TRANSMOUNTAIN

CELEBRATING 60 YEARS OF SERVICE 1953 to 2013

Trans Mountain Pipeline ULC

Trans Mountain Expansion Project

An Application Pursuant to Section 52 of the National Energy Board Act

December 2013

Volume 8a Marine Transportation

KINDER MORGAN CANADA

NATIONAL ENERGY BOARD

IN THE MATTER OF

the *National Energy Board Act*,
R.S.C. 1985, c. N-7, as amended, ("*NEB Act*")
and the Regulations made thereunder;

AND IN THE MATTER OF

the *Canadian Environmental Assessment Act*, 2012,
S.C. 2012, c. 37, as amended,
and the Regulations made thereunder;

AND IN THE MATTER OF

an application by Trans Mountain Pipeline ULC
as General Partner of Trans Mountain Pipeline L.P.
(collectively "Trans Mountain")
for a Certificate of Public Convenience and Necessity and
other related approvals pursuant to Part III of the *NEB Act*

APPLICATION BY TRANS MOUNTAIN FOR APPROVAL OF THE TRANS MOUNTAIN EXPANSION PROJECT

December 2013

To: The Secretary
The National Energy Board
444 — 7th Avenue SW
Calgary, AB T2P 0X8

Trans Mountain Expansion Project
Application Pursuant to Section 52 of the *National Energy Board Act*

Guide to the Application

Application	
Transmittal - Letter to the National Energy Board	
Volume 1	Summary
Volume 2	Project Overview, Economics and General Information
Volume 3A	Public Consultation
Volume 3B	Aboriginal Engagement
Volume 3C	Landowner Relations
Volume 4A	Project Design and Execution – Engineering
Volume 4B	Project Design and Execution – Construction
Volume 4C	Project Design and Execution – Operations and Maintenance
Volume 5A	Environmental and Socio-Economic Assessment – Biophysical
Volume 5B	Environmental and Socio-Economic Assessment – Socio-Economic
Volume 5C	Environmental and Socio-Economic Assessment – Biophysical Technical Reports
Volume 5D	Environmental and Socio-Economic Assessment – Socio-Economic Technical Reports
Volume 6A	Environmental Compliance
Volume 6B	Pipeline Environmental Protection Plan
Volume 6C	Facilities Environmental Protection Plan
Volume 6D	Westridge Marine Terminal Environmental Protection Plan
Volume 6E	Environmental Alignment Sheets
Volume 7	Risk Assessment and Management of Pipeline and Facility Spills
Volume 8A	**Marine Transportation**
Volume 8B	Marine Environmental and Socio-Economic Technical Reports
Volume 8C	TERMPOL Reports

This volume contains:

Volume 8A	
Section 1.0	Introduction
Section 2.0	Description of Marine Transportation Activities
Section 3.0	Public Consultation and Aboriginal Engagement
Section 4.0	Environmental and Socio-Economic Assessment
Section 5.0	Risk Assessment and Spill Management
Section 6.0	Conclusions
Section 7.0	References
Section 8.0	Appendices

Appendix A	Trans Mountain Submission to the Federal Tanker Safety Expert Panel, June 21, 2013
Appendix B	Marine Vessel Types
Appendix C	Summary of Outcomes of the Public Consultation Program
Appendix D	Marine Aboriginal Engagement PowerPoint Presentation
Appendix E	Interests or Concerns Identified Through Engagement Activities with Aboriginal Communities for the Project
Appendix F	Recommended Approach to Aboriginal Engagement in TERMPOL Review Process

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS AND ACRONYMS

This table lists the abbreviations and acronyms used in this volume of the application.

Term	Meaning
∑ BTEX	Sum of individual BTEX compounds
AANDC	Aboriginal Affairs and Northern Development Canada
AB	Alberta
AIS	Automated Information System
ANS	Alaska North Slope
AOOS	Alaska Ocean Observing System
A-S	age standardized
ASL	ambient sound levels
AWB	Access Western Blend
bbl	barrels
BC	British Columbia
BC CDC	British Columbia Conservation Data Centre
BC CSN	British Columbia Cetacean Sightings Network
BC MCA	British Columbia Marine Conservation Analysis
BC MFLNRO	British Columbia Ministry of Forests, Lands and Natural Resource Operations
BC MOE	British Columbia Ministry of Environment
BC OGC	British Columbia Oil and Gas Commission
BCCP	British Columbia Coastal Pilots
BCCPA	British Columbia Coast Pilots Association
BCIT	British Columbia Institute of Technology
BIEAP	Burrard Inlet Environmental Action Program
BSD	blue sac disease
BTEX	benzene, toluene, ethyl benzene, and xylene
CAAQS	Canadian Ambient Air Quality Standards
CACs	criteria air contaminants
CAPP	Canadian Association of Petroleum Producers
CCG	Canadian Coast Guard
CCME	Canadian Council of Ministers of the Environment
CEA	Canadian Environmental Assessment (both *Act* and Agency)
CEPA	*Canadian Environmental Protection Act*
CF	Conservation Framework
CH_4	methane
CHS	Canadian Hydrographic Service
CLWB	Cold Lake Winter Blend
CMAQ	Community Multi-scale Air Quality Model
CN	Canadian National
CO	carbon monoxide
CO_2	carbon dioxide
CO_{2e}	Carbon Dioxide Equivalents
COPC	chemicals of potential concern
COSBC	Chamber of Shipping of British Columbia
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CPCN	Certificate of Public Convenience and Necessity
CRD	Capital Regional District
CSAS	Canadian Science Advisory Secretariat
cSt	centistokes

