrusive investigations prior to construction will be conducted unless recent soil and/or groundwater data is available.

- For Tier 2 sites, available historic environmental reports will be reviewed, and a site visit will be conducted for those sites without a previous environmental report. Additional work will be conducted as required.
- Sites identified as Tier 3 may undergo limited further investigation to confirm that the Tier 3 classification is warranted. This would include further review of recent and historical aerial photographs. Further investigation would likely be limited to potential surface soil sampling to provide information that could be included in the contaminated soil Management Plan that will be implemented during construction.

During construction, the focus will be on preventing or mitigating exposure to the contaminants. Contingency plans will be in place to address short-term exposures that may result from construction-related activities to mitigate their impact and duration. A Construction Environmental Management Plan will be prepared by the contractor prior to construction that will include the following measures for the avoidance, mitigation and/or management of potential impacts:

- The preparation of a Construction Health and Safety Plan (CHSP) that includes provisions for protecting workers from potentially exposure to contaminated soil, sediment, surface water or groundwater;
- A Contaminated Sites Management Plan (CSMP) that provides processes and procedures to manage any contamination that may be encountered such as methods for handling contaminated material during construction, and a post construction monitoring plan if required. The measures recommended within Chapter 10 of the Application (the Contaminated Sites Impact Assessment) will form the basis of this plan;
- An Emergency Spill Response, Containment and Management Plan (ESRCMP) that addressed pre-emergency planning (identification of risks), emergency organization and responsibilities (including a list of contacts, and emergency telephone numbers), spill reporting, incident site security, emergency response, evacuation, site restoration and remediation, post-incident evaluation and training and practice drills.
- A Hazardous Waste Management and Spill Plan (HWMSP) that outlines procedures for accidental spill management during construction, and a post-construction monitoring plan if required; and
- Environmental monitoring of surface water and ground water during construction.

During operation of the Project, Project design features for the control, collection and treatment of surface runoff as well as environmental design for contaminant reduction, will mitigate potential operational impacts.

An Operational Environmental Management Plan (OEMP) will also be developed to address major spills (i.e., spills that trigger the Provincial Emergency Program thresholds) that could occur during highway operation. The OEMP will ensure that

*Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008*

highway operations procedures address the management of potential contamination in compliance with MOT's Best Management Practices for Highway Maintenance Activities (Ministry of Transportation, 2004).

Refer to Section 11.0 of the OTCA (~~Appendix XX~~) for a complete listing of commitments.

11.2.4 Key Issues Raised by the Working Group and Proponent Responses

Key issues raised by members of the Working Group during the Application review and MoT's responses and commitments (in italics), as appropriate, are summarized below. Refer to the Biophysical Issues Tracking Table (~~Appendix XX~~) for an expanded description, and to Section 11 of the OTCA for a complete listing of commitments.

Kwikwetlem First Nation

- Requested that they be advised of any remediation work to be completed between the east abutment of the Port Mann Bridge and the 152nd Street off-ramp during Project construction. The Application notes that there are elevated lead levels in surface soils adjacent to Highway 1 within this section, which is located within the Kwikwetlem territory the Bon Accord Creek watershed.
The excavation, off-site disposal and/or redeposit of metal-contaminated soil at active roadway sites will be completed in accordance with the BC Ministry of the Environment memo dated July 11, 2001 entitled "Clarification of independent remediation requirements for selected heavy metals at Ministry of Transportation active roadway sites". MoT will notify the Kwikwetlem First Nation of construction-related remediation works in this area related to the Project for Tier 1 and 2 sites

Ministry of Environment Land Remediation

- Requested that the CSMP, HWMSP and CHSP be provided to MOE Land Remediation at least 30 days in advance of the start of construction.
The component Environmental Management Plans will be provided for review to those agencies with a regulatory mandate at least 30 days in advance of the start of construction.
- Recommended that surficial soil along the existing highway corridor that will be disturbed or excavated be pre-characterized for metal content so that it can be appropriately managed.
The OTCA commits to completion of soil excavation within the current highway corridor in accordance with MOE memo dated July 11, 2001 titled "Clarification of independent remediation requirements for selected heavy metals at MoT active roadway sites".
- Concurs with the Application that known and potential contamination along the Project corridor can be managed through construction and into operation to prevent or minimize impacts to human health and the environment, subject to the satisfactory completion of the proposed supplementary site characterization work, as well as satisfactory preparation and implementation of the necessary environmental management plans.

Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008

Fisheries and Oceans Canada

- Known contaminated sites that are not likely to be disturbed may pose a risk to fish habitat, and these sites should be considered in the proposed CSMP.
The CSMP will address potential impacts from contaminated soil, surface water groundwater, dust or soil vapour both as a result of activities at properties within the corridor, but also as a result of potential migration of contaminants from off-corridor properties.

City of Burnaby

- Noted that details within the CSMP and HWMSP will be developed by the contractor, but expressed concern regarding the site-specific management of contaminated soils, including roadside ditch materials, and requested that local governments be given the opportunity to review these plans.
MoT responded that regulatory agencies will have the opportunity to review these plans in advance of construction, and that relevant municipal contacts will be incorporated into the emergency contacts for the HWMSP and the ESRCMP.

11.2.5 EAO and RA Conclusions

12.0 LOCAL AIR QUALITY AND HUMAN HEALTH

Chapter 8 in Volume II of the Application provides an assessment of potential impacts on local air quality and human health that may result from the construction and operation of the PMH1 Project, and MoT's proposed mitigation strategies to address those impacts.

12.1 Background

The local air quality and human health study area was generally defined as 1000m either side of the proposed alignment.

Local Air Quality

Airborne pollutant emissions from vehicles are generally categorized as follows: criteria air contaminants (CACs), such as oxides of nitrogen (NO_x), carbon monoxide (CO) and particulate matter (PM); greenhouse gases, such as carbon dioxide and methane; and trace hazardous air contaminants such as acetaldehyde and benzene. Greenhouse gases are discussed in Chapter 13 of this report.

The MoT's air quality predictions are based on modelling three scenarios: 2003 existing highway conditions, 2021 future conditions without the PMH1 project, and 2021 future operating conditions with new PMH1 components in regular use. The MoT's methods for air quality modelling have been used in various BC jurisdictions, and were accepted by
Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008

Metro Vancouver for this and other transportation projects. In the opinion of MoT, the model provides best estimates of traffic conditions based on growth and land use projections identified in Metro Vancouver's Growth Management Strategy (the traffic model is discussed in Chapter 21 of this report).

The MoT also analysed an interim year of 2011 to confirm that selection of 2003 for baseline, and 2021 for future operational conditions, was appropriate for evaluation of the potential effects of the PMH1 project on local air quality.

Potential traffic-related air quality effects were assessed against Metro Vancouver, provincial and federal air quality guidelines for CACs. Where more than one standard exists, MoT used the most stringent standards and objectives when evaluating impacts of the PMH1 project.

Human Health

The human health assessment modelled acute and chronic health effects as well as lifetime cancer risk. Potential health effects of CACs and hazardous air contaminants were assessed for the Project based on predicted changes in air quality from the 2003 base case to 2021 future conditions with and without the PMH1 project. The potential health effects were analyzed using risk assessment methodologies recommended by Health Canada, the US Environmental Protection Agency and the California Office of Environmental Health Hazard Assessment.

The assessment recognized that risks are not evenly distributed in the population and sensitive subpopulations such as children, the elderly or those with pre-existing medical conditions may be more susceptible than the population at large. An attempt was made to ascertain the impacts on these populations by locating schools, hospitals and care facilities along the project corridor.

12.2 Potential Impacts

12.2.1 Potential Construction Phase Impacts

Construction activities can cause an increase in emissions such as: fugitive dust, road dust and diesel particulate matter. As the environmental assessment was conducted on a pre-design concept, site-specific details for the construction phase of the project were not unavailable. The Application does not include a detailed assessment of potential local air quality and human health impacts of construction. The MoT discusses the construction phase of the PMH1 project (estimated at five years) in terms of potential mitigation measures.

12.2.2 Potential Operational Phase Impacts

Air Quality

Both 2021 scenarios (with and without PMH1) predicted a general improvement over the 2003 base case, with a reduction in CACs, and fewer ambient objectives exceeded. Improvements in air quality relative to the base case are due to improvements in fuels and a newer distribution of vehicles that meet stricter emissions standards.

*Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008*

Although there is an overall improvement in the air quality from the 2003 to the 2021 scenarios, both with and without the proposed PMH1 project, the following areas remain susceptible to exceedance events for NO_x, CO, PM₁₀, and road dust:

- Cassiar tunnel south entrance;
- Brunette Avenue Interchange;
- Cape Horn Interchange;
- 152nd Street Interchange;
- 192nd Street Interchange; and
- 200th Street Interchange.

In future scenarios, most events with concentrations above the ambient air quality objectives are predicted to occur within 50-100 m of the roadway.

When comparing the with and without PMH1 scenarios to each other, emissions are higher due to the Project. Table 12-1 compares the 2021 scenarios indicating that the PMH1 Project will increase local 1 hour concentrations of SO₂, NO₂, and CO. The MoT predicts that these impacts are unlikely to have a significant adverse effect on air quality.

Table 12-1: Ambient Air Quality Impacts of the PMH1 Project (2021) compared to the 2021 Without PMH1 scenario

Parameter	Likelihood of Adverse Effect	Overall Consequence	Magnitude	Direction	Frequency of Occurrence	Geographic (Spatial) Extent	Level of Confidence
SO ₂ 1-Hour	Unlikely	Low	Nil	Negative	Occasional	Local	High
SO ₂ 24-Hour	Unlikely	Low	Nil	Varies Positive to Negative	Regular	Local	High
SO ₂ Annual	Unlikely	Low	Nil	Varies Neutral to Negative	Continuous	Local	High
NO ₂ 1-Hour	Unlikely	Moderate	Medium	Negative	Occasional	Local	High
NO ₂ 24-Hour	Unlikely	Moderate	Medium	Varies Positive to Negative	Regular	Local	High
NO ₂ Annual	Unlikely	Moderate	Medium	Varies Positive to Negative	Continuous	Local	High
PM ₁₀ 24-Hour	Unlikely	Low	Low	Varies Positive to Negative	Occasional	Local	High
PM ₁₀ Annual	Unlikely	Low	Nil	Varies Positive to Negative	Continuous	Local	High
PM _{2.5} 24-Hour	Unlikely	Low	Low	Varies Positive to Negative	Occasional	Local	High
PM _{2.5} Annual	Unlikely	Low	Nil	Varies Positive to Negative	Continuous	Local	High
CO 1-hour	Unlikely	Low	Medium	Negative	Occasional	Local	High
CO 8-hour	Unlikely	Low	Medium	Varies Positive to Negative	Regular	Local	High

*Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008*

NH ₃ 24-hour	Unlikely	Low	Low	Varies Positive to Negative	Occasional	Local	High
Fugitive Dust							
PM ₁₀ 24-hour	Unlikely	Moderate	Medium	Varies Positive to Negative	Occasional	Local	Medium
PM _{2.5} 24-hour	Unlikely	Low	Low	Varies Positive to Negative	Occasional	Local	Medium

Table 8-13 of the Application outlines the significance criteria used by MoT in the Air Quality Impact Assessment. Below is a summary of key definitions for the criteria used in table 12-1.

Overall Consequence

- **Low:** The effect is expected to have a low consequence. Further management is likely not required for this effect.
- **Moderate:** The effect is expected to have a moderate consequence. Additional management of this effect is likely necessary

Magnitude of Impact

- **Nil:** No noticeable change in environmental impact
- **Low:** Disturbance expected to be somewhat above typical background conditions and concentrations, but within established or accepted protective standards, or to cause no detectable change in biological, social, or economic parameters.
- **Medium:** Disturbance expected to be considerably above background conditions or concentrations but within established criteria or scientific effects thresholds, or to cause a detectable change of parameters within the range of natural variability.

Direction

- **Negative:** Net loss to the resource/receptor, or a diminution in quality of a resource.
- **Positive:** Net benefit to the /resource receptor

Human Health

The MoT predicts that the acute non-cancer health effects along Highway 1 will decrease substantially for both 2021 scenarios in comparison to the 2003 base case. However, some areas currently at higher risk will remain at higher risk in the future, i.e. areas immediately adjacent to the road that are currently experiencing elevated acute respiratory hazard quotients, will remain at higher risk in the future.

The MoT predicts that chronic non-cancer health effects in 2021 along Highway 1 will decrease in comparison to the 2003 base case. No chronic non-cancer health impacts are projected in either the with or without PMH1 2021 scenarios. The results indicate that the non-cancer health effects of the proposed project do not pose a significant added risk to human health along the proposed route.

The modelling results indicate that, as in the 2003 base case, the lifetime cancer risk will continue to exceed the risk threshold at some locations along the PMH1 corridor. When

Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008

compared with the 2003 base scenario, the lifetime cancer risk is substantially decreased both in the geographic scope of the affected areas and in the magnitude of the risk. The MoT predicts an increase of 1.4 cancers per million in the 2021 with PMH1 scenario versus the 2021 without PMH1 scenario for sensitive receptors.

The MoT does not expect the health effects related to particulate matter to change as a result of the PMH1 project.

The spatial distribution of potential health impacts is provided in section 8.3.7 of the Application and associated figures.

12.3 Proposed Mitigation Measures

12.3.1 Construction

The Application lists general precautions that can be undertaken to ensure construction activities have a minimum impact on air quality including using ultra-low sulphur diesel fuels in construction equipment and various measures to minimize road dust. The MoT proposes implementing best management practices and mitigation measures as part of the Air Quality and Dust Control component of the Construction Environmental Management Plan to address potential air quality and human health impacts during construction.

12.3.2 Operation

The MoT incorporated mitigation measures relevant to air quality into the PMH1 project design including infrastructure for transit service, extension of eastbound and westbound HOV lanes, and electronic tolling on the Port Mann bridges. The MoT also identifies the following mitigation measures:

- Design and manage the project to ensure optimum traffic flow conditions;
- Include transportation demand management strategies that result in more efficient use of transportation resources within the right-of-way, including new transit routes, bicycle routes and integration with alternative transportation modes in consultation with local governments; and
- Manage road dust during operation at an appropriate frequency to clean the road where dirt, debris, sand and/or gravel have accumulated in accordance with MoT requirements for highway maintenance.

12.4 Key Issues Raised by the Working Group and Proponent Responses

Key issues identified by the Working Group during the Application review and MoT's responses and commitments (in *italics*), as appropriate, are summarized below. Refer to the Biophysical Issues Tracking Table (Appendix XX) for an expanded description.

The City of Burnaby, the City of New Westminster, the City of Surrey, Metro Vancouver, Environment Canada, Health Canada, and the Ministry of Environment commented that the traffic model which forms the basis of the air quality assessments does not consider induced effects/ induced development. Their concerns included the potential for this to result in actual emissions greater than those predicted by the model.

*Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008*

The EAO noted during the review that induced land use change is beyond the scope of the assessment as set out in the Section 11 Order and the Application Terms of Reference. The assessment includes issues for which a reasonably direct causal link can be demonstrated between some component of the project and the resulting effect.

The City of Coquitlam, Metro Vancouver, Environment Canada, and the Fraser Health Authority noted that exceedances of air quality objectives (with associated incremental health impacts) remain for some project areas and recommend consideration of mitigation measures beyond those proposed in the Application.

The assessment is a residual effects assessment. Mitigation measures incorporated in the Project and assessment include HOV lanes, transit priorities, tolling and currently legislated vehicle emissions improvements. These measures will contribute to a reduction in potential impacts to air quality.

Environment Canada

- In order for jurisdictions to comply with the Canada-wide Standards for PM and Ozone, decision-making authorities must require the application of best available technologies and practices to new and existing emission sources.

MoT recognizes the importance of the implementation of continuous improvement programs in accordance with the Canada-wide Standards for PM and ozone and wherever possible will adopt best management practices to minimize increases in emissions.

- Recommended a firm commitment be made to idle reduction policies and practices.

MoT will require the Contractor to develop an anti-idling protocol for construction equipment as part of their Air Quality and Dust Control Plan. The protocol will include a provision that, where economical, technologies that automatically shut the engine off after a preset time will be used and the Contractor will also limit the idling of off-road engines when the vehicle is not moving.

The Ministry of Environment

- Noted that PM_{2.5} levels associated with road dust are projected to increase above criteria levels with PMH1 in 2021. The proponent needs to address this so that PM_{2.5} levels do meet criteria.

All exceedances for road dust, for the 2021 with PMH1 scenario, are within 50 m of the roadway. Note that the PMH1 assessment was completed prior to the provincial air quality initiatives announced in 2007 and 2008. Road dust during the operation phase of the Project will be managed in accordance with MOT requirements for highway maintenance and at an appropriate frequency to clean the road where dirt, debris, sand and/or gravel have accumulated.

The Kwikwetlem First Nation

Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008

- Commented that air quality monitoring stations used in the study are outside the boundaries of the study area and are not valid (without modeling) for describing local air quality effects of PMH1. Recommended an air quality monitoring station should be built at or near the Kwikwetlem Indian Reserve No. 1 to begin real-time monitoring of the local air quality effects of the three Gateway Program projects.

The monitoring stations are used to determine the background concentrations which are then added to the model predictions to assess the Project effects. The methodology is standard in air quality assessments and provides a conservative estimate of potential effects. As part of Metro Vancouver's Air Quality Management Plan, additional mobile stations have been recommended and MoT will consult with Metro Vancouver to discuss the feasibility of determining monitoring data at this location.

- Requested that the Proponent discuss how to reduce and/or mitigate the predicted negative health effects of elevated levels of roadway pollutants on the residents of Kwikwetlem Indian Reserve No. 1.

Significant improvements in local air quality are predicted between 2003 and 2021 both with and without the PMH1 project. For all three modelled scenarios the ambient air quality objectives are at times predicted to be exceeded for certain pollutants, the magnitude and frequency of which are greatly reduced in both 2021 scenarios. Exceedances have been predicted to occur near the roadway, generally within 50 to 100 m, and any potential health risk is reduced in both 2021 scenarios compared to the 2003 scenario. The Kwikwetlem Indian Reserve No. 1 is approximately one km from the existing Port Mann Bridge.

Health Canada

- Noted that human health was assessed using maximum concentrations at the median receptor. This means that half of the receptor locations are expected to be exposed to higher risk than is detailed in the assessment. Health Canada requested tables be provided to present the median and 95th percentile risks for acute, chronic, cancer and PM related mortality.

MoT prepared a memo, dated February 12th, 2008, (Appendix XX) presenting the requested information.

- Recommended a discussion of the potential for health impacts due to secondary formation of $PM_{2.5}$ and ozone beyond 1 km of the highway.

The combination of the regional background concentrations of primary $PM_{2.5}$ and secondary $PM_{2.5}$ sulphate is $2.5 \mu g/m^3$. Based on the predicted changes in the regional annual average of $PM_{2.5}$, a 0.1% increase will result in an incremental change of $0.0025 \mu g/m^3$. This value had an insignificant effect on potential PM related mortality. No predicted change is reported for ozone between the 2021 without Gateway and with Gateway scenarios. Therefore, the expected impact of ozone change due to the Project on mortality is negligible.

12.5 EAO and RA Conclusions

Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008

13.0 REGIONAL AIR QUALITY AND GREENHOUSE GASES

Chapter 9 in Volume II of the Application provides an assessment of potential impacts on regional air quality that may result from the construction and operation of the PMH1 Project.

13.1 BACKGROUND

The regional assessment considers the impact on regional air quality of the construction and operation of all three proposed Gateway Program projects in the context of regional emissions, including other major infrastructure projects that may impact air quality. The assessment focuses on:

- regional air emissions – the mass of common air contaminants emitted
- regional air quality – the concentrations of contaminants at ground level
- potential social and economic impacts associated with predicted changes in air emissions.

The region is defined as the Lower Fraser Valley (LFV) airshed, an area bounded by the Coast and Cascade mountain ranges and the Strait of Georgia. The following scenarios were modelled: 2003 existing conditions, projected 2021 without Gateway, projected 2021 with PMH1, and projected 2021 with all Gateway Projects. Cumulative Effects scenarios for 2021 were also modelled and include the Border Infrastructure Program, Sea-to-Sky Highway Improvement Project, Golden Ears Bridge, Canada Line, Deltaport Third Berth and Terminal 2.

The air pollutants considered are those emitted directly by vehicles or formed by secondary reactions: carbon monoxide (CO), oxides of nitrogen (NOx), particulate matter (PM10 and PM2.5), sulphur dioxide (SO2), ozone (O3), volatile organic compounds (VOCs), ammonia (NH3), and greenhouse gases (GHGs). Social and economic impacts were calculated by combining predicted changes in criteria air contaminants (CAC) and GHGs emissions with estimates of the dollar value per tonne of emitted CAC or GHG. The impacts considered fall into five main categories: human health, visibility, agricultural crops, exterior material impacts and global warming. This analysis was performed using standard methodologies set out in section 9.4.3 of the Application.

The analysis below does not consider recently announced government initiatives including:

- reducing provincial greenhouse gas emissions by 33% by 2020;
- expanding the transit network to reduce GHG emissions;
- new tail pipe emissions standards to reduce CO2 emissions by 30%; and
- actions for making BC carbon neutral by 2010.

13.2 POTENTIAL IMPACTS

13.2.1 Potential Construction Phase Impacts

During construction of the Gateway Program projects, air emissions are anticipated from a number of sources/activities: site clearing and preparation, grading and surfacing of roadways, exhaust from stationary and mobile construction equipment, dust from exposed surfaces, emissions from the paving and painting of new roadways/lanes, and increased emissions due to traffic congestion during construction. Construction activities will have a temporary, localized effect on air quality.

As the environmental assessment is being conducted on a pre-design concept, site-specific details for the construction phase of the project are unavailable at this time.

13.2.2 Potential Operational Phase Impacts

The Gateway Projects are predicted to result in a 2.1% increase in traffic related GHG emissions in the Lower Fraser Valley in 2021. This represents an increase in regional GHG emissions of less than 1% when all sources are considered.

Table 13-1: GHG Emissions from Regional Traffic With and Without Gateway

Scenario	Traffic-related Emissions in the Canadian LFV (kt/y)	% change relative to 2021 Without Gateway	Total Emissions from All Sources in the LFV	Traffic-related Emissions % of Total LFV Emissions
Existing Situation 2003	6,696	n/a	26,352	25.4
Projected 2021 Without Gateway	8,261	n/a	30,594	27.0
Projected 2021 With PMH1	8,366	1.3%	30,699	27.3
Projected 2021 With All Gateway Projects	8,437	2.1%	30,769	27.4
Projected 2021 Cumulative Effects With All Gateway Projects	8,564	3.7%	30,988	27.6

The relative changes in predicted CAC emissions in the LFV between the Projected 2021 With and Without Gateway Program scenarios are small (Table 13-2). The difference in regional emissions ranges from no significant change to an increase of 0.9% for CO emissions. The MoT believes that emissions estimates suggest that the overall Gateway Program projects will contribute a negligible amount of CAC emissions in 2021.

Table 13-2: Change in Regional CAC Emissions With and Without Gateway

Scenario	Change in Regional Emissions from Existing Situation 2003 (%)						
	CO	NO _x	PM ₁₀	PM _{2.5}	SO ₂	VOC	NH ₃
Projected 2021 Without Gateway	-9.8	-17.2	+7.3	+7.2	+23.7	-9.0	+23.9
Projected 2021 With All Gateway Projects	-9.0	-17.1	+7.3	+7.3	+23.7	-9.0	+24.0
Difference between Projected 2021 Without Gateway and Projected 2021 With All Gateway Projects	+0.9	+0.2	0.0	0.0	0.0	0.0	+0.1
Projected 2021 Cumulative Effects With All Gateway Projects	-7.5	-15.7	+7.9	+8.1	+25.2	-8.7	+24.3
Difference between Projected 2021 Without Gateway and Projected 2021 Cumulative Effects With All Gateway Projects (%)	+2.6	+1.8	+0.5	+0.8	+1.2	+0.4	+0.3

The predicted changes in regional ambient air quality due to emissions from the Gateway Program are 0.2% or less (see Table 13-3). Slight increases in ambient concentrations of PM_{2.5}, NO₂ and NH₃ are anticipated in 2021 if the Gateway Program proceeds. No changes are expected to levels of other contaminants, including SO₂, PM₁₀, VOC and O₃.

Table 13-3: Changes in Regional Ambient Air Quality With and Without Gateway

Scenario	Change in Regional Annual Average Ambient Concentrations from 2003 (%)						
	NO ₂	PM ₁₀	PM _{2.5}	SO ₂	VOC	NH ₃	O ₃
Projected 2021 Without Gateway	-16.0	+7.2	+15.8	+13.4	-4.2	+20.9	-1.9
Projected 2021 With All Gateway Projects	-15.9	+7.2	+15.9	+13.4	-4.2	+21.0	-1.9
Difference between Projected 2021 Without Gateway and Projected 2021 With All Gateway Projects	+0.2	0.0	+0.1	0.0	0.0	+0.1	0.0
Projected 2021 Cumulative Effects With All Gateway Projects	-14.6	+7.5	+16.5	+14.3	-4.0	+21.2	-1.8
Difference between Projected 2021 Without Gateway and Projected 2021 Cumulative Effects With All Gateway Projects	+1.4	+0.3	+0.7	+0.9	+0.2	+0.3	+0.1

Socio-economic impacts of Regional Air Quality

In MoT's analysis, the economic benefits (avoided damages) of lower CAC emissions in 2021 compared to 2003 outweigh the economic costs of higher GHG emissions. Total economic impacts are lower in 2021 compared to 2003, with or without the Gateway Program. In 2021, the estimated difference in potential economic impact associated with traffic-related CAC and GHG emissions in the LFV between the With and Without Gateway scenarios is approximately \$9.9 million or 2.1%.

Table 13-4: Estimates of Economic Impacts of Traffic-related Emissions in the LFV

Economic Impact Category	Existing Situation 2003 (\$2005)	Projected 2021 Without Gateway (\$2005)	Projected 2021 With All Gateway Projects (\$2005)	Difference between With and Without Gateway (\$2005)	Difference between With and Without Gateway (%)
Human health	280,263,455	153,350,810	156,596,971	3,246,160	2.1
Visibility	22,750,447	7,617,121	7,784,171	167,050	2.2
Agricultural crops	4,548,543	1,841,426	1,645,623	4,197	0.3
Exterior materials	6,069,553	2,190,310	2,195,910	5,600	0.3
Subtotal - local impacts	313,631,998	164,799,668	168,222,875	3,423,007	2.1
Climate change	247,752,000	305,657,000	312,169,000	6,512,000	2.1
Total local and global impacts	561,383,998	470,456,668	480,391,875	9,935,007	2.1

13.3 PROPOSED MITIGATION MEASURES

CONSTRUCTION

Mitigation for potential construction related impacts are discussed with respect to local air quality (section 12 of this report; Chapter 8 of the Application).

OPERATION

As discussed under local air quality, MoT's incorporated mitigation measures relevant to air quality into the PMH1 project design including infrastructure for transit service, extension of eastbound and westbound HOV lanes, and electronic tolling on the Port Mann bridges. The MoT also identifies the following mitigation measures:

- Design and manage the project to ensure optimum traffic flow conditions;

- Include transportation demand management strategies that result in more efficient use of transportation resources within the right-of-way, including new transit routes, bicycle routes and integration with alternative transportation modes in consultation with local governments; and
- Manage road dust during operation by cleaning the road of accumulated dirt, debris, sand and/or gravel at an appropriate frequency in accordance with MoT requirements for highway maintenance

13.4 Key Issues Raised by the Working Group and Proponent Responses

Key issues identified by the Working Group during the Application review and MoT's responses and commitments (in italics), as appropriate, are summarized below. Refer to the Biophysical Issues Tracking Table (Appendix XX) for an expanded description.

The City of Burnaby, the City of New Westminster, the City of Surrey, Metro Vancouver, Environment Canada, Health Canada, and the Ministry of Environment commented that the traffic model which forms the basis of the air quality assessments does not consider induced effects/ induced development. Their concerns included the potential for this to result in actual emissions greater than those predicted by the model.

The EAO noted during the review that induced land use change is beyond the scope of the assessment as set out in the Section 11 Order and the Application Terms of Reference. The assessment includes issues for which a reasonably direct causal link can be demonstrated between some component of the project and the resulting effect.

The City of Coquitlam, Environment Canada, and the City of Burnaby noted that greenhouse gases emissions are marginally higher with the project than without and recommend consideration of mitigation measures beyond those proposed in the Application.

The assessment is a residual effects assessment. Mitigation measures incorporated in the Project and assessment include HOV lanes, transit priorities, tolling and currently legislated vehicle emissions improvements. The Assessment was prepared before provincial initiatives to reduce greenhouse gas emissions by 33% by 2020, such as introducing California tail pipe emissions and low-carbon fuel standards, were announced.

Environment Canada

- Recommended that the Proponent implement economically feasible GHG emission reduction measures during construction such as the use of biodiesel and mandated idle reduction.
*The OCTA commits to an anti-idling protocol for construction equipment.
The Province is undertaking several initiatives to reduce emissions including maintaining the fuel tax exemption for ethanol and biodiesel.*
- Suggested that the Proponent commit to monitoring the effectiveness of proposed TDM measures such as lane allocation for HOV and tolls, and be prepared to make modifications with the ultimate goal of minimizing transportation GHG emissions.

Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008

MoT to provide response re monitoring TDM.

The Ministry of Environment

- Recommended that in order to ensure the effectiveness of HOV lanes as mitigation, the number of occupants that are defined as high occupancy should be three individuals.

Consistent with the two-plus occupancy requirements on the existing Highway 1 HOV lanes through Burnaby and eastbound over the Port Mann Bridge, the proposed extension of these HOV lanes will also be two-plus occupancy. MOT routinely monitors all of its facilities and considers implementation of operational changes as conditions require.

The Kwikwetlem First Nation

- Commented that despite improvements expected in vehicle emission technology, and more efficient vehicle travel associated with the completion of the Gateway Program projects, the levels of regional contaminants such as CO, PM₁₀, PM_{2.5}, NO₂, and NH₃ are expected to increase between 2003 and 2021 in the Lower Fraser Valley. Greenhouse gas emissions are also expected to rise by about 2%.
Traffic-related emissions of all CACs except NH₃ are expected to decrease from 2003 and 2021. Increases in emissions from other sources in the Lower Fraser Valley (e.g., marine sources, agriculture) are expected to outweigh the improvements in traffic emissions. These increases in regional ambient concentrations of CACs occur both with and without the Gateway Program. From 2003 to 2021, regional GHG emissions are expected to increase by 16% without the Gateway Program. The incremental increase in regional GHG emissions due to the Gateway Program is 0.6%.

13.5 EAO and RA Conclusions

PART D: SOCIO-ECONOMIC EFFECTS

14.0 AGRICULTURE

Section 18.0 in Volume III of the Application provides an assessment of agriculture resources within the PMH1 project area, the potential Project effects on these resources, and the proposed mitigation and compensation measures.

14.1 Background

The agricultural impact study focused on the sections of Highway 1 that pass through the Agricultural Land Reserve (ALR) or are zoned for agricultural use. The ALR is a provincial zone in which agriculture is recognized and encouraged as the priority use and other land uses are controlled.

The assessment considered direct loss of agricultural land due to the Project footprint as well as potential impacts on agriculture including noise, drainage and irrigation considerations, disturbance of on-farm utilities, and changes to transportation networks.

14.2 Potential Impacts

The ALR lands affected by the Project are in Langley, Surrey, and Coquitlam; there are no ALR lands adjacent to Highway 1 in Vancouver or Burnaby.

Footprint impacts

Approximately 6.1 ha of land in the ALR will be affected as a result of the Project. 2.0 ha of this land are located within the existing right-of-way. The 4.1 ha within the widened PMH1 right-of-way occur in the area of the proposed new interchange at 216th Street. The interchange at 216th Street will directly affect two farm properties in the ALR and one that is outside the ALR. Several other ALR properties east and north of the 216th Street Interchange will experience minor footprint impacts. Widening along the Mary Hill Bypass and construction beneath the new Port Mann crossing will also result in impacts on ALR land. Approximately 40% of the area affected is currently in agricultural production.