Term	Meaning
CVTS	Cooperative Vessel Traffic Service
CWS	Canadian Wildlife Service
dB	decibel
dBA	A-Weighted decibels
DFO	Fisheries and Oceans Canada
DHI	Danish Hydraulic Institute
DNV	Det Norske Veritas
DPS	distinct population segment
dv	deciview
DWT	dead weight tonnage
EBA	EBA Engineering Consultants Ltd. operating as EBA, A Tetra Tech Company
EC	Environment Canada
ECA	emissions control area
ECRC	Eastern Canada Response Corporation
EEDI	Energy Efficiency Design Index
EEMP	Environmental Emergency Management Program
ENGO	Environmental Non-Governmental Organization
ERA	ecological risk assessment
ESA	Environmental and Socio-Economic Assessment
EVOS	Exxon Valdez Oil Spill
EVOSTC	Exxon Valdez Oil Spill Trustee Council
FEARO	Federal Environmental Assessment Review Office
FHA	Fraser Health Authority
FOSET	Fishers Oil Spill Emergency Team
FSC	food, social, and ceremonial
FVRD	Fraser Valley Regional District
GHG	greenhouse gas
H_2S	hydrogen sulphide
HCB	hydrocarbonoclastic bacteria
HHRA	Human Health Risk Assessment
HSDA	Health Service Delivery Areas
IBA	Important Bird Area
ICS	Incident Command System
IMO	International Maritime Organization
Intrinsik	Intrinsik Environmental Sciences Inc
IOPC	International Oil Pollution Compensation
IRA	Increased Response Area
ISO	International Organization for Standardization
ITOPF	International Tanker Owners Pollution Federation
JASCO	JASCO Applied Sciences Ltd.
KMC	Kinder Morgan Canada Inc.
KPI	key performance indicator
kt	kilotonnes
L_{eq}	energy equivalent sound level
LFV	Lower Fraser Valley Photochemical Model Domain
LNG	liquefied natural gas
LOU	Letter of Understanding
LSA	Local Study Area
MAMU	Marbled murrelet
MARPOL	International Convention for the Prevention of Pollution from Ships

Term	Meaning
MBA	Mutual Benefit Agreement
MBCA	Migratory Birds Convention Act
MCRTU	marine commercial, recreational and tourism use
MCTS	Marine Communications and Traffic Services
MLA	*Marine Liability Act*
MMPA	*Marine Mammals Protection Act*
MNA	minimum number alive
MOU	memorandum of understanding
MPA	Marine Protected Area
MPMO	Major Projects Management Office
MPOI	Maximum Point of Impingement
MRA	Movement Restriction Area
MSRC	Marine Spill Response Corporation
MSZ	Moving Safety Zone
Mt	megatonne
MTSA	*Marine Transportation Security Act*
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NEB	National Energy Board
NEB Act	*National Energy Board Act*
NGO	Non Governmental Organization
NM	nautical mile
NMFS	National Marine Fisheries Service
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NO_x	nitrogen oxides
NWA	National Wildlife Areas
OPEP	Oil Pollution Emergency Plan
OPPP	Oil Pollution Prevention Plan
OSA	oil-suspended particulate matter aggregate
OSRP	Oil Spill Response Plan
OSV	offshore supply vessel
P_{50}	50^{th} percentile
P_{90}	90^{th} percentile
PAH	polycyclic aromatic hydrocarbon
PHC	petroleum hydrocarbon
PM	particulate matter
PMV	Port Metro Vancouver
PPA	Pacific Pilotage Authority
ppb	parts per billion
PPE	personal protective equipment
ppt	parts per thousand
PPU	Portable Pilotage Unit
PSL	Permissible Sound Levels
PTS	Permanent Threshold Shifts
RCA	Rockfish Conservation Area
REET	Regional Environmental Emergency Team
RMS	Root Mean Square
RP	Responsible Party
RSA	Regional Study Area

Term	Meaning
RWDI	Rowan Williams Davies and Irwin Inc
SARA	*Species at Risk Act*
SCAT	Shoreline clean-up and assessment techniques
SDR	Special Drawing Right
SEAPRO	Southeast Alaska Petroleum Response Organization
SEL	Sound Exposure Level
SMIT	SMIT Harbour Towage Inc
SMS	Safety Management Systems
SO_2	sulphur dioxide
SOLAS	Safety of Life at Sea
SOPEP	Shipboard Oil Pollution Emergency Plan
SOPF	Ship-source Oil Pollution Fund
SO_x	sulphur oxides
SPL	Sound Pressure Level
Stantec	Stantec Consulting Ltd
STCW	Standards of Training, Certification and Watchkeeping for Seafarers
TBT	tributyl tin
TC	Transport Canada
TERA	TERA Environmental Consultants
TERMPOL	Technical Review Process of Marine Terminal Systems and Transshipment Sites
TEZ	Tanker Exclusion Zone
the Panel	the Federal Tanker Safety Expert Panel
the Project	Trans Mountain Expansion Project
TMEP	Trans Mountain Expansion Project
TMPL system	Trans Mountain pipeline system
TMRU	traditional marine resource use
TPH	total petroleum hydrocarbons
Trans Mountain	Trans Mountain Pipeline ULC
TSB	Transportation Safety Board
TSP	total suspended particulate
TSS	Traffic Separation Scheme
TTS	Temporary Threshold Shifts
US	United States
USCG	United States Coast Guard
VCHA	Vancouver Coastal Health Authority
VECs	valued ecosystem component
VIHA	Vancouver Island Health Authority
Vista Strategy	Vista Strategy Corp
VLCC	very large crude carrier
VOCs	volatile organic compound
VSCs	valued social component
VTS	Vessel Traffic Services
WCMRC	Western Canada Marine Response Corporation
WDFW	Washington State Department of Fish and Wildlife
WMA	Wildlife Management Area
YVR	Vancouver International Airport
ZOI	zone of influence

NEB FILING MANUAL CHECKLIST

CHAPTER 3 – COMMON INFORMATION REQUIREMENTS

Filing #	Filing Requirement	In Application? References	Not in Application? Explanation
3.1 Action Sought by Applicant			
1.	Requirements of s.15 of the Rules.	Volume 1 Section 1.1	---
3.2 Application or Project Purpose			
1.	Purpose of the proposed project.	Volume 2 Section 1.1	---
3.4 Consultation		Volumes 3A, 3B, 3C; Volumes 5A, 5B Section 3; **Volume 8A Section 3**	--
3.4.1 Principles and Goals of Consultation			
1.	The corporate policy or vision.	Volume 3A Section 1.2.1 Volume 3B Section 1.2.1	--
2.	The principles and goals of consultation for the project.	Volume 3A Section 1.2.2 Volume 3B Section 1.2.2 Volume 5A Section 3.2.1 Volume 5B Section 3.2.1	--
3.	A copy of the Aboriginal protocol and copies of policies and principles for collecting traditional use information, if available.	Volume 3B Section 1.3.5	--
3.4.2 Design of Consultation Program			
1.	The design of the consultation program and the factors that influenced the design.	Volume 3A Section 1.3 Volume 3B Section 1.3 Volume 5A Section 3.1.1, 3.2.2 Volume 5B Section 3.1.1, 3.2.2	--
3.4.3 Implementing a Consultation Program			
1.	The outcomes of the consultation program for the project.	Volume 3A Section 1.7 Volume 3B Section 1.5 Table 1.5.1 Volume 5A Section 3.1.5, 3.2.4 Volume 5B Section 3.1.5, 3.2.4	--
3.4.4 Justification for Not Undertaking a Consultation Program			
2.	The application provides justification for why the applicant has determined that a consultation program is not required for the project.	N/A	N/A
3.5 Notification of Commercial Third Parties			
1.	Confirm that third parties were notified.	Volume 2 Section 3.2.2	--
2.	Details regarding the concerns of third parties.	Volume 2 Section 3.2.2	--
3.	List the self-identified interested third parties and confirm they have been notified.	N/A	N/A
4.	If notification of third parties is considered unnecessary, an explanation to this effect.	N/A	N/A

CHAPTER 4 – SECTIONS 4.1 AND 4.2: COMMON REQUIREMENTS FOR PHYSICAL PROJECTS

Filing #	Filing Requirement	In Application? References	Not in Application? Explanation
4.1 Description of the Project			--
1.	The project components, activities and related undertakings.	Volume 2 Section 2.0; Volume 4A	--
2.	The project location and criteria used to determine the route or site.	Volume 2 Section 4.0; Volume 4A	--
3.	How and when the project will be carried out.	Volume 2 Section 2.3; Volume 4B Section 2.0	--
4.	Description of any facilities, to be constructed by others, required to accommodate the proposed facilities.	N/A	N/A
5.	An estimate of the total capital costs and incremental operating costs, and changes to abandonment cost estimates.	Volume 2 Section 2.9	--
6.	The expected in-service date.	Volume 2 Section 1.1; Volume 4B Section 2.1	--
4.2 Economic Feasibility, Alternatives and Justification			
4.2.1 Economic Feasibility			
1.	Describe the economic feasibility of the project.	Volume 2 Section 3.5	--
4.2.2 Alternatives			
1.	Describe the need for the project, other economically-feasible alternatives to the project examined, along with the rationale for selecting the applied for project over these other possible options.	Volume 2 Section 3.0; **Volume 8A Section 2.2**	--
2.	Describe and justify the selection of the proposed route and site including a comparison of the options evaluated using appropriate selection criteria.	Volume 2 Section 4.0; **Volume 8A Section 2.2**	--
3.	Describe the rationale for the chosen design and construction methods. Where appropriate, describe any alternative designs and methods evaluated and explain why these other options were eliminated.	Volume 2 Section 4.0; **Volume 8A Section 2.2**	--
4.2.3 Justification			
1.	Provide a justification for the proposed project	Volume 2 Section 3.4	--

GUIDE A – A.1 ENGINEERING

Filing #	Filing Requirement	In Application? References	Not in Application? Explanation
A.1.1 Engineering Design Details			
1.	Fluid type and chemical composition.	Volume 4A Section 3.1.1	--
2.	Line pipe specifications.	Volume 4A Section 3.2.8	--
3.	Pigging facilities specifications.	Volume 4A Section 3.3.1, 3.3.2	--
4.	Compressor or pump facilities specifications.	Volume 4A Section 3.4	--
5.	Pressure regulating or metering facilities specifications.	Volume 4A Section 3.5	--
6.	Liquid tank specifications, or other commodity storage facilities.	Volume 4A Section 3.4	--
7.	New control system facilities specifications.	Volume 4A Section 3.3	--
8.	Gas processing, sulphur or LNG plant facilities specifications.	N/A	N/A
9.	Technical description of other facilities not mentioned above.	N/A	N/A
10.	Building dimensions and uses.	Volume 4A Section 3.3, 3.4, 3.5	--
11.	If project is a new system that is a critical source of energy supply, a description of the impact to the new system capabilities following loss of critical component.	N/A	N/A
A.1.2 Engineering Design Principles			
1.	Confirmation project activities will follow the requirements of the latest version of CSA Z662.	Volume 4A Section 2.2	--
2.	Provide a statement indicating which Annex is being used and for what purpose	Volume 4A Section 2.3	--
3.	Statement confirming compliance with OPR or PPR.	Volume 4A Section 2.1	--
4.	Listing of all primary codes and standards, including version and date of issue.	Volume 4A Section 2, Table 5.1.1	--
5.	Confirmation that the project will comply with company manuals and confirm manuals comply with OPR/PPR and codes and standards.	Volume 4A Section 2.6, Table 5.1.2	--
6.	Any portion of the project a non-hydrocarbon commodity pipeline system? Provide a QA program to ensure the materials are appropriate for their intended service.	N/A – all hydrocarbons	N/A
7.	If facility subject to conditions not addressed in CSA Z662: • Written statement by qualified professional engineer • Description of the designs and measures required to safeguard the pipeline	Volume 4A Section 2.9	--
8.	If directional drilling involved: • Preliminary feasibility report • Description of the contingency plan	Volume 4A Section 2.12	--
9.	If the proposed project involves the reuse of materials, provide an engineering assessment in accordance with CSA Z662 that indicates its suitability for the intended service.	Volume 4A, Section 2.7	--
10.	If new materials are involved, provide material supply chain information, in tabular format.	Volume 4A Section 2.7	
11.	If reuse of material is involved, provide an engineering assessment in accordance with CSA Z662 that indicates its suitability for the intended service.	Volume 4A, Section 2.7	--
A.1.3 Onshore Pipeline Regulations			
1.	Designs, specifications programs, manuals, procedures, measures or plans for which no standard is set out in the OPR or PPR.	--	Existing standards will be followed
2.	A quality assurance program if project non-routine or incorporates unique challenges due to geographical location.	--	No unique challenges
3.	If welding performed on a liquid-filled pipeline that has a carbon equivalent of 0.50% or greater and is a permanent installation: • Welding specifications and procedures • Results of procedure qualification tests	--	Welding on liquid filled pipe will not be conducted