Other potential impacts include:

- Severance or isolation effects
- Changes to drainage, irrigation systems and water quality
- Disturbance of on-farm utilities
- Disturbance of fencing and other structures
- Increased noise
- Increased public access
- Changes in transportation networks (secondary road traffic)

14.3 Impact Avoidance, Mitigation Measures and Compensation

*Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008*

The reference concept incorporates efforts by MoT to minimize impacts to agricultural land by concentrating highway widening east of the Port Mann Bridge within the existing median. The Owner's Table of Commitments and Assurances commits to minimizing loss of ALR land by refining the Project footprint and optimizing use of the existing right-of-way.

Table 14-1: Summary of Key Agricultural Mitigation Proposed in the Application

PMH1 Section	Key Mitigation Procedures
All Sections	<ul style="list-style-type: none"> Continue to refine the design concepts to minimize footprint in agricultural land. Optimize use of existing ROW. Obtain required ALC and municipal approvals for soil storage, removal, and filling. Implement Surface Water Quality and Sediment Control Plan. Avoid hydrocarbon spills to soils and ditches. Restore temporary work areas to existing agricultural capability.
Mary Hill Bypass Upgrades	<ul style="list-style-type: none"> Move any fences prior to construction. Upgrade any fences that do not meet current MOT standards. Where ditches are currently being used for agricultural purposes, restore and construct ditches to Ministry of Agriculture and Lands standards.
Harvie Road on-ramp to Hwy 1 east	<ul style="list-style-type: none"> Consider design options to avoid ALR incursion. Move any fences prior to construction. Upgrade any fences that do not meet current MOT standards. Where ditches are currently being used for agricultural purposes, restore and construct ditches to Ministry of Agriculture and Lands standards.
216 th Street Interchange	<ul style="list-style-type: none"> Relocate mushroom barn and replace access from 216th Street. If noise impacts to the poultry operation indicate, consider noise buffering such as berms or other mitigation measures. Include paved shoulders on 216th Street within the project limits to facilitate farm vehicle movements. Add signage to indicate presence of farm traffic. If noise assessment indicates, provide noise mitigation between ROW and farms as a visual and sound screen. As much as possible avoid sudden loud noises near poultry operation. Move any fences prior to construction. Upgrade any fences that do not meet current MOT standards. Where ditches are currently being used for agricultural purposes, restore and construct ditches to Ministry of Agriculture and Lands standards.

14.4 Residual Impacts

- Loss of approximately 6.1 ha of ALR land due to the project footprint
- 216th Street Interchange will directly affect a mushroom farm and a small holding located in the northeast quadrant (both within the ALR) and a poultry farm in the southwest quadrant (not in the ALR). For the mushroom farm to remain operational, buildings will need to be moved and new routes of access from 216th Street will be required. This would reduce the land available for soil-based farming by about one hectare.
- Noise levels associated with traffic on Highway 1 are expected to increase but remain below levels that would have a negative effect on livestock.

Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008

- Increased traffic volumes as a result of the new interchange at 216th Street will affect farm and farm service traffic using secondary roads. Glover Road, between TWU and Highway 10, may also experience increased traffic volumes.

14.5 Key Issues Raised by the Working Group and Proponent Responses

Key issues identified by the Working Group during the Application review and MoT's responses and commitments (in italics), as appropriate, are summarized below. Refer to the Socio-Community/ Socio-Economic Issues Tracking Table (Appendix XX) and the OTCA for an expanded description.

The Ministry of Agriculture and Lands and the Agricultural Land Commission

- Suggest an alternative design at the 216th Street Interchange requiring less ALR land.
The current design avoids congestion and potential conflicts associated with left-turning traffic. The diamond configuration would require two additional lanes on the overpass (6 rather than 4) to accommodate left turning lanes.
- Higher levels of dust increase disease levels at the mushroom farms resulting in a reduction in production. Request consideration of a vegetative strip between the exit ramp and the mushroom farm to reduce dust.
The OCTA commits to implementing dust control measures as part of the Air Quality and Dust Control Plan including those to address the particular sensitivity of the operating mushroom farm at 216th Street. This sensitivity will be noted in the Project construction drawings.
- Consider re-locating the mushroom farm.
Moving the mushroom barn to allow the operation to remain in business could further impact agricultural lands if the proprietors choose to locate it on ALR land. Gateway has initiated discussions with the proprietors of the mushroom operations but their plans for the future have not been confirmed.

City of Surrey

- Re-aligning the 192 Street overpass to 192 Street on both sides of the Highway would impact more ALR land than is considered in the current design.
Should the design of the 192nd Street overpass change, the OTCA commits to design the interchange so that effects to ALR lands are minimized and conduct additional agricultural assessment to identify potential impacts and develop mitigation measures as required.

The Kwikwetlem First Nation

- Requested that prior to drainage enhancement activities near Kwikwetlem Indian Reserve No. 1, the Proponent consult with the Kwikwetlem and other stakeholders who are currently coordinating fish habitat enhancement projects to ensure that plans are compatible with ongoing work.

Drainage enhancement is intended as mitigation on actively farmed ALR lands and is not planned in the vicinity of Kwikwetlem Indian Reserve No. 1.

14.6 EAO and RA Conclusions

15.0 ARCHAEOLOGY

Chapter 19.0 in Volume III of the Application describes the archaeological resources within the PMH1 Project area, the potential Project effects on these resources, and the proposed mitigation and compensation measures.

15.1 Background

The PMH1 study area lies within the asserted traditional territories of the Katzie, Kwantlen, Kwikwetlem, Musqueam, Qayqayt, Tsawwassen, and Tsleil-Waututh First Nations, the Squamish Nation, and Stó:lō Nation, and field investigations included representatives from the Katzie, Kwantlen, Kwikwetlem and Tsleil-Waututh First Nations.

The archaeological study area was generally defined as extending 25 m on either side of the proposed alignment, from the edge of the existing road shoulder. The field inventory did not identify any new archaeological sites, but three previously recorded sites were investigated. These sites include:

- DhRr-30, a petroglyph located north of Highway 1 on the Brunette River,
- DhRq-34, a small lithic scatter located below and upriver from the Port Mann Bridge; and
- DhRq-2, a "legacy site" consisting of a natural deposit of marine shell in the vicinity of 176th Street.

Legacy sites are sites that are recorded in the Provincial Archaeological Site Inventory, but are considered destroyed with no physical evidence remaining. Table 15-1 summarizes the significance of the two remaining archaeological sites using the *British Columbia Archaeological Impact Assessment Guidelines* (Archaeology Branch, 1998).

Table 15-1: Summary of Archaeological Site Significance

Site	Scientific Significance	Historic Significance	Public Significance	Economic Significance	Ethnic Significance
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Site	Scientific Significance	Historic Significance	Public Significance	Economic Significance	Ethnic Significance
DhRr-30	High	Low	High	Moderate	High
DhRq-34	Low	Low	Low	Low	High

Scientific significance is based upon the ability of a site to provide further data that could improve our understanding of the culture history of a region or have the potential to resolve current archaeological research problems. Ethnic significance refers to the traditional, social, or religious importance of a site to a particular community. Historic significance is based upon whether a site is connected with an event or person considered important in British Columbia's history, such as early exploration, settlement, land use, or other aspects of cultural development. Public significance assesses whether the site is accessible to the general public and whether it contains visible features that could be appreciated by the public such as in an interpretive, educational or recreational capacity. Economic significance refers to the ability of a site to create revenue (e.g., a heritage park with visitation fees).

15.2 Potential Impacts

Archaeological Site DhRr-30 (Petroglyph)

Based on the Project concept plan and DhRr-30's streamside location, it is unlikely that the site will be directly impacted by PMH1 improvements.

Archaeological Site DhRq-34 (Lithic Scatter)

The concept plan for the Project indicates archaeological site DhRq-34 is likely to be impacted by proposed ground improvements associated with the foundations of the existing Port Mann Bridge.

15.3 Impact Avoidance, Mitigation and Compensation Measures Proposed

Potential impacts of the Project on archaeological sites DhRr-30 and DhRq-34 will be specifically addressed in the Archaeological Mitigation and Monitoring Plan (AMMP), a sub-plan of the Construction Environmental Management Plan. The AMMP will be prepared by the contractor prior to construction, and the mitigation measures recommended within Chapter 19 of the Application (the Archaeological Impact Assessment) will form the basis of the AMMP.

The Owner's Table of Commitments and Assurances (OTCA) (Appendix XX) commits to inclusion of the following impact avoidance and mitigation measures in the AMMP:

- The location of archaeological site DhRr-30 will be clearly identified on detailed design plan drawings as a 'no work area' to prevent inadvertent or "indirect" impacts to the site;

- Temporary protective barriers will be erected between any archaeological site and the construction zone prior to construction activities in the vicinity of known archaeological sites;
- Periodic archaeological monitoring (i.e. surveillance) of construction activities in the vicinity of archaeological site DhRr-30 will be conducted;
- Detailed site recording work will be conducted at petroglyph site DhRr-30 if necessary;
- Further archaeological testing will be conducted in beach area at site DhRq-34 during low water (i.e. low tide and pre-freshet);
- Further archaeological testing will be conducted at site DhRq-34 (riverbank and adjacent areas);
- Other protective works will be considered at archaeological sites within the Project area limits;
- MoT will work with First Nations and the Archaeology Branch to investigate at a level appropriate for an archaeological impact assessment, unsurveyed areas within the Project area that are assessed as having archaeological potential, and will develop mitigation measures consistent with the BC Archaeological Impact Assessment Guidelines;
- Soil within the proposed alignment on the south side of the existing Highway 1 at 192nd Avenue, will be systematically stripped prior to construction, to identify and mitigate archaeological materials if present. The soil stripping will be monitored by an archaeologist;
- A valid *Heritage Conservation Act* Section 14 Heritage Inspection Permit will be obtained, with adequate provisions to address requirements for investigations and potential impacts to previously unrecorded archaeological sites should they arise. Previously undocumented archaeological sites that come to light during the construction phase of the Project will be immediately reported to the BC Archaeology Branch and interested First Nations;
- Further options/opportunities will be explored to avoid or reduce potential Project impacts to archaeological and/or identified sites of cultural significance to First Nations; and
- If site DhRr-30 is located on land owned by the City of Burnaby, permission of the City will be sought before detailed recording, conservation and interpretation of the site are undertaken.

15.4 Key Issues Raised by the Working Group and Proponent Responses

Key issues identified by the Working Group during the Application review and MoT's responses and commitments (in italics), as appropriate, are summarized below. Refer to the Socio-Community/Socio-Economic Issues Tracking Table **(Appendix XX)** for an *Port Mann/Highway 1 Environmental Assessment Report* March 14, 2008

expanded description, and to Section 15.0 of the OTCA for a complete listing of commitments.

Archaeology Branch

- No testing was conducted for buried deposits at archaeological site DhRq-34.
The OTCA commits to further archaeological testing.
- An area of "extreme cultural sensitivity" is located at the 192nd Street Interchange, for which further site investigation is recommended.
The OTCA commits to further systematic soil stripping, monitored by an archaeologist, prior to construction.
- A full and complete record of the petroglyph at archaeological site DhRr-30 has not been completed.
The OTCA commits to detailed site work if necessary.
- Consideration should be given to the placement of a temporary protective cover over the petroglyph at site DhRr-30.
The OTCA commits to the consideration of other protective works at archaeological sites within the Project area limits and at DhRr-30.
- Areas with archaeological potential downstream of the proposed Port Mann Bridge could be affected by hydrological changes as a result of the project.
If hydraulic modeling determines that shoreline areas downstream of the Port Mann Bridge would potentially be affected by scour, these areas will be subject to an archaeological impact assessment (Application, page 19-47).

Kwikwetlem First Nation

- Kwikwetlem archaeological consultants participated in the reconnaissance archaeological surveys, and reported that not all areas were subject to uniform, systematic coverage at the intensity indicated in the Application. The AIA report and mapping should be revised to show the actual field survey coverage, and additional work should be conducted in the unsurveyed areas.
Some areas adjacent to, but outside of the PMH1 reference concept, were less intensively inspected. These areas were examined given their proximity to the Mary Hill site and the Fraser River. These areas are not within the Project limits. Areas east of the Coquitlam River are outside of the PMH1 conceptual alignment. The area of dense blackberry, east of Colony Farm and adjacent to the Mary Hill Bypass, is outside of the PMH1 project area. Gateway's archaeologists will remove any references to survey coverage that is outside of the PMH1 conceptual alignment in their forthcoming HCA permit report that will be circulated to First Nations for review and comments. Areas still requiring archaeological assessment and/or monitoring are listed in Chapter 19 (p. 19-47 and 19-48) of the EAC Application. MoT will work with First Nations and the Archaeology Branch to ensure that unsurveyed areas within the Project area assessed as having archaeological potential are investigated at an appropriate level for an archaeological impact

Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008

assessment and develop mitigation consistent with the BC Archaeological Impact Assessment Guidelines.

- The Project should provide the means to conduct systematic AIAs at sites to which access is currently restricted.
For any sites at which the Project archaeologist is able to obtain access for the assessment, the Kwikwetlem First Nation will be notified and invited to participate.
- Petroglyph sites are rare in the region and of high cultural significance to the Kwikwetlem. Detailed AIA, site recording and mitigation efforts should be completed at site DhRr-30.
Petroglyph site DhRr-30 is not within the PMH1 project limits. The Gateway Program acknowledges that the Kwikwetlem First Nation does not accept the proposal that mitigation (i.e., additional detailed recording) at DhRr-30 might be considered as compensation for impacts to DhRq-34. The OTCA commits to additional site assessment and mitigation studies, if warranted.
- Site DhRq-34 has been assigned a high ethnic value and a low scientific value, and the Application indicates that due to the low scientific value, the site warrants only minimal mitigative measures. The Kwikwetlem assert that site significance recommendations should also address First Nations interests in heritage preservation and protection, and recommend that an evaluation of the site significance of DhRq-34 should only be made after a thorough site assessment has been completed. A systematic impact assessment using standard site assessment methods is requested for site DhRq-34, to be timed to coincide with seasonally low river levels and low tides to maximize site exposure and data recovery potential.
The OTCA commits to further archaeological testing in the beach area at site DhRq-34 during low water (i.e. low tide and pre-freshet). The Kwikwetlem First Nation will be invited to participate in the field program. If feasible, additional testing will take place on the river bank and inland areas.
- Members of the Kwikwetlem First Nation and their archaeological consultants must be involved in completion of systematic Archaeological Impact Assessments (AIAs) of sites DhRr-30 and DhRq-34. After completion of AIAs, proper site potential evaluation and management recommendations can be made. Construction monitoring must take place in other areas of high and medium archaeological potential located in the Kwikwetlem territory of interest in relation to PMH1. Any differences regarding AIA methods, results and heritage resource management must be resolved in consultation with the Kwikwetlem.
Members of the Kwikwetlem First Nation and their archaeological consultants have been involved in the archaeological impact assessment field program to date and have been asked to provide input for areas within Kwikwetlem territory. For any future work that is to occur at these two sites, the Kwikwetlem First Nation will be notified and invited to participate. At present, remaining areas needing assessment have been identified, as well as a chance find discovery plan for construction

activities. If there are specific high or moderate potential areas of interest not already captured by fieldwork completed to date or in the comments on pages 19-47 and 19-48 of the EAC Application, they should be brought to the attention of the Gateway Program for consideration.

- Kwikwetlem does not support the proposal that mitigation at DhRr-30 might be considered as compensation for impacts for DhRq-34.
Petroglyph site DhRr-30 is not within the PMH1 project limits. The Gateway Program acknowledges that the Kwikwetlem First Nation does not accept the proposal that mitigation (i.e., additional detailed recording) at DhRr-30 might be considered as compensation for impacts to DhRq-34. Additional site assessment and mitigation studies, if warranted, will be completed at both DhRr-30 and DhRq-34.

Kwantlen First Nation

- Kwantlen requests that a Kwantlen/Gateway Archaeological Management Agreement be developed that contains a Chance Find Discovery Plan, and that the Kwantlen will have an opportunity to participate and approve the scope and content of the Discovery Plan.
MoT response pending.
- Management strategies developed to date relating to DhRq-34 and DhRr-30 should be made clear and communicated to Kwantlen.
MoT response pending.
- More work should be undertaken at DhRq-34 to locate and define the extent of subsurface deposits. The site should be tested at 5 m or 10 m intervals to determine the extent of the deposits. The site should not be altered until an acceptable amount of work is conducted and a management strategy agreed to by Kwantlen.
MoT response pending.