GUIDE A – A.2 ENVIRONMENTAL AND SOCIO-ECONOMIC ASSESSMENT

The following table identifies where information requested in the National Energy Board (NEB) Filing Manual Guide A – A.2 Environmental and Socio-economic Assessment checklist may be found in the various volumes of the Application for the Trans Mountain Expansion Project.

Filing #	Filing Requirement	In Application? References	Applicable Marine Transportation Elements	Not in Application? Explanation
A.2.5 Description of the Environmental and Socio-Economic Setting				
1.	Identify and describe the current biophysical and socio-economic setting of each element (*i.e.*, baseline information) in the area where the project is to be carried out.	Volume 5A: ESA - Biophysical • Sections 5.0 and 6.0 Volume 5B: ESA - Socio-Economic • Sections 5.0 and 6.0 Volume 5C: ESA - Biophysical Technical Reports Volume 5D: ESA - Socio-Economic Technical Reports	**Volume 8A: Marine Transportation** • **Section 4.2** Volume 8B: Technical Reports	---
2.	Describe which biophysical or socio-economic elements in the study area are of ecological, economic, or human importance and require more detailed analysis taking into account the results of consultation (see Table A-1 for examples). Where circumstances require more detailed information in an ESA see: i. Table A-2 – Filing Requirements for Biophysical Elements; or ii. Table A-3 – Filing Requirements for Socio-economic Elements.	Volume 5A: ESA - Biophysical • Sections 5.0 and 6.0 Volume 5B: ESA - Socio-Economic • Sections 5.0 and 6.0 Volume 5C: ESA - Biophysical Technical Reports Volume 5D: ESA - Socio-Economic Technical Reports	**Volume 8A: Marine Transportation** • **Section 4.2** Volume 8B: Technical Report**s**	---
3.	Provide supporting evidence (*e.g.*, references to scientific literature, field studies, local and traditional knowledge, previous environmental assessment and monitoring reports) for: • information and data collected; • analysis completed; • conclusions reached; and • the extent of professional judgment or experience relied upon in meeting these information requirements, and the rationale for that extent of reliance.	Volume 5A: ESA - Biophysical • Sections 5.0 and 6.0 Volume 5B: ESA - Socio-Economic • Sections 5.0 and 6.0 Volume 5C: ESA - Biophysical Technical Reports Volume 5D: ESA - Socio-Economic Technical Reports	**Volume 8A: Marine Transportation** • **Section 4.2** Volume 8B: Technical Reports	---
4.	Describe and substantiate the methods used for any surveys, such as those pertaining to wildlife, fisheries, plants, species at risk or species of special status, soils, heritage resources or traditional land use, and for establishing the baseline setting for the atmospheric and acoustic environment.	Volume 5A: ESA - Biophysical • Sections 5.0 and 6.0 Volume 5B: ESA - Socio-Economic • Sections 5.0 and 6.0 Volume 5C: ESA - Biophysical Technical Reports Volume 5D: ESA - Socio-Economic Technical Reports	**Volume 8A: Marine Transportation** • **Section 4.2** Volume 8B: Technical Reports	---
5.	Applicants must consult with other expert federal, provincial or territorial departments and other relevant authorities on requirements for baseline information and methods.	Volume 5A: ESA - Biophysical • Sections 3.0, 5.0 and 6.0 Volume 5B: ESA - Socio-Economic • Sections 3.0, 5.0 and 6.0 Volume 5C: ESA - Biophysical Technical Reports Volume 5D: ESA - Socio-Economic Technical Reports	**Volume 8A: Marine Transportation** • **Sections 3.0 and 4.2** Volume 8B: Technical Reports	---