15.5 EAO and RA Conclusions

16.0 NAVIGATION

Chapter 23.0 in Volume III of the Application provides an assessment of navigation within the PMH1 project area, and of the potential impacts and proposed mitigation and compensation measures.

16.1 Background

The PMH1 Project will cross two navigable waterways: the Brunette River and the Fraser River. The navigation and use of navigable waterways are controlled by the Navigable Waters Protection Division (NWPD) of Transport Canada (TC) and the Vancouver Fraser Port Authority (VFPA) control. The:

- NWPD protects the public's right to navigation in accordance with *Navigable Waters Protection Act* (NWPA) (revised 1985); and the
- VFPA is responsible for leases, permits and licenses along those reaches of the Fraser River under its jurisdiction, which includes the area of the river crossed by the Port Mann Bridge.

While the Brunette River at the location of the Highway 1 crossing is likely navigable only by shallow draught vessels such as canoes and rubber rafts, the Fraser River at Port Mann is approximately 900 m wide, and includes a 201 m wide primary navigation channel, named Queen's Reach, and a secondary navigation passage, the Essondale Reach. There are over 30 water lot leases in the vicinity of the existing Port Mann Bridge that are used for a variety of industrial (e.g. log booming) and non-industrial activities, and this section of the river is heavily used by a variety of recreational and commercial marine vessels. Marine activity also includes commercial, recreational and aboriginal salmon fisheries. A small municipal park (Maquebeak Park), with a boat launch facility used mainly by recreational boaters, is located on the north bank of the Fraser River immediately downstream of the Port Mann Bridge.

16.2 Potential Project Impacts on Navigable Waters

16.2.1 Brunette River Bridge

The proposed bridge widening will not affect the existing vertical and horizontal clearances within the navigational channel. The minimum navigational clearances proposed for the Brunette River crossing are the existing clearances approved for the existing structure.

During construction, recreational navigation may be temporarily impeded by the presence of construction equipment and by coffer dams erected to allow construction of foundations and piers.

Significant effects to Brunette River hydraulics and channel geomorphology are not anticipated. Extension/widening of two piers is proposed as part of the widening of the Brunette River Bridge: one in-river pier, and one pier that will be located in the wetted perimeter during high water.

16.2.2 Fraser River

The new Port Mann Bridge has the potential to affect marine navigation and other users of the Fraser River through:

- Vertical and horizontal clearance limitations, which affect the size of marine vessels that can safely transit under a structure;
- Right-of-way requirements through sections of waterway that currently contain commercial water lots;
- Impacts on channel hydraulics and downstream geomorphological processes. Modelling indicates that in addition to local pier scour, general scour and an overall lowering of the channel in response to high flows will occur. Assuming that all bed lowering occurs in the main channel, the expected scour would be in the order of 4 m. This rough estimate needs to be confirmed for the preliminary design;
- Temporary impedance of passage through a section of waterway during construction; and
- Temporary impedance of the use of a section of waterway during construction, for example commercial or First Nations fisheries.

The new bridge also has the potential to affect air navigation. The new Port Mann Bridge will be designed by the Contractor and could have a vertical height greater than that of the existing Port Mann Bridge. If this is the case, the new bridge may need to be marked for aviation safety, pursuant to the requirements of the Canadian Aviation Regulations.

16.3 Proposed Impact Avoidance, Mitigation and Compensation

The PMH1 Project will undertake planning, compensation, and mitigation measures that satisfy the navigational concerns and requirements of the NWPA and the operational requirements and issues associated with water lot leaseholders managed by FRPA.

The Owner's Table of Commitments and Assurances (OTCA) commits the Contractor to avoid or minimize potential impacts to navigation channels resulting from Project works and activities, and to obtain regulatory approval under the NWPA prior to the commencement of works. The following specific measures to avoid, mitigate and compensate for potential impacts on navigation are also included in Section 17.0 of the OTCA:

- Prepare a pre/post construction assessment for final design of the new Port Mann Bridge pier placement in accordance with NWPD requirements, including NWPD's May 9, 2007 Letter of Understanding. The assessment will address the potential for scour and deposition of material 500 m up and downstream of the pier locations. Consult with the VFPA and TC regarding criteria for hydrographic survey and assessment and hydrotechnical assessment prior to commencement;

- Address potential changes to channel hydraulics and scour in the Fraser and Brunette rivers as a result of the Project, including but not limited to:
 - Temporary effects during construction; and
 - Associated effects on channel stability, fish habitat and movements and archaeological resources;
- Ensure that the Port Mann Bridge design complies with Transport Canada:
 - Aviation regulatory requirements (such as marking and lighting); and
 - NWPD conditions for bridge design;
- As part of the Port Mann bridge design process, consult with marine users, including commercial and aboriginal fishers, other vessel operators and log storage operators;
- Ensure that the design criteria for the Port Mann Bridge consider the:
 - Potential effect of ice flows and potential resulting jams in the Fraser River, and that the effect will not be worse than the existing conditions; and
 - Prevention of ice dams on the existing piers;
- Design new piers to prevent formation of ice dams on the existing piers;
- Prepare and implement a communications plan to ensure recreational marine users of the Brunette River are informed of any temporary closures due to Project construction;
- Minimize potential impacts to marine navigation and to First Nations and commercial fisheries in the Fraser River during Port Mann Bridge construction by preparing a Marine Communications Strategy to describe marine communications and consultation activities during bridge construction. The strategy will:
 - Be reviewed/approved by the NWPD;
 - Include a Marine Communication Plan that details the local marine communications and emergency preparedness procedures; and
 - Include a Marine Construction Plan that identifies measures necessary to ensure that all navigational traffic utilizing the main navigational channel, the secondary navigational passage and the working passages are made aware of any Project construction activities that would be occurring in those areas.
 - Include the establishment of a Marine Communications Committee that meets monthly, and which will be chaired by the bridge Contractor;
- Reinstate any changes made to the existing dike system in accordance with the requirements of the Inspector of Dikes.

Compensation agreements will also be negotiated with leaseholders of affected water lots.

16.4 Key Issues Raised by the Working Group and Proponent Responses

*Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008*

Key issues identified by the Working Group during the Application review and MoT's responses and commitments (in italics), as appropriate, are summarized below. Refer to the Socio-Community/Socio-Economic Issues Tracking Table and to the OTCA (~~Appendices XX and XX~~) for an expanded description of issues, Proponent responses and commitments.

Transport Canada and the Vancouver Fraser Port Authority

- TC and the VFPA noted that there is evidence of indirect scour and infill effects from similar new bridge piers at the Golden Ears Bridge upstream of the proposed crossing. Downstream of the Golden Ears Bridge, the formation of significant sandbars has affected navigation. TC and VFPA have requested that in the event that the bridge pier footings cause scouring and erosion, resulting in sandbars that interfere with navigation, these effects be mitigated for the duration of the tenure of the Bridge to the satisfaction of regulatory agencies.

~~MoT is currently reviewing how best to address potential indirect effects to navigation.~~

Transport Canada

- The potential impacts identified in the hydrotechnical assessment should be considered for their ability to affect navigation.

MoT is currently reviewing how best to address potential indirect effects to navigation.

Vancouver Fraser Port Authority

- The Application indicates there are approximately 30 VFPA tenants who operate within the vicinity of the new bridge crossing, however, only two companies appear to be affected - Timberwest and Western Forest Products. It isn't clear in the documents if others are affected and if so, how will they be compensated.

Water lots affected by the Project and therefore potentially requiring compensation are those lots directly affected by the Project footprint. Based on the Reference Concept, only four water lots and two water lot lease holders, International Forest Products and Timberwest, may be affected directly as a result of the right-of-way requirements of the new Port Mann Bridge. Discussions and agreement on compensation has taken place between these two companies and VFPA (Vancouver Fraser Port Authority) at the time.

- If the VFPA loses an opportunity to generate revenue from its tenants because a suitable solution cannot be found to accommodate our tenants affected by the footprint of the new bridge crossing, how will VFPA be compensated?

MoT will continue to work with VFPA to minimize impacts to water lot lease holders, and to identify potential new lease areas to compensate for areas required for the Project; however, discussion regarding specific revenue generation for VFPA is beyond the scope of the EAC Application.

- In the event the bridge pier footings continue to cause scouring and erosion downstream, resulting in the formation of sandbars, the VFPA requests the proponent mitigate these effects for the duration of the tenure of the bridge.
The Contractor will be required to prepare a hydrotechnical assessment on the detailed design, in accordance with the requirements of the Transport Canada's Navigable Water's Protection Division (NWPD), including NWPD's Letter of Understanding (May 9, 2007). A post-construction assessment of the new Port Mann Bridge pier placement will be conducted in accordance with the requirements of Transport Canada. Should there be deposition of materials within 500 m upstream or downstream of the new instream piers that interferes or could potentially interfere with marine use of the navigation channels or working passages, remedial action to remove these materials will be undertaken by the Project within a reasonable timeframe acceptable to authorities having jurisdiction.

City of Coquitlam

- Requested assurance that the boat launch facility and overall operation and accessibility of Maquabeak Park will be maintained during construction (for recreational and emergency use) and potentially enhanced after completion of the project.
The Project will work with the City to determine the timing of any temporary closures of the boat launch at Maquabeak Park and provision of temporary access for recreational and emergency first response uses.

16.5 EAO and RA Conclusions

17.0 RAIL CONSIDERATIONS

Chapter 24.0 in Volume III of the Application provides an assessment of rail considerations within the PMH1 project area, and of the potential impacts and proposed mitigation measures.

17.1 Background

The existing Highway 1 alignment intersects or parallel sections of three railways: the Burlington Northern Santa Fe Railway (BNSF), Canadian Pacific Railway (CPR), and the Canadian National Railway (CNR). In addition, the SkyTrain Millennium Line crosses Highway 1 at two locations, near Boundary Road and at North Road.

17.2 Potential Project Impacts on Rail

*Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008*

Table 17-1 summarizes the locations where development of the PMH1 project requires specific consideration of railway infrastructure and facilities.

Table 17-1 Proposed PMH1 Works and Associated Rail Infrastructure and Facilities

Railway	PMH1 Section/Location	Proposed PMH1 Activity
BNSFR	Approx. 300m east of Broadway ³	Widening of the overpass
BNSFR	Approx. 320m east of Cariboo Road	Widening of the overpass
CPR	South of Highway 1, between approx. Schoolhouse Street and the Cape Horn Interchange	Proposed relocation of approximately 1.5 km of track to the south, to accommodate highway widening
CPR	Vicinity of the Cape Horn Interchange	Construction of new overpasses spanning the CPR
CNR	Port Mann Bridge	New bridge to span CNR infrastructure including the Thornton switchyard on the east side of the Fraser River.
SkyTrain (Millennium Line)	Approx. 300 m east of Broadway (BNSFR ROW)	SkyTrain line spans Highway 1
SkyTrain (Millennium Line)	North Road	SkyTrain line spans Highway 1

Project construction can potentially affect railways due to:

- Temporary railroad closures during construction. There may be times during project construction when the Contractor needs to work within a railway right-of-way. For example, it is anticipated that during the construction of the proposed new Port Mann Bridge the Contractor will need to work within CN's right-of-way in the vicinity of the Thornton switchyard in order to construct foundations, piers and bridge superstructure; and
- Vertical and horizontal clearance limitations. Railways have vertical and horizontal clearance requirements that ensure safe passage of trains under bridges and other structures.

17.3 Proposed Impact Avoidance and Mitigation

The Project will ensure that, with respect to proposed construction within a right-of-way, construction schedules and/or communications plans will be developed and adhered to, that are compatible with the requirements of the railways, with respect to the movements of trains.

³ BNSF railway has leased the trackage and operation in Coquitlam, Burnaby and Vancouver to Canadian National Railway. Right-of-way and property issues are still the responsibility of BNSFR.
Port Mann/Highway 1 Environmental Assessment Report
 March 14, 2008

The PMH1 project will ensure that either:

- Existing vertical and horizontal clearances are maintained (i.e., when an existing structure is being modified); or the
- Vertical and horizontal clearance requirements pursuant to Canadian transportation standards and regulations, and in accordance with the design specifications of the respective railways, are addressed (Chapter 24.2).

Railway related construction works will be in accordance with the following regulations and codes to minimize and reduce the potential for impacts:

- The Railway Safety Act and associated regulations;
- The Canadian Transportation Act and associated regulations;
- The American railway engineering and maintenance-of-way manual; and
- All matters related to BNSFR, CPR, or CNR will be in accordance with the respective rail authorities' design specifications and standard practice circulars and drawings.

At the two locations where the SkyTrain Millennium Line crosses Highway 1, Transportation Association of Canada (TAC) standards will be used for vertical clearances.

The Owner's Table of Commitments and Assurances (OTCA) details the commitments that must be met by the Project contractor.

17.4 Key Issues Raised by the Working Group and Proponent Responses

Key issues identified by the Working Group during the Application review and MoT's responses and commitments (in italics), as appropriate, are summarized below. Refer to the Socio-Community/Socio-Economic Issues Tracking Table Appendix XX for an expanded description, and to Section 18.0 of the OTCA for a complete listing of commitments.

City of Coquitlam

- Noted that approximately 1.5 kilometres of CPR tracks may be relocated south of Highway 1 between Schoolhouse Street and the Cape Horn Interchange, and requested information as to whether the re-alignment will affect existing watercourses and sensitive habitats, and if so what mitigation measures or compensation will be required.

MoT responded that all watercourses in proximity to this section of the Project alignment were assessed using City of Coquitlam mapping, and that predicted impacts on ditches have been used to estimate habitat loss. Where required, ditches will be recreated, and MoT's best management practices will be followed to avoid, mitigate and compensate for impacts.

17.5 EAO and RA Conclusions

During this harmonized EA review EAO, DFO and TC have considered: the Application; Clarification Reports and memos; government, First Nation and public comments on the potential effects of the Project; responses from MoT; and Working Group discussions. Based on this information and provided that MoT implements the actions described in the *Owner's Commitments and Assurances*, EAO, DFO and TC are satisfied that the Project will not result in significant adverse impacts on rail considerations.

18.0 NOISE

Section 15.0 in Volume III of the Application provides an assessment of noise impacts within the PMH1 project area and the proposed mitigation and compensation measures.

18.1 Background

The noise assessment and proposed mitigation follow MoT's *Revised Policy for Mitigating the Effects of Traffic Noise from Freeways and Expressways* (hereinafter MOT Noise Policy; Appendix 15-A of the Application). Additional relevant standards and guidelines were incorporated into the assessment of noise impacts including thresholds and guidelines established by Health Canada (currently in draft form), the U.S. Environmental Protection Agency (EPA), and the International Organization for Standardization (ISO). Mitigation is proposed in accordance with MoT's Noise Policy.

The study area for the operational phase of the Project is based on residential lands along the study corridor that may experience ground level noise approaching 55 dBA⁴ due to the new or upgraded highway 10 years after project completion. The assessment includes consideration of impacts to schools, hospitals and daycares. The study boundary for short-term construction noise impacts includes all residences at which highway construction noise is expected to increase daily noise exposures above baseline levels. This generally includes the first two rows of residences fronting on the PMH1 alignment.

Baseline noise environments were established through measurement at 40 residential sites and two schools along the Project corridor. These baseline noise levels, in combination with predicted construction and future year 2021 traffic noise levels, were then used to quantify potential noise impacts due to PMH1 construction and operation.

18.2 Potential Impacts

Construction

Analysis of construction noise impacts indicate that construction noise may cause disturbance, potentially leading to community complaints at a number of sites if noise levels are not controlled or other steps are not taken to minimize impacts. Noise impacts can result from the following construction activities:

⁴ dBA are decibels (dB) measured with a frequency weighting to account for human hearing being more sensitive to some frequencies than others.

- Minor demolition of structures and removal of old pavements, etc.;
- Demolition of highway overpass structures;
- Excavation of soils and pre-loading;
- Construction of retaining walls and highway ditching;
- Grading, paving and painting;
- Construction of structures such as overpasses and interchanges, including pile driving;
- Bridge work – decommissioning/major rehabilitation of structures, including pile-driving and steelwork assembly; and
- Trucking of materials along haul routes to and from construction sites.