Filing #	Filing Requirement	In Application? References	Applicable Marine Transportation Elements	Not in Application? Explanation
A.2.6 Effects Assessment				
Identification and Analysis of Effects				
1.	Describe the methods used to predict the effects of the project on the biophysical and socio-economic elements, and the effects of the environment on the project (*i.e.*, changes to the Project caused by the environment).	Volume 5A: ESA - Biophysical • Section 7.0 Volume 5B: ESA - Socio-Economic • Section 7.0 Volume 7: Risk Assessment and Management of Pipeline and Facility Spills • Sections 6.0, 7.0 and 8.0 • Technical Reports	**Volume 8A: Marine Transportation** • **Sections 4.3, 5.5 and 5.6**	---
2.	Predict the effects associated with the proposed project, including those that could be caused by construction, operations, decommissioning or abandonment, as well as accidents and malfunctions. Also include effects the environment could have on the project. For those biophysical and socio-economic elements or their valued components that require further analysis (see Table A-1), provide the detailed information outlined in Tables A-2 and A-3.	Volume 5A: ESA - Biophysical • Section 7.0 Volume 5B: ESA - Socio-Economic • Section 7.0 Volume 5C: ESA - Biophysical Technical Reports Volume 5D: ESA - Socio-Economic Technical Reports Volume 7: Risk Assessment and Management of Pipeline and Facility Spills • Sections 6.0, 7.0 and 8.0 • Technical Reports	**Volume 8A: Marine Transportation** • **Sections 4.3, 5.6 and 5.7** Volume 8B: Technical Reports	---
Mitigation Measures for Effects				
1.	Describe the standard and project specific mitigation measures and their adequacy for addressing the project effects, or clearly reference specific sections of company manuals that provide mitigation measures. Ensure that referenced manuals are current and filed with the NEB.	Volume 5A: ESA - Biophysical • Section 7.0 Volume 5B: ESA - Socio-Economic • Section 7.0 Volume 5C: ESA - Biophysical Technical Reports Volume 5D: ESA - Socio-Economic Technical Reports Volume 6B: Pipeline Environmental Protection Plan (EPP) Volume 6C: Facilities EPP Volume 6D: Westridge Marine Terminal EPP Volume 6E: Environmental Alignment Sheets Volume 7: Risk Assessment and Management of Pipeline and Facility Spills • Sections 2.0, 3.0, 4.0, 6.0, 7.0, and 8.0 • Technical Reports	**Volume 8A: Marine Transportation** • **Sections 4.3, 5.1, 5.3, 5.6 and 5.7** Volume 8B: Technical Reports	---
2.	Ensure that commitments about mitigative measures will be communicated to field staff for implementation through an Environmental Protection Plan.	Volume 5A: ESA - Biophysical • Section 7.0 Volume 5B: ESA - Socio-Economic • Section 7.0 Volume 6A: Environmental Compliance Volume 6B: Pipeline EPP Volume 6C: Facilities EPP Volume 6D: Westridge Marine Terminal EPP Volume 6E: Environmental Alignment Sheets Volume 7: Risk Assessment and Management of Pipeline and Facility Spills • Sections 2.0, 3.0, 4.0, 6.0, 7.0 and 8.0	**Volume 8A: Marine Transportation** • **Sections 4.3, 5.1, 5.3, 5.6 and 5.7**	---

Filing #	Filing Requirement	In Application? References	Applicable Marine Transportation Elements	Not in Application? Explanation
3.	Describe plans and measures to address potential effects of accidents and malfunctions during construction and operation of the project.	Volume 5A: ESA - Biophysical • Section 7.0 Volume 5B: ESA - Socio-Economic • Section 7.0 Volume 6B: Pipeline EPP Volume 6C: Facilities EPP Volume 6D: Westridge Marine Terminal EPP Volume 7: Risk Assessment and Management of Pipeline and Facility Spills • Sections 2.0, 4.0, 6.0, 7.0 and 8.0	**Volume 8A: Marine Transportation** • **Sections 4.3, 5.1, 5.3, 5.6 and 5.7**	---
Evaluation of Significance				
1.	After taking into account any appropriate mitigation measures, identify any remaining residual effects from the project.	Volume 5A: ESA - Biophysical • Section 7.0 Volume 5B: ESA - Socio-Economic • Section 7.0	**Volume 8A: Marine Transportation** • **Section 4.3**	---
2.	Describe the methods and criteria used to determine the significance of remaining adverse effects, including defining the point at which any particular effect on a valued component is considered "significant".	Volume 5A: ESA - Biophysical • Section 7.0 Volume 5B: ESA - Socio-Economic • Section 7.0	**Volume 8A: Marine Transportation** • **Section 4.3**	---
3.	Evaluate significance of residual adverse environmental and socio-economic effects against the defined criteria.	Volume 5A: ESA - Biophysical • Section 7.0 Volume 5B: ESA - Socio-Economic • Section 7.0	**Volume 8A: Marine Transportation** • **Section 4.3**	---
4.	Evaluate the likelihood of significant, residual adverse environmental and socio-economic effects occurring and substantiate the conclusions made.	Volume 5A: ESA - Biophysical • Section 7.0 Volume 5B: ESA - Socio-Economic • Section 7.0	**Volume 8A: Marine Transportation** • **Section 4.3**	---
A.2.7 Cumulative Effects Assessment				
Scoping and Analysis of Cumulative Effects				
1.	Identify the valued components for which residual effects are predicted, and describe and justify the methods used to predict any residual results.	Volume 5A: ESA - Biophysical • Section 8.0 Volume 5B: ESA - Socio-Economic • Section 8.0	**Volume 8A: Marine Transportation** • **Section 4.4**	---
2.	For each valued component where residual effects have been identified, describe and justify the spatial and temporal boundaries used to assess the potential cumulative effects.	Volume 5A: ESA - Biophysical • Section 8.0 Volume 5B: ESA - Socio-Economic • Section 8.0	**Volume 8A: Marine Transportation** • **Section 4.4**	---
3.	Identify other physical works or activities that have been or will be carried out within the identified spatial and temporal boundaries for the cumulative effects assessment.	Volume 5A: ESA - Biophysical • Section 8.0 Volume 5B: ESA - Socio-Economic • Section 8.0	**Volume 8A: Marine Transportation** • **Section 4.4**	---
4.	Identify whether the effects of those physical works or activities that have been or will be carried out would be likely to produce effects on the valued components within the identified spatial and temporal boundaries.	Volume 5A: ESA - Biophysical • Section 8.0 Volume 5B: ESA - Socio-Economic • Section 8.0	**Volume 8A: Marine Transportation** • **Section 4.4**	---