Operation

Increased traffic volumes and highway widening have the potential to increase noise levels as summarized in table 18-1 (below) and described on a site specific basis in Appendix 15-G of the Application.

18.3 Proposed Impact Avoidance, Mitigation and Compensation

Construction

MOT proposes means by which the contractor could minimize community noise impacts from construction including: implementation of relevant noise mitigation measures (such as noise walls for traffic noise control during the operation phase) as early in the construction phase as possible, avoidance of high noise emission activities during late evening and night-time hours, adherence to construction noise control guidelines such as proper equipment maintenance and operation, creation and maintenance of good relationships/communications with affected communities and the timely response to community concerns when noise issues arise.

The OTCA commits to conduct further assessment of Project-related noise impacts and implement mitigation prior to construction where possible.

Operational

According to MoT's Noise Policy, where pre-project noise levels are low (e.g. 45 dBA) the project-related noise level increases required to warrant mitigation are fairly large (e.g. 10 dBA for a 45 dBA baseline), but where pre-project levels are already quite high (62 dBA or more) only a small increase (3 dBA) is required. MoT's Noise policy does not capture all sites identified for mitigation using the Health Canada, ISO and other criteria (see sections 15.4.3.2-15.4.3.3 of the Application).

Based on MoT's Noise Policy, nineteen residential sites and three schools were identified as locations which may be within the threshold for mitigation. These sites, which represent approximately 600 residences and three schools, generally have small setbacks from Highway 1.

Based on the pre-design assessment of these sites MoT found mitigation is clearly warranted at three residential sites, and potentially warranted at 14 residential sites and the three schools.

*Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008*

Table 18-1: Operational Noise Impacts and Consideration for Mitigation

Site No.s	PMH1 Sub-section	Range of 24 hour Equivalent Sound Levels (dBA)				Mitigation Consideration Warranted?
		2004 Baseline Noise	2021 Predicted Overall Noise	Increase Due to Project (unmitigated)	MOT Threshold	
1-13, s1-s3	McGill Street to Gaglardi Way	54.1 to 72.0	60.3 to 73.4	1.0 to 6.2	60.4 to 75.0	Yes - 1 Potential - 7 No - 7 N/A - 1
14-18,	Gaglardi Way to King Edward Street	58.6 to 70.7	60.4 to 71.9	0.5 to 4.2	63.6 to 73.7	Yes - 0 Potential - 1 No - 4
19-20	King Edward Street to West Abutment	64.2 to 67.7	68.8 to 73.4	1.1 to 9.2	66.4 to 70.7	Yes - 1 Potential - 0 No - 1
21-28	East Abutment to 157 th Street	54.5 to 67.3	60.1 to 70.4	-0.3 to 9.5	60.6 to 70.3	Yes - 1 Potential - 2 No - 4 N/A ¹ - 1
29-41, s4-s9	157 th Street to 216 th Street	51.3 to 68.6	53.7 to 69.2	-0.7 to 2.8	58.7 to 71.8	Yes - 0 Potential - 7 No - 12

Potential mitigation includes the use of quiet pavement, landscaping (berms, landscape buffers, hedges), and noise walls.

Based on the assessment at the pre-design stage MoT believes it will be possible to achieve MoT's Noise Policy goal of a minimum 5 dBA reduction in noise at most sites requiring mitigation. This can be achieved through a combination of noise walls (conventional and structure mounted) and landscaping (berms, landscape buffers, hedges). The MoT distinguishes between these mitigation measures and impact avoidance through the use of quiet pavement (see table 18-2 below). Other standard mitigation measures such as traffic calming and speed reduction are not likely appropriate for the PMH1 Project.

The MoT will conduct detailed noise modelling and review mitigation requirements at the final Project design stage once alignments are finalized. The OCTA commits to conducting noise measurements one-year following completion of construction to evaluate the effectiveness of mitigation measures and commits to further mitigation if necessary and where technically feasible and practical (in accordance with the MoT Noise Policy).

Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008

18.4 Residual Impacts

Table 18-2: Residual effects of PMH1 Project – Average Noise Increases

Site Nos.	Section	Affected Dwellings	Average Noise Increase (dBA)		
			Unmitigated	Mitigated without Avoidance	Mitigated with Avoidance (quiet pavement)
1-13, s1-s3	McGill Street to Gagliardi Way	410	2.6	0.4	-0.2
14-18,	Gagliardi Way to King Edward Street	325e	1.5	0.5	-1.7
19-20	King Edward Street to West Abutment	96	5.2	2.7	1.0
21-28	East Abutment to 157 th Street	251	2.9	1.0	0.1
29-41, s4-s9	157 th Street to 216 th Street	259	1.7	-0.1	-0.7
Totals / Averages		1341	2.3	0.4	-0.4

In the table above, the noise projections with mitigation assume an average barrier effect of minus 5 dBA. Mitigation with avoidance includes the noise barrier and the use of quiet pavement with an additional effect of minus 4 dBA.

18.5 Key Issues Raised by the Working Group and Proponent Responses

Key issues identified by the Working Group during the Application review and MoT's responses and commitments (in italics), as appropriate, are summarized below. Refer to the Socio-Community/Socio-Economic Issues Tracking Table (Appendix XX) for an expanded description.

The City of Burnaby and Health Canada expressed concern that the noise from night-time construction was underestimated in the Application.

MoT will ensure that the Contractor's noise assessment and mitigation conducted prior to construction will be based on the Contractor's site specific activities, including the physical extent and types of night work.

The Cities of Burnaby, Surrey and Coquitlam, and Health Canada expressed reservations about using only MoT's Noise Policy in determining sites warranting mitigation. MoT's Noise Policy does not capture all sites identified for mitigation using the Health Canada, ISO and other criteria.

MoT is committed to working with communities to identify appropriate and effective mitigation measures in accordance with the MoT Noise Policy.

The City of Burnaby requested a commitment for a post-operational monitoring plan which includes monitoring to validate assumptions made in the Application and, where warranted, undertake additional mitigation measures.

The OTCA commits to noise monitoring at the final design phase and 1 year following completion of construction. The effectiveness of any mitigation measures will be evaluated, with a commitment to further mitigation if necessary.

Health Canada explained that the assessment of residual impacts should estimate the duration of exposure of individual receptor sites for a more precise evaluation of the severity of impacts of human receptors will actually experience.

The duration of construction and resulting noise exposure at individual receptor sites will be assessed during the detailed design stage.

18.6 EAO and RA Conclusions

19.0 SOCIO-COMMUNITY CONSIDERATIONS

Chapter 17.0 in Volume III of the Application provides an assessment of potential community and business impacts resulting from the proposed PMH1 improvements.

19.1 Background

The study area for the PMH1 project includes communities or portions of communities adjacent to the proposed PMH1 alignment in the municipalities of Vancouver, Burnaby, New Westminster, Coquitlam, Surrey and the Township of Langley.

The width of the study area for the socio-community impact assessment was determined by the boundaries of Statistics Canada 2001 census tracts that abut the Project alignment. As such, the geographic extent of the socio-community study area varies in distance from the proposed alignment from 500 m to 6,500 m, depending upon the extent of the census tract boundary.

Land use within the PMH1 study area is dominated by industrial and/or commercial uses, particularly at most existing interchanges west of the Port Mann Bridge. Other significant land uses adjacent to PMH1 include greenspace at Burnaby Lake and Tynehead regional parks, several residential communities, and farmland within Surrey and the Township of Langley. Statistics Canada census tracts, show that in 2001 (the most recent census), approximately 177,171 people lived in the Project study area, 60% of these west of the Port Mann Bridge.

Metro Vancouver planning documents (LRSP) emphasize the need for enhancing goods movement capacity and transit capability. Generally, local community plans do not specifically reference widening of PMH1 or construction of a new Port Mann Bridge

*Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008*

span, but in a number of instances recommend interchange improvements to reduce congestion, which are reflected in proposed PMH1 improvements. The views of the local governments regarding the PMH1 Project are summarized in Table 19-1. The Cities of Burnaby, Coquitlam, New Westminster and Surrey and the Township of Langley have all participated in the review of the PMH1 Application.

Table 19-1: Summary of Municipal Views as Presented by Metro Vancouver (formerly the Greater Vancouver Regional District) in 2006⁵

Agency	Views
City of Vancouver	Opposed to twinning of the Port Mann Bridge and the expansion of Highway 1
City of Burnaby	Does not support the PMH1 component of the Gateway project.
City of Coquitlam	Supports overall Gateway goals.
City of New Westminster	Does not support twinning of the Port Mann Bridge or widening of Highway 1 until agreement is reached on mitigation of NFPR in a manner to support New Westminster regional town centre designation
City of Surrey	Supports the PMH1 project subject to conditions
Township of Langley	Endorses the PMH1 project.

19.2 Potential Project Impacts

The improvements associated with PMH1 will enhance the movement of goods and people and facilitate economic activity in and around the corridor. The ability of transit vehicles to cross the Fraser River at Port Mann, which is currently not feasible, will enhance regional connectivity and features to facilitate transit and alternative mode use such as the extension of HOV lanes to 216th Street (as per regional plans contemplated), transit-only ramps, and significant upgrades to cycling facilities will enhance community connectivity. Truck movements to and from major employment nodes will be enhanced, and will alleviate congestion for goods movement, resulting from additional capacity and the development of dedicated commercial ramps at key commercial nodes connected by PMH1. Proposed ramps are intended to provide more direct commercial vehicle access to employment areas reducing the need for extensive use of local roads and saving travel and operational time.

Proposed road widening for PMH1 will occur largely within the existing right-of-way, which minimizes property impacts. In some cases, interchange improvements has the potential to affect the use of adjacent lands and will require further consultation with property owners, adjacent residents and applicable local governments (recognizing that responsibility for land use lies with local governments). Although Highway 1 is an

⁵ Information from the September 12, 2006 report to the GVRD Board of Directors by the GVRD Land Use and Transportation Committee: GVRD Response to the Gateway Program Proposals to Twin the Port Mann Bridge and Widen Highway 1.

established corridor generally located away from residential areas, incremental visual impacts are expected to occur at some locations due to new structures and lighting.

Potential socio-community impacts reviewed in the assessment include property requirements, local transportation network, property access, dangerous goods movement and emergency response, utility, land use, visual issues, community cohesion and business impacts. A summary of impacts is provided below:

- In the reference concept, land is required for PMH1 from about 218 legal parcels of land. Of those, (41%) are owned by various levels of government. Of the 131 privately held parcels, many are vacant and for many, only a portion is required. It is estimated that only 32 parcels are required by the PMH1 structures and will require owners to relocate. In continuing design refinements, further efforts will be made to minimize impacts to private property;
- Due to the addition of several overpasses and the widening of others along the route, community accessibility and mobility is expected to be enhanced, and local street network connectivity improved. However during construction, access changes potentially involve 8 full closures, 19 modifications and provision of 25 alternative accesses. For the most part, alternative access is identified to accommodate full closures; however, in some cases alternative travel patterns will also be required;
- Proposed improvements will increase opportunities for cyclists to cross the highway and connect to the regional cycling network. Existing alternative transportation mode routes are not likely to be adversely affected, except for the potential severance of Langley's 83rd Avenue bike route near the proposed 216th Street Interchange. Re-routing of the bicycle route on 80th Avenue, and on-road bicycle lanes could mitigate this impact, but will need to be confirmed through further discussions with municipal staff;
- Highway 1 is a restricted access facility; therefore incremental impacts to individual properties will be minimal, except where there are alignment changes at overpasses or interchanges. Specific property access impacts identified at the proposed Wayburne Drive overpass, and 192nd Street and 216th Street Interchanges will be addressed during the preliminary or detailed design phase of the Project;
- Modest impacts to community cohesion and connectivity, both positive and negative, are expected. Enhanced connections between community areas will occur where new connections are proposed (i.e. Wayburne Drive, 216th Street). At a few locations, adverse effects may occur as a result of new traffic patterns, such as from the rerouting of 152nd and 176th Street traffic from the north to the south side of Highway 1. In two communities in Coquitlam (Lower Lougheed adjacent to the Brunette Interchange and Cape Horn adjacent to Lougheed Highway improvements), existing housing may be displaced and transportation infrastructure will encroach at the edge of their neighbourhood;

- Low or moderate visual impacts are predicted for over 90% of the PMH1 alignment. Locations where the visual impact is rated as high include the area adjacent to the new Wayburne Overpass and the Cape Horn Interchange;
- The reduced traffic congestion on and improved access to Highway 1 is expected to accelerate new development and re-development within currently zoned industrial and commercial lands, and allow more intensive and higher land use. In turn, this will generate earlier Development Cost Charge revenues, higher tax revenues and employment growth. For example, build-out for the NW Langley industrial area is expected at year 2017 without PMH1, but advances to 2014 with PMH1. For the Carvolth business area at 200th Street, build-out without PMH1 is estimated at year 2042 but accelerates to year 2029 with improvements to PMH1. Also, as a direct result of improved connectivity to Highway 1, a new business park is proposed for the new interchange at 216th Street. The proposed park will support 40 hectares of new developable land and generate up to 6500 new jobs and over \$5 million in annual property tax revenue;
- Highway 1 supports the regional economy by providing access to major business areas, and the new truck-only ramps and reduced overall congestion will improve the level of service. The addition of east-facing commercial ramps at Douglas Road and at 192nd Street for example, will greatly improve connectivity to business districts at Still Creek and Port Kells.
- None of the sites heritage sites identified within Project study area will be directly affected by proposed PMH1 improvements. In Surrey, the heritage site closest to the corridor is Anniedale Elementary School, south of the alignment and adjacent to the 176th Street east bound on-ramp. The Reference Concept indicates that the relocated east-bound on-ramp will move the PMH1 facility further away from this heritage site.

19.3 Proposed Impact Avoidance and Mitigation

Overall, impacts of the PMH1 project have been minimized through design mitigation that has confined most of the improvements to existing right-of-way, and minimized impacts to private property. Impacts to specific communities such as Lower Lougheed and Cape Horn communities will need to be addressed through further design refinements and work with local governments. As an existing major transportation corridor, PMH1 improvements are located primarily away from residential areas. However, some communities will likely experience visual impacts (e.g. from new structures and lighting) for which mitigation has been identified. Similarly, further consultation with local governments and residents will aid in reducing impacts to the extent possible.

The following mitigation measures will minimize the socio-community impacts due to the operation and construction of PMH1:

- Continued collaboration with regional and local governments with respect to regional and community planning initiatives, long term utility servicing, local road network planning, recreational planning for parks, cycle and pedestrian routing,

facilitation of on-going industrial land development/infrastructure, and establishing design guidelines for structural aesthetics and landscaping;

- Continued consultation with residential neighbourhoods regarding options for alternative access and changes to the local road network comprising part of preliminary and detailed design, as well as desirable measures to reduce visual impacts;
- Provision of alternative access to individual properties, adequate screening and landscaping to minimize the physical impact of the PMH1 project where it is relocated closer to residential land or community facilities, and replacement of parkland required for PMH1 project; and
- Payment of compensation for required land, reduction in value of parcel remainders and consequential losses.

Refer to section 16.0 of the OTCA for a detailed listing of commitments.

19.4 Key Issues Raised by the Working Group and Proponent Responses

Key issues identified by the Working Group during the Application review and MoT's responses and commitments (in italics), as appropriate, are summarized below. Refer to the Socio-Community/Socio-Economic Issues Tracking Table (Appendix XX) for an expanded description, and to Section 16.0 of the OTCA for a detailed listing of commitments.

City of Burnaby

- An increase in car travel is forecast. Which neighbourhood are expected to be at increased risk of "rat-running", and what will be done to mitigate these effects?
The Gateway Program undertook an analysis of traffic on Burnaby roads (excluding Highway 1) and found that, consistent with project objectives to restore and retain regional traffic on regional roads, overall vehicle km of travel on City of Burnaby streets declined by 2.7% with the introduction of the Gateway Program (2031 analysis).
- The Application's assessment of impacts on property access is universally positive. There are however areas of negative impact, such as at the Still Creek industrial area. Here, the Reference Concept cuts off the primary southern access, severely limiting access from the west.
A balanced assessment of potential impacts on local street and property access is provided in Chapter 17.5.2.1, including the Land Use Impact Maps, which provide specific comments on access issues, primarily at interchanges, which note where access has been improved or replaced with less direct access. The Still Creek industrial area access referenced by the City is not the primary southern access. It primarily serves a small amount of traffic from the Grandview Highway, and is a low volume, left-turn across a high volume freeway off-ramp. This is not a desirable movement. Other existing connection options, including Canada Way and Gilmore have been maintained.

Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008

- The socio-community assessment contains a lot of information, but says little about the community. Positive and negative socio-community impacts of the Project should be identified, mitigation measures proposed for the negative impacts and community-enhancement strategies for building on the positive effects.

Chapter 17 of the EAC Application characterizes the community and areas that may be affected by capacity and safety improvements to PMH1. This includes information on access, general traffic changes, potential land absorption, potential property losses resulting from highway widening and interchange alterations (e.g. new ramps), visual impact assessment, mitigation measures, and connectivity between areas traversed by the highway. Every effort has been made to note both positive and negative impacts as appropriate.

- The term "community cohesion" is used to refer to "the physical continuity of a community to its outermost boundaries". This is a very narrow, engineering-oriented definition. Community is about people, and the PMH1 project will inevitably affect commuting and driving patterns and decisions about locations of employment.

The definition of "community cohesion" is consistent with standard socio-community impact assessments for projects of this scale including other recent regional projects. Chapter 17 of the EAC Application material incorporates a characterization of the community and areas that may be affected by capacity and safety improvements to PMH1 as outlined previously.

Metro Vancouver

- Expressed concern that adjacent to Burnaby Lake Regional Park, the proposed mitigation to protect/screen users on trails parallel to the Highway, including horse riders, is to replace the fences/barriers. To maintain the integrity of the urban trails, new fences, barriers and vegetation should be required to mitigate the impacts as opposed to 'replacement' of what is currently there. There may also be creek crossings / culvert replacements that will provide opportunities for habitat enhancement.

MoT responded that where feasible, the PMH1 project team proposes to recycle and re-use existing fences and vegetation, and to replace if required. Mitigation for noise impacts to park areas is not addressed in MoT's noise policy and therefore is beyond the scope of the assessment, as set out in the Application Terms of Reference. The Project team agrees that there are habitat enhancement opportunities in this area, and will continue to work with Metro Vancouver to identify and provide habitat enhancement opportunities along the entire corridor. With reference to existing creek crossings and culvert replacements or retrofits within the Project area, on fish-bearing watercourses, MOT will maintain, or if possible improve, fish passage.

City of Surrey

- A significant direct community impact is the site of the Dogwood RV Park north of 112 Avenue and east of Highway 1. Although the Application states that "existing housing units may be affected by potential encroachment of a new retaining wall resulting from a necessity to widen the highway in this area," the current plans for the alignment show that a significant proportion of this property will be required and the remainder will be affected. Approximately 50 trailer pads, some of which are used (against City by-laws) as permanent residences, appear to be directly affected by the currently proposed alignment. There are limited locations for relocation of these units in the Lower Mainland. Additional consultation with campground residents and assistance with relocation is warranted.

The OTCA commits to working with the City of Surrey during the design phase regarding impacts to the Dogwood RV Park.

- Access need to be maintained or enhanced to areas in Surrey that will be severed by the Highway, particularly the Fraser Heights area and the Port Kells area.

The new 156th street underpass, a partnership between MoT, the Gateway Program and the City of Surrey, will help maintain and enhance access between Fraser Heights and the rest of Surrey. The OTCA commits to working with the City during the design phase to maintain and enhance access to Fraser Heights.

City of Coquitlam

- The City seeks assurance that all pedestrian, cycling and transit connections and routes will to be enhanced along the Brunette Avenue corridor from King Edward through to the interchange with the Trans Canada Highway and the Braid Street Skytrain station.

The PMH1 project includes \$50 million planned infrastructure to accommodate cyclists and pedestrians across Hwy 1 at all interchanges and overpasses, and pedestrian and cycling connections will be included for the Brunette Ave and King Edward overpass. The OTCA commits to the infrastructure improvements as well as to ongoing consultation with municipal staff regarding cycling and pedestrian access. Improving transit connections at Brunette Ave Interchange and any other interchanges along the corridor will be subject to ongoing discussions with TransLink staff.

- Maillardville is home to key cultural facilities including Place des Arts, Mackin House, Heritage Square and the Buddhist Temple on Jackson Street. Access to these important facilities must be protected during the construction and operation of the Gateway project.

The Place des Arts, Mackin House and Heritage Square are located some distance from the proposed improvements, and direct impacts to access are not expected, although there may be indirect effects from the construction at Brunette Avenue and Highway 1. The OTCA commits to ongoing consultation with local governments to refine the design concept,

which creates an opportunity to consider the protection of access to the Buddhist Temple during construction and operation.

- There is a lack of substantial analysis on project impacts related to property values and tax impacts, projected taxes and commercial /industrial growth potential associated with the project for business and employment areas in Coquitlam.
In accordance with the Application Terms of Reference, property values and tax impacts focused on areas which experience clear and significant value shifts due to PMH1 improvements, specifically due to altered access which open new areas for economic development. As a result, the assessment focused on business impacts in areas where current access is not available, but new access is proposed, such as at 216th Street in Langley.
- The Application provided a very limited assessment of the Cape Horn and Brunette Interchanges and King Edward overpass, and the City requests more detailed information.
The OTCA commits to ongoing consultation with municipal staff regarding project design.
- Tree replacement for those trees removed as part of the project is not adequately addressed. The City seeks confirmation from Gateway that it tends to develop as part of their Environmental Management Program a tree replacement policy to ensure that there will be no net loss of trees or canopy cover.
Specific details regarding tree replacement, site specific vegetation treatments, and monitoring requirements will be developed during the design and preconstruction phase of the Project. However, the Project will preserve, to the extent possible, native trees and understory plants in areas outside of the actual roadwork footprint where safety concerns or infrastructure requirements are not of concern.
- Maquabeak Park has the potential to be the most severely impacted of all the City's parks due to its proximity to the proposed twinning of the Port Mann Bridge. Any amenities or amenity values lost as a result of the bridge construction will need to be compensated for by the provision of land and replacement or relocation of those same amenities in a nearby area on the Fraser River foreshore.
There is the potential for minor encroachment on Maquabeak Park, but impacts are anticipated to be temporary, construction-related effects. Should any park improvements be permanently lost or altered, these will be compensated for in a nearby area of Fraser River foreshore.
- The City seeks assurance that existing and planned trail corridors linking the proposed Fraser River Greenway and Brunette River trails with the PoCo trail system and the Central Valley Greenway will be protected.
Existing pedestrian and cycling facilities currently used will be either maintained or reinstated in a safe and efficient manner throughout construction.

- The City requests that Gateway develop comprehensive urban and landscape design principles that will be applied to all project elements including interchanges, intersections approaches and corridor as a whole.
MoT's Manual of Aesthetic Design Practice will form part of the landscape and site restoration design criteria to be considered for the Project along with MoT's Landscape Policy and Design Standards. If there are specific project areas where Coquitlam wishes to fund and maintain special aesthetic or restoration activities, the Project may consider such requests.
- The visual impact of the rebuilt Cape Horn Interchange from adjacent residential neighbourhoods will be quite significant given the proposed multi level ramp system.
The visual impact rating for the Cape Horn Interchange and Lougheed Highway/United Boulevard area of Coquitlam was listed as high, acknowledging that proposed improvements are likely to substantially modify existing configurations with multiple grade separated roads and new elevated overpasses. Consultation with the City of Coquitlam will continue throughout the design phase of the project.
- The City requests that the Maillardville Streetscape and Pedestrian Corridor Design Guidelines be used for project components within the Maillardville Neighbourhood Plan area.
The revitalization goals and plans for the Maillardville Village are recognized in the Application as one of the City's economic development goals and priorities. The OTCA commits to work with municipalities to refine the design concept.

19.5 EAO and RA Conclusions

20.0 TOLLING

Chapter 21.0 in Volume III of the Application provides an assessment of tolling considerations within the PMH1 project area, and of the potential impacts and proposed mitigation measures.

20.1 Background

The PMH1 Project proposes tolls in both directions for the Port Mann crossing as a funding mechanism for construction, operation and maintenance as well as to assist in managing congestion of the facility over time.

The proposed tolling framework will include: a point toll at the bridge; a toll rate for three classes of users including cars, light commercial and large commercial vehicles; and a fully electronic free-flow collection system. The Province retains control for all toll rate increases.

The PMH1 project will be consistent with the provincial tolling guidelines including the requirement for a reasonable untolled alternative.

20.2 Potential Project Impacts

When tolling is introduced on existing facilities a proportion of motorists will move to other routes to avoid paying a toll. MoT has modelled this impact and estimates that the traffic not willing to pay the toll in the peak direction could result in traffic diversion from the Port Mann Bridge that is similar to the traffic attracted to the Port Mann Bridge due to the improved travel time savings it offers. The analysis for the Pattullo Bridge is based on the existing structure and lane configurations (2 lanes in each direction).

Fig. 20.1 Effect of Port Mann Tolling on Alternate Fraser River Crossings in 2021

		Westbound			Eastbound		
		No PMH1	PMH1	% Difference	No PMH1	PMH1	% Difference
Daily	Pattullo	69,733	70,117	1%	69,733	70,117	1%
	Alex Fraser	70,223	68,931	-2%	72,388	71,056	-2%
		No PMH1	PMH1	% Difference	No PMH1	PMH1	% Difference
AM Peak	Pattullo	5,633	5,151	-9%	4,329	4,808	11%
	Alex Fraser	7,926	7,078	-11%	3,942	4,104	4%

20.3 Key Issues Raised by the Working Group and Proponent Responses

Key issues identified by the Working Group during the Application review and MoT's responses and commitments (in *italics*), as appropriate, are summarized below. Refer to the Socio-Community/Socio-Economic Issues Tracking Table (Appendix XX) for an expanded description.

Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008

The Cities of Surrey, New Westminster, and Burnaby noted that while daily averages are balanced, diversion effects to the Pattullo Bridge are estimated to be 11% in the morning peak hour eastbound/southbound direction. The cities requested that mitigation of diversion effects be considered.

MoT and municipalities will continue to discuss this issue as part of on-going municipal liaison in Project development.

The Kwikwetlem First Nation commented that diversion to the Pattullo Bridge or to Mary Hill Bypass and the Pitt River Bridge could result in additional impacts of increased traffic (noise, air contamination) on Kwikwetlem Indian Reserve No. 1.

MoT's analysis, which includes the Golden Ears Bridge due to open in 2009, indicates very little interaction between Port Mann Bridge traffic and Pitt River Bridge traffic (via Mary Hill Bypass) as the bridges serve two different markets.

The City of Burnaby noted that a higher toll rate than used for the assessment would have a higher diversionary impact than modelled.

Using the initial toll rate and taking into account Consumer Price Index increases, the toll will be in the \$3.00 range by 2013, when the Project opens. The relative cost of the toll as a percentage of consumer spending won't change from that modeled in the Application.

20.4 EAO and RA Conclusions

21.0 TRAFFIC, TRANSPORTATION, AND ROAD USER ASSESSMENT

Chapter 24.0 in Volume III of the Application a Traffic, Transportation, Road User Assessment for the PMH1 project area, and of the potential impacts and proposed mitigation measures.

21.1 Background

The MoT's analysis of current and projected future conditions along the PMH1 corridor includes current traffic characteristics, such as traffic volume and travel patterns, as well as forecast characteristics, based on transportation modeling. This information was used in the development of the reference concept and forms the basis for the analysis presented in other sections of the Application.

Development of the Traffic Model

In 2004, the Gateway Program commissioned the development of an appropriate travel demand forecasting model to assist in the planning and project development aspects of the three corridors within the Gateway Program. With the assistance of TransLink to provide technical advice, the Gateway Program retained TSi Consultants to develop the Gateway Sub Area Model. As part of the development of the new model, which includes both AM and PM peak hours, an extensive Trip Diary Survey, in partnership with TransLink, was conducted to support the calibration efforts. Significant traffic data was collected throughout the region for use in calibrating the models to current conditions at the time.

When the model development was completed, the Gateway Program retained David Kriger of iTRans Consulting and Dr. Eric Miller from the University of Toronto to review the models for completeness as well as the degree of accuracy of the calibration. An acceptance report was prepared by this team and submitted to the Gateway Program prior to the model being used for any planning purposes.

Since the initial development of the Gateway Sub Area Model, several updates to the model have been conducted by the Gateway Program Modelling Team to maintain the relevance of the model with respect to the future road and transit networks.

21.2 Key Issues Raised by the Working Group and Proponent Responses

Key issues identified by the Working Group during the Application review and MoT's responses and commitments (in italics), as appropriate, are summarized below. Refer to the Socio-Community/Socio-Economic Issues Tracking Table (Appendix XX) for an expanded description.

As discussed in the Air Quality sections of this report, the City of Burnaby, the City of New Westminster, the City of Surrey, Metro Vancouver, Environment Canada, Health Canada, and the Ministry of Environment commented that the traffic model does not consider induced effects/ induced development.

The EAO noted during the review that induced land use change is beyond the scope of the assessment as set out in the Section 11 Order and the Application Terms of Reference. The assessment includes issues for which a reasonable direct causal link can be demonstrated between some component of the project and the resulting effect.

The City of Burnaby

- The EMME/2 model does not model traffic queues and as a result significant traffic impacts have not been considered.
MoT response pending
- Modelling by the Proponent indicates that northbound peak-hour volumes on the Second Narrows Bridge will be 800 vehicles greater than today. Since this location is already congested today, an additional 800 vehicles will lead to significantly greater congestion and queuing.
The Reference Concept was designed to accommodate the projected increase in traffic volumes.

Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008

21.3 Pedestrian and Cycling Facilities

A primary element of the Project is a joint cyclist/pedestrian facility on a new Port Mann Bridge with connections to Lougheed Highway, Mary Hill Bypass and United Boulevard. At all local road crossings, including interchanges, overpasses and underpasses, facilities are proposed that would allow cyclists utilizing the local road network to cross the highway. These facilities could include multi-use paths, bike lanes, shoulders and/or wide shared lanes. Features to support cycling and pedestrian access are outlined in section 4.4.3 of the Application.

21.4 Key Issues Raised by the Working Group and Proponent Responses

Key issues identified by the Working Group during the Application review and MoT's responses and commitments (in italics), as appropriate, are summarized below. Refer to the Socio-Community/Socio-Economic Issues Tracking Table (Appendix XX) for an expanded description.

The City of Burnaby recommended that design standards for all cycling and pedestrian facilities should meet or exceed the guidelines of the Transportation Association of Canada.

The OTCA commits to meeting Transportation Association of Canada cycling and pedestrian facilities.

The City of Surrey recommended the proponent work with the community to plan facilities for pedestrians, cyclists and access to recreation and natural areas affected by the project.

MoT has been meeting with municipalities to discuss interchange-specific pedestrian and cycling improvements. The Contractor will be required to undertake further public consultation during the different design stages to accommodate pedestrian and cycling requirements and maintain existing or reinstate pedestrian and cycling facilities in the Project area.

21.5 Traffic Management during construction

The PMH1 project will be a major multi-year construction project on the busiest stretch of highway in the Lower Mainland. Construction and traffic management planning is required to mitigate the potential effects to traffic operations related to construction work and avoid or minimize construction-related traffic congestion, disruption of traffic flows, longer travel times for commuters and temporary reduction in route connectivity for vehicles, pedestrians and cyclists.

A detailed traffic management plan will be developed to document how MoT and its Contractors will identify traffic management risks, manage traffic and communicate with the public during the construction period. Key elements of the traffic management plan are:

A traffic control plan which sets performance requirements which may include:

- Permitted lane closure/reduction windows;
- Local detours and lane shifts;

*Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008*

- Traffic control devices, including construction and advisory signs, project signs and changeable message signs;
- Temporary roadside barrier requirements;
- Treatment and protection of drop offs (abrupt changes in roadway elevation);
- Temporary Pavement Markings;
- Location and storage of materials and equipment;
- Speed Limits and Safe Passage through construction sites;
- Permissible cross-street stoppages (if any); And
- Accommodation of pedestrians/cyclists and transit.

A traffic management communications plan which includes:

- Stakeholder awareness of the Project and its impacts on traffic operations;
- Communications to groups directly impacted by the Project (i.e., local residents and businesses);
- Communications to the traveling public in a timely manner regarding events that might negatively affect traffic operations; and
- Communications to emergency response agencies in a timely manner regarding events that might negatively affect traffic operations.

Incident management and response plans to address passage of emergency vehicles, assistance to emergency response personnel, motor vehicle crashes, emergency road repairs, disabled vehicles and debris on the road.

21.6 Key Issues Raised by the Working Group and Proponent Responses

Key issues identified by the Working Group during the Application review and MoT's responses and commitments (in italics), as appropriate, are summarized below. Refer to the Socio-Community/Socio-Economic Issues Tracking Table (Appendix XX) for an expanded description.

The City of Coquitlam requested that base accessibility and service level for travel be maintained during the construction period to ensure economic viability for businesses in the affected.

The preliminary Traffic Management Plan has been revised to reflect changes that were suggested during consultation with stakeholders, including Coquitlam staff, and includes provisions that during Restricted Periods, no lane closures along the highway mainline, interchange ramps and cross-streets will be permitted.

The Kwikwetlem First Nation requests that details of the Traffic Management Plan be discussed with the Kwikwetlem prior to completion, especially with regard to detours, construction scheduling, and temporary increases of traffic near Kwikwetlem Indian Reserve No. 1.

MOT will continue to consult with the Kwikwetlem First Nation regarding Project concerns during the planning, design and construction of the Project, including concerns regarding traffic management.

21.7 EAO and RA Conclusions

PART E: FEDERAL REVIEW REQUIREMENTS

22.0 CONSIDERATION OF ALTERNATIVES

As described in Volume I, Sections 3.2 and 3.3 of the Application, MoT evaluated a number of alternatives in planning the PMH1 Project.

22.1 Alternatives to the Project

The Canadian Environmental Assessment Agency (CEA Agency) provided guidance on the assessment of alternatives for the PMH1 Project in a letter dated October 17, 2006 (Appendix XX). The letter explains that as a Responsible Authority (RA) under the *Canadian Environmental Assessment Act*, Transport Canada is requiring a consideration of alternatives to ensure that the proponent has shown due diligence in planning the project.

The CEA Agency letter defines "alternatives to" the project as functionally different ways to meet the project need and achieve the project purpose from the perspective of the proponent.

The MoT defines the project goals of PMH1 as:

- Reduce travel times for trips along the corridor and increase their predictability;
- Reduce congestion at entry and exit points to Highway 1;
- Reduce travel times for trips across the corridor and improve connections within and between communities;
- Improve access to and egress from the corridor for goods movement;
- Facilitate the introduction of transit service along the corridor and the improvement of transit service across the corridor;
- Expand HOV, cycling and pedestrian networks along or in the vicinity of the corridor; and,
- Improve safety for vehicle operators and passengers, cyclists, and pedestrians

Under Section 3.2 of the Application, MoT discusses the following as functionally different ways to achieve one or more of the project goals.

22.1.1 Upgrading Parallel Corridors

In most segments of the PMH1 corridor, at-grade and lower-capacity/speed arterials routes flank the highway. In reviewing other candidate corridors (including Kingsway, Canada Way, Lougheed Hwy and Fraser Hwy), MoT determined that the impacts of widening and grade-separating these corridors would exceed the impacts of development within the PMH1 corridor.

22.1.2 Development of New Corridors

The MoT concluded that no other suitable corridor is available for the development of a high-speed/capacity limited-access highway within the Burrard Peninsula. This area is

Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008

substantially built-up and any new corridor would require the acquisition of large amounts of densely-populated and developed land.

22.1.3 Widening/Replacing the Pattullo Bridge

Due to severe constraints posed by urban development on either side of the existing Pattullo Bridge, MoT determined that road capacity improvements, and therefore congestion relief, could not be realized in the near term.

22.1.4 Tolling the Port Mann Bridge without Investment in New Bridge Capacity

The MoT concluded that in the urban environment of Greater Vancouver, tolling the Port Mann Bridge without providing additional capacity would result in unacceptable overloading of untolled alternative routes, such as the Pattullo Bridge.

22.1.5 Applying a System-Wide Toll without Investment in New Bridge Capacity

The MoT determined that in order to achieve traffic flow conditions at the Port Mann Bridge comparable to those predicted with the PMH1 project, individuals would require adequate opportunities to use alternative modes that are not contemplated within TransLink's 10-Year Plan. The MoT concluded that imposing a system-wide congestion toll could have significant detrimental impact on the region's economic development.

22.1.6 Reversible East-bound/West-bound HOV Lane on the Port Mann Bridge

The MoT determined that the reversible HOV lane option would provide some short-term congestion reduction benefits but would not address: congestion at entry and exit points; community, pedestrian and cyclist connectivity; and the growing flow of east/west traffic during both peak periods.

22.1.7 Rail-based Transit Alternatives

The MoT determined that ridership levels would not justify investment in rail-based transit infrastructure at this time. The existing PMH1 corridor, east of the Port Mann Bridge, generally passes through regions of low population density and does not connect with regional town centres. In MoT's analysis, a rail-based transit system along the PMH1 corridor would not address the complex trip patterns that result in congestion at the bridge and would not address the movement of goods along the corridor.

22.1.8 Bus-based Transit Alternatives

The MoT concluded that transit-only solutions, utilizing the existing Highway 1 roadway and Port Mann Bridge, would achieve only a small reduction in vehicle use for a limited period and therefore would be inadequate as a stand-alone solution for congestion reduction.

22.1.9 Short Sea Shipping

The MoT concluded that short-sea shipping is not a viable stand-alone alternative to the truck-based movement of containers, as it will not substantially reduce the reliance on

trucks to move containers to destinations served by the PMH1 corridor. The MoT notes that the short-sea shipping concept falls outside of its mandate.

22.1.10 Port of Prince Rupert

Due to the nature of the container traffic that the Port of Prince Rupert is likely to attract, MoT does not consider this a viable alternative for goods movement. With local destinations and as a major logistics and redistribution centre, the Vancouver ports complex will likely remain the destination of choice for the foreseeable future. The MoT notes that this alternative falls outside of its mandate.

22.1.11 Proponent's Conclusion Regarding Alternatives to the Project

In the opinion of MoT, no single alternative to the project adequately achieves all project goals. In a comparison between the alternatives outlined above and the proposed PMH1 Project, MoT concluded that PMH1 will best technically and economically meet all of the identified project goals and needs.

22.2 Alternative Means of Carrying Out the Project

The CEA Agency letter of October 17, 2006, explains that "[o]nce the preferred alternative is selected, 'alternative means' of carrying out the project would be described that identify the various technically and economically feasible ways that the project could be designed and implemented by the proponent." Alternative means could include, for example, components of the project such as the design of interchanges, the number of lanes to be added, HOV lanes, and the supporting infrastructure required.

Under Section 3.3.3 of the Application, MoT considered alternative means of carrying out the PMH1 Project. The MoT summarizes what they term strategic alternatives, such as options for transit and commercial vehicle priority ramps, as well as technical alternatives including interchange configurations and alternative locations for the proposed new Port Mann Bridge. The MoT summarizes the rationale for including various alternatives in the reference concept and generally indicates a preference in cases where an option has not yet been selected.

22.3 Key Issues Raised by the Working Group

The City of Burnaby commented that the Reference Concept is a multi-modal proposal incorporating all modes of transportation, plus demand management while the alternatives are single-mode options, or stand-alone demand management. These will be less effective than the broader approach being proposed for the Reference Concept. The Proponent should be required to analyze realistic, viable alternatives that can meet the project goals.

The MoT responded that it has been reviewing options for improvements to goods and people movement on Highway 1 since the early 1990's. The alternatives discussed in the Application have been analyzed by some of the foremost transportation engineering firms in Canada.

22.4 EAO and RA Conclusions

The EAO and federal Responsible Authorities are satisfied that MoT has carried out an adequate assessment of project alternatives.

23.0 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

Section 26.2 of the Application provides an assessment of environmental factors that have the potential to affect the Project. Predicted effects of slope/terrain stability, erosion, climate change, flooding, seismic events and other natural hazards, are discussed along with measures to mitigate these effects.

23.1 Seismic Hazards

The Lower Mainland lies within one of the most highly seismically active areas of Canada and therefore, seismic design of the new Port Mann Bridge and other Highway 1 structures is important to the Project.

The new Port Mann Bridge will be designed and constructed as a Canadian Standards Association "Lifeline Structure" and other bridges required to carry Highway 1 other than the main river crossing will be designed as "Disaster Response Route Structures". Foundations in soils susceptible to liquefaction will be designed to have sufficient lateral capacity to resist the forces generated by the soils, or ground improvement will be carried out to prevent soil liquefaction.

23.2 Slope Stability

Steep slopes exist adjacent to only limited portions of the Highway 1 alignment including:

- In the vicinity of the Grandview Overpass;
- Cape Horn north of the Lougheed Highway; and
- Port Mann to the south of the Fraser River.

Soil nailing, the use of retaining structures or other suitable technique may be required where widened or realigned roadways encroach on the slopes at Grandview Highway or Cape Horn. In most cases where changes in the highway width/alignment cause encroachment in these areas, use of retaining structures or other measures such as re-grading of the slopes or soil nailing, can be used to maintain overall stability of the slopes adjacent to the highway.

23.3 Potential for Acid Rock Drainage

Exposure of bedrock is not anticipated within the cut slopes for the upgrading of Highway 1 and its interchanges in the Project. Therefore, acid rock drainage associated with the proposed works is considered extremely unlikely.

23.4 Climate Change Impacts

*Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008*

The main potential impact of climate change on the Project is flooding associated with sea-level rise coupled with high river flows and/or high tides in the Fraser River. In addition, the occurrence of more extreme weather events would lead to more severe, extreme precipitation events and droughts, causing alterations to watercourse flows. These factors have been taken into account in the definition of design criteria and development of the reference concept for the Project.

23.5 Erosion and Scour

There are no erosion risks posed by the smaller watercourses crossed by PMH1 because they have relatively small catchment areas and the existing municipal stormwater collection systems limit the peak water flows.

A hydrotechnical investigation was carried out for PMH1 which assessed scour at the north and south piers for two conceptual bridge configurations for the proposed Port Mann Bridge. All tests for both construction and operations/maintenance phases were conducted with a discharge equivalent to the 200-year flood. Depending on pier configuration, scour depth went from minor local scour to depths of up to 12 m below the mean bed level. Pier location should take into account the effects the structure could have on the stability of the bank and the effects of the bank on flow patterns at the caisson.

In addition to local pier scour, general scour or an overall lowering of the channel in response to high flows will occur. As an initial estimate, general scour was computed based on the area of the caissons. Assuming that all bed lowering occurs in the main channel, the expected scour would be in the order of 4 m. This estimate will be confirmed for detailed design.

23.6 Severe Climate Conditions

The potential impacts on the Project arising from severe climatic events include:

- Decreases in slope stability, increased erosion potential and flooding from heavy rainfall events;
- Potential damage to roads, structures and drainage facilities from high winds and heavy rain, leading to untreated runoff and debris entering watercourses;
- Adverse driving conditions leading to more accidents during heavy rain, snow, fog and high wind events;
- Environmental effect of de-icing materials and winter abrasives applied to roads for increased safety during winter (snow and ice) conditions.

The potential for severe climate conditions to alter the incidence of vehicle accidents, erosion and frequency of flooding, and stormwater and drainage impacts is considered to be less with the Project than it currently is because design effort and operational management of the Project will provide and maintain infrastructure that will result in better stormwater and drainage management and improved safety for vehicle operators and passengers, cyclists and pedestrians along the PMH1 corridor.

23.7 Key Issues Raised by the Working Group and Proponent Responses

Key issues identified by the Working Group during the Application review and MoT's responses and commitments (in italics), as appropriate, are summarized below. Refer to the Biophysical Issues Tracking Table (Appendix XX) for an expanded description.

CEAA recommended the proponent investigate the possibility that erosion in the vicinity of the piers due to river hydrology could induce changes in the configuration of the banks downstream by introducing sand dunes or sand islets.

Hydraulic assessment will be part of the final bridge design and, as outlined by Transport Canada conditions of approval, will include pre/post construction hydraulic assessment for final design pier placement that identifies potential for scour and deposition of material within 500 m upstream and downstream of the new piers.

Transport Canada noted that with construction of the Golden Ears Bridge there have been changes in stream morphology near and downstream of the new piers. Any changes in flow characteristics will need to be used to update the hydraulics assessment for the new Port Mann crossing. Hydraulic changes can result in erosion and deposition and changes in the navigation channel and habitat, which can potentially affect the First Nation's efforts to catch fish and other operators in the area e.g. log storage, vessel traffic.

The OCTA commits to conducting further hydraulic assessment. The Project team continues to meet regularly with the Golden Ears Bridge team and will follow-up regarding hydraulic assessment and requirements. Marine users, including commercial and aboriginal fishers, other vessel operators and log storage operators will be consulted as part of the bridge design process. Commitment being further developed.

23.8 EAO and RA Conclusions

24.0 ACCIDENTS AND MALFUNCTIONS

Section 26.1 of the Application provides identifies the environmental impacts that may occur in the event of an accident or malfunction during PMH1 construction and operations and provides an overview of existing contingency measures to avoid and/or minimize adverse environmental impacts.

24.1 Construction

Potential accidents and malfunctions during construction of the PMH1 project that could adversely affect the biophysical environment include:

- Release of toxic/hazardous materials (e.g., hydrocarbon fuels, lubricants, concrete) to fish habitat;

- Structural failure in a culvert, ditch, detention pond or sediment containment measure resulting in localized flooding, erosion, sedimentation, and/or discharge of deleterious materials to the aquatic environment;
- Damage to utilities (e.g., buried natural gas pipes, water mains) resulting in the release of deleterious materials to fish habitat;
- Accidents involving construction vehicles associated with the Project, and/or vehicles moving through or around construction sites; and
- Disturbance of environmentally sensitive habitat or accidental mortality of animals due to inappropriate machinery or equipment operation.

Chapter 26.1.2 of the Application outlines the various contingency measures required by MOT to minimize the environmental impacts of accidents and malfunctions during construction. These measures include:

- Spill Prevention and Emergency Response plans and protocols
- Control of stormwater and sediment
- Management of Concrete and Concrete Washwater
- Working with potentially affected utilities
- Traffic Management Plan including measures to prevent traffic hazards during construction

24.2 Operation

Potential accidents and malfunctions during highway operations and maintenance that could adversely affect the biophysical environment include:

- Incidents resulting in the release of toxic/hazardous materials (e.g., hydrocarbons) to environmentally sensitive habitat (e.g., wetland, watercourse);
- Structural failure of a culvert or ditch resulting in localized flooding and/or erosion, sedimentation, and/or discharge of deleterious materials to the aquatic environment;
- Collapse of a highway structure;
- Vessel strike against one or more piers of the existing or new Port Mann Bridge; and
- Incidents resulting in an adverse impact to environmentally sensitive habitat and/or wildlife injury or mortality.

Accidents and other types of emergencies will be managed as they are currently along the existing Highway 1 (e.g., Vancouver Emergency Operations Centre, local police and fire departments, Provincial Emergency Program). Emergency responder access to the highway will be improved due to the reduction in traffic congestion and provision of additional HOV lanes. A key goal of the PMH1 project is to improve road safety for vehicle operators and passengers, cyclists and pedestrians.

24.3 Key Issues Raised by the Working Group and Proponent Responses

Key issues identified by the Working Group during the Application review and MoT's responses and commitments (in italics), as appropriate, are summarized below. Refer to the Biophysical Issues Tracking Table (Appendix XX) for an expanded description.

Canadian Environmental Assessment Agency

Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008

- Noted that there is a time delay or the possibility for the contingency to fail. What environmental components could be impacted and what is the worst case scenario?

While it is conceivable that damage to the environment could occur in the short-term as a result of a time delay or failure of a contingency measure, MoT's goal would be to minimize any long-term adverse effects by implementing effective clean-up, mitigation and habitat restoration measures in a timely manner. With reference to water courses, the situation will be better than today since, in the case of a spill, there will be pre-treatment prior to draining into fish bearing streams.