Filing #	Filing Requirement	In Application? References	Applicable Marine Transportation Elements	Not in Application? Explanation
5.	Where other physical works or activities may affect the valued components for which residual effects from the applicant's proposed project are predicted, continue the cumulative effects assessment, as follows: • consider the various components, phases and activities associated with the applicant's project that could interact with other physical work or activities; • provide a description of the extent of the cumulative effects on valued components; and • where professional knowledge or experience is cited, explain the extent to which professional knowledge or experience was relied upon and justify how the resulting conclusions or decisions were reached.	Volume 5A: ESA - Biophysical • Section 8.0 Volume 5B: ESA - Socio-Economic • Section 8.0	**Volume 8A: Marine Transportation** • **Section 4.4**	---
Mitigation Measures for Cumulative Effects				
1.	Describe the general and specific mitigation measures, beyond project-specific mitigation already considered, that are technically and economically feasible to address any cumulative effects.	Volume 5A: ESA - Biophysical • Section 8.0 Volume 5B: ESA - Socio-Economic • Section 8.0	**Volume 8A: Marine Transportation** • **Section 4.4**	---
Applicant's Evaluation of Significance of Cumulative Effects				
1.	After taking into account any appropriate mitigation measures for cumulative effects, identify any remaining residual cumulative effects.	Volume 5A: ESA - Biophysical • Section 8.0 Volume 5B: ESA - Socio-Economic • Section 8.0	**Volume 8A: Marine Transportation** • **Section 4.4**	---
2.	Describe the methods and criteria used to determine the significance of remaining adverse cumulative effects, including defining the point at which each identified cumulative effect on a valued component is considered "significant".	Volume 5A: ESA - Biophysical • Section 8.0 Volume 5B: ESA - Socio-Economic • Section 8.0	**Volume 8A: Marine Transportation** • **Section 4.4**	---
3.	Evaluate the significance of adverse residual cumulative effects against the defined criteria.	Volume 5A: ESA - Biophysical • Section 8.0 Volume 5B: ESA - Socio-Economic • Section 8.0	**Volume 8A: Marine Transportation** • **Section 4.4**	---
4.	Evaluate the likelihood of significant, residual adverse cumulative environmental and socio-economic effects occurring and substantiate the conclusions made.	Volume 5A: ESA - Biophysical • Section 8.0 Volume 5B: ESA - Socio-Economic • Section 8.0	**Volume 8A: Marine Transportation** • **Section 4.4**	---
A.2.8 Inspection, Monitoring and Follow-up				
1.	Describe inspection plans to ensure compliance with biophysical and socio-economic commitments, consistent with Sections 48, 53 and 54 of the *NEB Onshore Pipeline Regulations (OPR)*.	Volume 5A: ESA - Biophysical • Section 7.0 Volume 5B: ESA - Socio-Economic • Section 7.0 Volume 6A: Environmental Compliance Volume 6B: Pipeline EPP Volume 6C: Facilities EPP Volume 6D: Westridge Marine Terminal EPP	**Volume 8A: Marine Transportation** • **Section 4.3**	---
2.	Describe the surveillance and monitoring program for the protection of the pipeline, the public and the environment, as required by Section 39 of the *NEB OPR*.	Volume 5A: ESA - Biophysical • Section 7.0 Volume 5B: ESA - Socio-Economic • Section 7.0 Volume 6A: Environmental Compliance Volume 6B: Pipeline EPP Volume 6C: Facilities EPP Volume 6D: Westridge Marine Terminal EPP	**Volume 8A: Marine Transportation** • **Section 4.3**	---

Filing #	Filing Requirement	In Application? References	Applicable Marine Transportation Elements	Not in Application? Explanation
3.	Consider any particular elements in the Application that are of greater concern and evaluate the need for a more in-depth monitoring program for those elements.	Volume 5A: ESA - Biophysical • Sections 9.0 and 10.0 Volume 5B: ESA - Socio-Economic • Sections 9.0 and 10.0 Volume 6A: Environmental Compliance Volume 6B: Pipeline EPP (Socio-Economic Management Plan of Appendix C)	**Volume 8A: Marine Transportation** • **Section 4.5**	---
4.	For *Canadian Environmental Assessment (CEA) Act, 2012* designated projects, identify which elements and monitoring procedures would constitute follow-up under the *CEA Act, 2012*.	Volume 5A: ESA - Biophysical • Section 10.0 Volume 5B: ESA - Socio-economic • Section 10.0	N/A	---

Filing #	Filing Requirement	In Application? References	Applicable Marine Transportation Elements	Not in Application? Explanation
Table A-1 Circumstances and Interactions Requiring Detailed Biophysical and Socio-Economic Information				
Physical and meteorological environment		Volume 5A: ESA - Biophysical • Sections 5.0, 6.0 and 7.0	N/A	---
Soil and soil productivity		Volume 5A: ESA - Biophysical • Sections 5.0, 6.0, 7.0 and 8.0 Volume 5C: ESA - Biophysical Technical Reports • Soil Assessment Technical Report Volume 7: Risk Assessment and Management of Pipeline and Facility Spills • Section 5.3, 6.0 and 7.0	N/A	---
Water quality and quantity (onshore and marine)		Volume 5A: ESA - Biophysical • Sections 5.0, 6.0, 7.0 and 8.0 Volume 5C: ESA - Biophysical Technical Reports • Groundwater Technical Report • Fisheries (Alberta) Technical Report • Fisheries (British Columbia) Technical Report • Wetland Evaluation Technical Report • Marine Sediment and Water Quality – Westridge Marine Terminal Technical Report Volume 7: Risk Assessment and Management of Pipeline and Facility Spills • Section 7.0 • Quality Ecological Risk Assessment of Pipeline Spills Technical Report	**Volume 8A: Marine Transportation** • **Sections 4.2, 4.3, 4.4, 5.6 and 5.7** Volume 8B: Technical Reports • Ecological Risk Assessment of Marine Transportation Spills Technical Report	---
Air emissions (onshore and marine)		Volume 5A: ESA - Biophysical • Sections 5.0, 6.0, 7.0 and 8.0 Volume 5C: ESA - Biophysical Technical Reports • Marine Air Quality and Greenhouse Gas – Marine Transportation Technical Report • Air Quality and Greenhouse Gas Emissions Technical Report Volume 7: Risk Assessment and Management of Pipeline and Facility Spills • Section 7.0	**Volume 8A: Marine Transportation** • **Sections 4.2, 4.3, 4.4, 5.6 and 5.7** Volume 8B: Technical Reports • Marine Air Quality and Greenhouse Gas Emissions	---
Greenhouse gas emissions (onshore and marine)		Volume 5A: ESA - Biophysical • Sections 5.0, 6.0 and 7.0 Volume 5C: ESA - Biophysical Technical Reports • Air Quality and Greenhouse Gas Emissions Technical Report	**Volume 8A: Marine Transportation** • **Sections 4.2 and 4.3** Volume 8B: Technical Reports • Marine Air Quality and Greenhouse Gas Emissions	---
Acoustic environment (onshore and marine)		Volume 5A: ESA - Biophysical • Sections 5.0, 6.0, 7.0, and 8.0 Volume 5C: ESA - Biophysical Technical Reports • Acoustic Environment Technical Report	**Volume 8A: Marine Transportation** • **Sections 4.2, 4.3 and 4.4** Volume 8B: Technical Reports • Marine Noise (Atmospheric)	---
Fish and fish habitat (onshore and marine), including any fish habitat compensation required		Volume 5A: ESA - Biophysical • Sections 5.0, 6.0, 7.0 and 8.0 Volume 5C: ESA - Biophysical Technical Reports • Fisheries (Alberta) Technical Report • Fisheries (British Columbia) Technical Report • Marine Resources - Westridge Marine Terminal Technical Report Volume 7: Risk Assessment and Management of Pipeline and Facility Spills • Sections 6.0, 7.0 and 8.0 • Qualitative Ecological Risk Assessment of Pipeline Spills Technical Report	**Volume 8A: Marine Transportation** • **Sections 4.2, 4.3, 4.4, 5.6 and 5.7** Volume 8B: Technical Reports • Marine Resources – Marine Transportation Technical Report • Ecological Risk Assessment of Westridge Marine Terminal Spills	---

Filing #	Filing Requirement	In Application? References	Applicable Marine Transportation Elements	Not in Application? Explanation
Wetlands		Volume 5A: ESA - Biophysical • Sections 5.0, 6.0, 7.0 and 8.0 Volume 5C: ESA - Biophysical Technical Reports • Wetland Evaluation Technical Report Volume 7: Risk Assessment and Management of Pipeline and Facility Spills • Sections 7.0 and 8.0 • Qualitative Ecological Risk Assessment of Pipeline Spills Technical Report	N/A	---
Vegetation		Volume 5A: ESA - Biophysical • Sections 5.0, 6.0, 7.0 and 8.0 Volume 5C: ESA - Biophysical Technical Reports • Vegetation Technical Report Volume 7: Risk Assessment and Management of Pipeline and Facility Spills • Sections 7.0 and 8.0 • Qualitative Ecological Risk Assessment of Pipeline Spills Technical Report	N/A	---
Wildlife and wildlife habitat (onshore and marine)		Volume 5A: ESA - Biophysical • Sections 5.0, 6.0, 7.0 and 8.0 Volume 5C: ESA - Biophysical Technical Reports • Wildlife and Wildlife Habitat Technical Report • Wildlife Modeling and Species Accounts Report • Marine Resources –Westridge Marine Terminal Technical Report • Marine Birds – Westridge Marine Terminal Technical Report Volume 7: Risk Assessment and Management of Pipeline and Facility Spills • Sections 6.0, 7.0 and 8.0 • Qualitative Ecological Risk Assessment of Pipeline Spills Technical Report	**Volume 8A: Marine Transportation** • **Sections 4.2. 4.3, 4.4, 5.6 and 5.7** Volume 8B: Technical Reports • Marine Resources – Marine Transportation Technical Report • Marine Birds – Marine Transportation Technical Report • Ecological Risk Assessment of Westridge Marine Terminal Spills	---
Species at Risk or Species of Special Status and related habitat (onshore and marine)		Volume 5A: ESA - Biophysical • Sections 5.0, 6.0, 7.0 and 8.0 Volume 5C: ESA - Biophysical Technical Reports • Fisheries (Alberta) Technical Report • Fisheries (British Columbia) Technical Report • Vegetation Technical Report • Wildlife and Wildlife Habitat Technical Report • Wildlife Modeling and Species Accounts Report • Marine Resources –Westridge Marine Terminal Technical Report • Marine Birds – Westridge Marine Terminal Technical Report Volume 7: Risk Assessment and Management of Pipeline and Facility Spills • Sections 6.0, 7.0 and 8.0 • Qualitative Ecological Risk Assessment of Pipeline Spills Technical Report	**Volume 8A: Marine Transportation** • **Sections 4.2. 4.3, 4.4, 5.6 and 5.7** Volume 8B: Technical Reports • Marine Resources – Marine Transportation Technical Report • Marine Birds – Marine Transportation Technical Report • Marine Transportation Spills Ecological Risk Assessment Technical Report	---
Human occupancy and resource use (onshore and marine)		Volume 5B: ESA - Socio-Economic • Sections 5.0, 6.0, 7.0 and 8.0 Volume 5D: ESA - Socio-Economic Technical Reports • Socio-Economic Technical Report • Managed Forest Areas Technical Report • Agricultural Assessment Technical Report Volume 7: Risk Assessment and Management of Pipeline and Facility Spills • Sections 6.0, 7.0 and 8.0	**Volume 8A: Marine Transportation** • **Sections 4.2, 4.3, 4.4, 5.6 and 5.7** Volume 8B: Technical Reports • Marine Commercial, Recreational and Tourism Use – Marine Transportation Technical Report	---