Environment Canada

- Recommended that a review of the Spill Prevention and Emergency Response Plan be considered as part of the follow-up for this assessment.
The EMP sub-plans for surface water quality and sediment control, environmental monitoring, emergency spill response, containment and management, and construction waste management will be submitted to EC at least 30 days prior to the start of construction activities for review. MOT will ensure that the Spill Prevention and Emergency Response Plan, for construction, will include contingency measures for addressing emergency response for rupture of any oil, gas, water or sewer pipelines crossing the Fraser River in the Project area, a vessel accident due to the construction of the bridge resulting in a fuel release, the release of large quantities of uncured cement, or the release of large quantities of fuel, such as from a fuel storage tank or fuel tanker truck.
- Recommended that all spills of deleterious substances that may impact waters frequented by fish be reported to the Provincial Emergency Program (PEP), regardless of the quantity.
MOT will require the Contractor to report to PEP any spills of deleterious substances into waters frequented by fish that are substances reportable under the Spill Reporting Regulation, regardless of amount of the spill.
- Recommended the proponent review the *Implementation Guidelines for Part 8 of the Canadian Environmental Protection Act, 1999—Environmental Emergency Plans* to determine if the Environmental Emergency Regulations apply to their situation.
The OCTA commits to obtaining required statutory Permits, Approvals, and Authorizations before proceeding with construction that requires such permits.

24.4 EAO and RA Conclusions

During this harmonized EA review EAO, DFO and TC have considered: the Application; Clarification Reports and memos; government, First Nation and public comments on the potential effects of the Project; responses from MoT; and Working Group discussions. Based on this information and provided that MoT implements the actions described in the *Owner's Commitments and Assurances*, EAO, DFO and TC are satisfied with MoT's

*Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008*

assessment of, and measures to address, the potential effects of any accidents or malfunctions.

25.0 CUMULATIVE AND RESIDUAL EFFECTS

25.1 Background

The *Canadian Environmental Assessment Act* (Section 16(1) (a)) requires that the environmental assessment of projects such as the PMH1 project include an assessment of cumulative environmental effects (CEEs). CEE assessments examine the interaction between the residual effects of a project and those associated with other past/existing and imminent projects or activities. Residual effects are defined as those changes, either positive or negative, which remain and influence an environment after implementation of project mitigation and compensation measures. The interaction of residual effects associated with multiple projects and activities can result in cumulative impacts.

As directed in the Application Terms of Reference (ATOR), the CEE assessment follows methodology described in the Cumulative Effects Assessment Practitioners Guide (Hegmann et al, 1999).

25.2 Scoping of Residual Effects

As set out in the ATOR, only those valued ecosystem components (VECs) for which potential residual environmental effects could be identified were considered in the CEE assessment. The ATOR also specified that social components (SCs) were to be considered only where they could be affected by a change in an environmental component (e.g., human health and air quality, respectively). The results of the assessment studies with respect to potential impacts to stormwater quality, air quality, fisheries and aquatic habitat, and vegetation and wildlife resources were reviewed during issues scoping.

The results of the issues scoping is as follows:

- **Stormwater quality:** The PMH1 project is expected to have a negligible long-term effect on stormwater quality.
- **Air Quality:** Between 2000 and 2020, the incremental contribution to total regional criteria air contaminant and GHG emissions by the Gateway Program in combination with these other infrastructure projects is expected to be small compared with that associated with all other regional emissions sources. Consequently, the operations/maintenance phase of the proposed PMH1 project is expected to have a negligible residual effect on ambient air quality in the Lower Fraser Valley.
- **Fisheries and aquatic habitat:** The federal *Fisheries Act* requires that there be "no net loss" of productive capacity of fish habitat, and the mitigation and compensation measures of the PMH1 project are designed to achieve this requirement. Consequently by law, there will be no residual effects on fish habitat. There may even be net positive effects due to improvement and creation of in-stream, riparian and terrestrial compensation habitats in the PMH1 project corridor in areas where habitat does not currently exist or is of very low value. Additionally, mitigation measures proposed to be implemented during

construction of the new Port Mann Bridge will protect the most sensitive aquatic species (e.g. salmonids) and therefore provide more than adequate protection to white and green sturgeon, at-risk fish species that occur in the Project area.

- Vegetation and wildlife resources: Potential residual effects to terrestrial resources in the PMH1 project area are primarily related to habitat loss along the widened roadway alignment and within the footprint of associated structures, and disturbance resulting in wildlife displacement and interference with movement patterns during construction.

25.3 Potential Significance of Residual Effects

The potential significance (ecological consequence) of residual effects for each VEC, based on the reference concept, is presented in Table 25-1. Only those VECs with a moderate or high overall significance rating, the mature forest and Great Blue Heron, will be further considered in the CEE assessment.

Comment [JH24]: Is there a definition of significance that could be included here to clarify how the significance ratings were arrived at?

- Table 25-1: Potential Significance of Residual Effects on VECs for the PMH1 Project

Valued Ecosystem Component	Potential Residual Effect	Overall Significance Rating
Nuttall's Waterweed (a provincially blue-listed wetland plant species)	Temporary loss of rare (blue-listed) plant species	Low
Wetland Habitat	Temporary loss/fragmentation of habitat Note that all wetland habitat potentially affected by the PMH1 project is man-made.	Negligible
Mature Mixed & Coniferous Forests (structural stage 6) (a red-listed plant community)	Permanent loss of localized habitat	Moderate
Pacific Water Shrew (provincially red-listed, Endangered Threatened under SARA, Schedule 1)	Temporary loss of localized habitat and disruption of dispersal patterns	Low
Great Blue Heron (provincially blue-listed species, Special Concern under SARA, Schedule 1)	Sensory disturbance of nesting colony at Coquitlam Wildlife Management Area	High

s.18

- Table 25-1: Potential Significance of Residual Effects on VECs for the PMH1 Project

Valued Ecosystem Component	Potential Residual Effect	Overall Significance Rating
Raptors	Sensory disturbance resulting in displacement and reduced foraging, breeding and recruitment success for raptor species	Low
Red-legged Frog (provincially blue-listed, Special Concern under SARA Schedule 1)	Medium-term loss of localized summer foraging habitat. Temporary displacement from site-specific summer foraging areas in non-breeding season.	Low
Rare Aquatic Insects (provincially red-listed and blue-listed species)	Temporary loss of localized breeding and foraging habitat	Negligible
Wildlife Corridor Connectivity	Temporary disruption in movements of small- and medium-sized mammals	Low

25.4 Past/Present Projects and Activities Considered During the CEE Assessment

Past/present projects and activities considered during the CEE assessment include:

- Existing Port Mann Bridge and Highway 1 (baseline);
- Golden Ears Bridge connections near 176th Street Interchange;
- Border Infrastructure Program (Highway 10/11, Highway 15);
- CN Rail right-of-way;
- Burlington Northern Santa Fe Rail right-of-way;
- CP Rail right-of-way;
- BC Hydro transmission line corridor parallel to Highway 1;
- Burnaby Lake Rejuvenation Program;
- Lubbocks Creek fish habitat enhancement east of Kensington;
- Buena Vista Creek fish habitat enhancement at Gagliardi Way;
- Como Creek fish habitat enhancement at Cape Horn; and
- Other residential, commercial and industrial development in Burnaby, Coquitlam, Surrey and Langley.

Future planned projects and activities include:

*Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008*

- South Fraser Perimeter Road; and
- Residential, commercial and industrial development in Burnaby, Coquitlam, Surrey and Langley.

25.5 Cumulative Effects Assessment Conclusion

Spatial and temporal overlaps in potential cumulative environmental effects between the PMH1 project and past/present projects and activities were analysed for the two identified VECs (mature structural stage 6 forest and great blue heron), and the probability of a significant cumulative effect on mature forest and great blue herons is considered to be low.

25.6 Key Issues Raised by the Working Group

Key issues identified by the Working Group during the Application review and MoT's responses and commitments (in italics), as appropriate, are summarized below. Refer to the Biophysical Issues Tracking Table (Appendix XX) for an expanded description and listing of commitments.

Transport Canada

- Please clarify why the Pitt River Bridge Construction is not considered in the cumulative effects assessment.

Chapter 26.3.2.3 (p. 26-29) of the Application indicates that to be considered relevant to the discussion regarding potential cumulative effects, other projects and activities must satisfy the following tests:

- *Temporal – the effects of the project or activity must be expected to occur at the same time or to overlap with the time when the effect of the PMH1 project will occur;*
- *Spatial – the effects of the project or activity must be expected to overlap the spatial area affected by the PMH1 project; and*
- *Type – the environmental effect of the Project or activity must be sufficiently similar or capable of interacting with the effect of the PMH1 project to produce a combined effect on the VEC in question.*

The Pitt River Bridge was not included in the list of potential projects to be considered during the cumulative effects assessment as there was no potential for project interactions (spatial or temporal overlap) with respect to the identified valued ecosystem components (VECs).

City of Surrey

- Rare aquatic insects – SFPR works are to be conducted in Bon Accord Creek area, in which case the combined effect on the insects is a concern.
A coordinated approach to potential effects of PMH1 and SFPR is recognized and underway.

- Local Air Quality concerns from concurrent construction projects and traffic disruptions. Surrey is concerned about the cumulative impacts of SFPR and PMH1 construction, staging areas, etc. on local streets. Project scheduling should be coordinated.

Note that cumulative effects on air quality are addressed in the Regional Air Quality Assessment. Air quality concerns related to the PMH1 project and concurrent construction projects will be addressed as part of the Environmental Management Plan developed prior to the construction phase of the Project. Guidance for the development of these mitigation strategies has been provided in Chapter 8.4.1 (p. 8-72) of the EAC Application.

Canadian Environmental Assessment Agency

- Future planned projects should include Deltaport Expansion and Terminal 2 as both will add to regional increases in impervious surface, increases in traffic and possibly other cumulative effects.

The Deltaport Expansion and Terminal 2 were included in the cumulative effects assessment of regional air quality, which is the relevant biophysical effect of increased traffic. These projects were not included in the assessment of increased impervious surface as the potential effects of net change in total impervious area resulting from the Project (ranging from 0.5% for the Yorkson drainage to 2.0% for the Como drainage) were considered to be low and not included.

25.6 EAO and RA Conclusions

PART F: OTHER REVIEW CONSIDERATIONS

26.0 ENVIRONMENTAL MANAGEMENT PLANNING

Chapter 27 in Volume IV of the Application describes the Environmental Management Plan (EMP) that will be developed for the PMH1 Project.

26.1 Background

Potential impacts of the Project will be specifically addressed through the EMP, which will be prepared by the contractor prior to construction. The EMP will have the following components:

- Wildlife Habitat Mitigation and Compensation Plan;
- Fisheries Habitat Mitigation and Compensation Plan;
- Construction Environmental Management Plan (CEMP); and
- Operational Environmental Management Plan (OEMP).

26.2 Wildlife and Fisheries Habitat Mitigation and Compensation Plans

The impact avoidance and mitigation strategies for wildlife and wildlife habitat in the EMP will be based on the recommendations in Chapters 11 and 14 of the Application [the Fisheries and Aquatic Resources Impact Assessment (aquatic and riparian habitat) and the Terrestrial Resources Impact Assessment]. The fisheries and aquatic impact avoidance and mitigation strategies of the EMP will be based on the recommendations in Chapters 11 of the Application (the Fisheries and Aquatic Resources Impact Assessment). The EMP will outline how these guidelines are to be implemented, and will describe environmental protection measures to be implemented by the contractor in response to planned work activities.

26.3 Construction Environmental Management Plan

The CEMP for the PMH1 project will include various sub-plans that provide detail on specific components of construction activities. These include the:

- Air Quality and Dust Control Plan;
- Archaeological Mitigation/Monitoring Plan;
- Construction Health and Safety Plan;
- Construction Waste Management Plan;
- Contaminated Sites Management Plan;
- Emergency Spill Response, Containment and Management Plan;
- Environmental Monitoring Plan;
- Environmental Training Plan;
- Fisheries Mitigation and Compensation Plan;
- Hazardous Waste Management and Spill Plan;
- Noise Management Plan;
- Surface Water Quality and Sediment Control Plan;
- Terrestrial Habitat Management Plan; and
- Traffic Communications Management Plan.

*Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008*

Generally the CEMP will include:

- Establishment of environmental goals and objectives;
- Conditions of project approval;
- Lists of actions, timing and responsibilities;
- Supervision protocols fully identifying areas of responsibility for environmental management;
- Statutory requirements – licences and approvals required;
- A structured reporting system detailing all relevant matters on a regular basis;
- Procedures and forms for documentation and reporting of issues;
- Standard specifications incorporating environmental safeguards;
- Training of personnel in environmental awareness and best practice Environmental Management Systems (EMS);
- Guidelines for emergencies, contact names and corrective actions for non-conformance and notifications to appropriate authorities and affected parties;
- Calibration and measuring of testing equipment;
- Review procedures and protocols for modification of the CEMP;
- Site management and control procedures;
- Monitoring procedures; and
- Environmental Quality management procedures.

26.4 Operational Environmental Management Plan

The OEMP describes the environmental management measures and best management practices to be used during PMH1 operations. The OEMP will address operation and maintenance activities that may negatively affect environmental and socio-economic/socio-community resources. The plan will outline the following:

- Agency reporting procedures;
- Post-construction monitoring program requirements;
- Waste management practices;
- Emergency maintenance procedures;
- Emergency spill response containment and management procedures;
- Management of stormwater and surface water runoff and maintenance of stormwater management features and facilities;
- Road and structure (including bridges) maintenance procedures; and
- Vegetation management plans.

26.5 Key Issues Identified by the Working Group

Key issues identified by the Working Group during the Application review and MoT's responses and commitments (in italics), as appropriate, are summarized below. Refer to the Biophysical Issues Tracking Table Appendix XX for an expanded description and listing of commitments.

City of Surrey

- The EMP should require that construction routes be coordinated with local governments.

MOT will ensure that construction vehicle access to the site(s) is addressed in the Contractor's Traffic Management Plan, and that the Contractor consults with municipalities regarding access points and routes through Municipalities. MOT Design Build Standard Specifications require the Contractor to repair any damages caused by them to existing highways and local roadways.

- The City of Surrey seeks assurance that the EMP will require that the Project obtain the required municipal permits.
The Contractor will be required to obtain all Permits which relate to, or are required under Environmental laws in connection with the Project and the Project works. This includes all permits necessary for the Contractor to fulfill its environmental obligations.

Ministry of Environment Environmental Protection Division

- Mitigation measures are outlined in general terms: standard BMPs will be implemented, the *Environmental Management Act* will be met, and burning will not occur without a permit from Metro Vancouver. A more complete picture of what mitigation efforts will be undertaken needs to be provided, including the training that will take place to ensure that staff has knowledge of how to react in certain situations.
Detailed and site-specific Environmental Management Plans (EMPs) for Construction will be prepared prior to construction per commitments 1.1, 1.2, 1.3, and 1.4. of the OTCA. Construction activities will be conducted in accordance with conditions of the EAC and the Contract Agreement, including MOT Design/Build specifications Section 165, Protection of the Environment.

Environment Canada

- In the EMP, the storage and handling of petroleum products and allied petroleum products should be in accordance with the CCME Environmental Code of Practice for Storage Tanks Systems Containing Petroleum Products and Allied Petroleum Products (2003).
In the event that the Contractor determines that temporary fuel storage/fuelling facilities are required during construction, they will be responsible for ensuring that the procedures set out in MOT's Construction Specifications (Section 165 Protection of the Environment) and the CCME Environmental Code of Practice for Storage Tank Systems Containing Petroleum Products and Allied Petroleum Products (2003) are followed. Where there is a conflict between these two documents, whichever wording provides the most stringent measure of environmental protection will take precedence.

Kwantlen First Nation

- Kwantlen is seeking a commitment that BC and Canada and Kwantlen, and other First Nations with aboriginal interests, work to develop a decision-making and monitoring forum to oversee the identified issues.

*Port Mann/Highway 1 Environmental Assessment Report
March 14, 2008*

MoT response pending.

25.6 EAO and RA Conclusions