Filing #	Filing Requirement	In Application? References	Applicable Marine Transportation Elements	Not in Application? Explanation
Heritage resources		Volume 5B: ESA - Socio-Economic • Sections 5.0, 6.0 and 7.0 Volume 7: Risk Assessment and Management of Pipeline and Facility Spills • Section 6.3.3	N/A	---
Navigation and navigation safety		Volume 5B: ESA - Socio-Economic • Sections 5.0, 6.0 and 7.0 Volume 5D: ESA - Socio-Economic Technical Reports • Socio-Economic Technical Report	**Volume 8A: Marine Transportation** • **Section 5.2**	---
Traditional land and resource use		Volume 5B: ESA - Socio-Economic • Sections 5.0, 6.0, 7.0 and 8.0 Volume 5D: ESA - Socio-Economic Technical Reports • Traditional Land and Resource Use Report • Pipeline and Facilities Human Health Risk Assessment Technical Report Volume 7: Risk Assessment and Management of Pipeline and Facility Spills • Sections 6.0, 7.0 and 8.0 • Qualitative Ecological Risk Assessment of Pipeline Spills Technical Report	**Volume 8A: Marine Transportation** • **Sections 4.2, 4.3, 4.4, 5.6 and 5.7** Volume 8B: Technical Reports • Traditional Marine Use Report for Marine Transportation • Marine Transportation Human Health Risk Assessment Technical Report	---
Social and cultural well-being		Volume 5B: ESA - Socio-Economic • Sections 5.0, 6.0, 7.0 and 8.0 Volume 5D: ESA - Socio-Economic Technical Reports • Socio-Economic Technical Report Volume 7: Risk Assessment and Management of Pipeline and Facility Spills • Sections 6.0, 7.0 and 8.0	N/A	---
Human health and aesthetics		Volume 5B: ESA - Socio-Economic • Sections 5.0, 6.0, 7.0 and 8.0 Volume 5D: ESA - Socio-Economic Technical Reports • Socio-Economic Technical Report • Community Health Technical Report • Viewshed Modelling Analysis Technical Report • Pipeline and Facilities Human Health Risk Assessment Technical Report Volume 7 Risk Assessment and Management of Pipeline and Facility Spills • Sections 6.0, 7.0 and 8.0 • Qualitative Ecological Risk Assessment of Pipeline Spills Technical Report	Volume 7: Risk Assessment and Management of Pipeline and Facility Spills • Qualitative Human Health Risk Assessment of Westridge Marine Terminal Technical Report **Volume 8A: Marine Transportation** • **Sections 4.2, 4.3, 4.4, 5.6 and 5.7** Volume 8B: Technical Reports • Marine Transportation Human Health Risk Assessment Technical Report • Marine Transportation Spills Human Health Risk Assessment Technical Report	---
Infrastructure and services		Volume 5B: ESA - Socio-Economic • Sections 5.0, 6.0, 7.0 and 8.0 Volume 5D: ESA - Socio-Economic Technical Reports • Socio-Economic Technical Report • Community Health Technical Report Volume 7: Risk Assessment and Management of Pipeline and Facility Spills • Sections 6.0, 7.0 and 8.0	**Volume 8A: Marine Transportation** • **Sections 4.2, 4.3, 4.4, 5.6 and 5.7** Volume 8B: Technical Reports • Marine Commercial, Recreational and Tourism Use – Marine Transportation Technical Report	---
Employment and economy		Volume 5B: ESA - Socio-Economic • Sections 5.0, 6.0, 7.0 and 8.0 Volume 5D: ESA - Socio-Economic Technical Reports • Socio-Economic Technical Report • Worker Expenditures Analysis Technical Report	N/A	---

GUIDE A – A.3 ECONOMICS

Filing #	Filing Requirement	In Application? References	Not in Application? Explanation
A.3.1 Supply			
1.	A description of each commodity.	Volume 2 Section 3.1.1	--
2.	A discussion of all potential supply sources.	Volume 2 Section 3.3.2	--
3.	Forecast of productive capacity over the economic life of the facility.	Volume 2 Sections 3.3.1, 3.4.1	
4.	For pipelines with contracted capacity, a discussion of the contractual arrangements underpinning supply.	Volume 2 Section 3.3.2	--
A.3.2 Transportation Matters			
Pipeline Capacity			
1.	In the case of expansion provide: • Pipeline capacity before and after and size of increment • Justification that size of expansion is appropriate	Volume 2 Sections 1.1, 2.1, 3.5	--
2.	In case of new pipeline, justification that size of expansion is appropriate given available supply.	N/A – expansion	N/A
Throughput			
1.	For pipelines with contracted capacity, information on contractual arrangements.	Volume 2 Section 3.2.1	--
2.	For non-contract carrier pipelines, forecast of annual throughput volumes by commodity type, receipt location and delivery destination over facility life.	N/A	N/A
3.	If project results in an increase in throughput: • theoretical and sustainable capabilities of the existing and proposed facilities versus the forecasted requirements • flow formulae and flow calculations used to determine the capabilities of the proposed facilities and the underlying assumptions and parameters	Volume 2 Section 3.1	--
4.	If more than one type of commodity transported, a discussion pertaining to segregation of commodities including potential contamination issues or cost impacts.	N/A	N/A
A.3.3 Markets			
1.	Provide an analysis of the market in which each commodity is expected to be used or consumed.	Volume 2 Section 3.4.2	--
2.	Provide a discussion of the physical capability of upstream and downstream facilities to accept the incremental volumes that would be received and delivered.	Volume 2 Section 3.4.2	--
A.3.4 Financing			
1.	Evidence that the applicant has the ability to finance the proposed facilities.	Volume 2 Section 3.2.2	--
2.	Estimated toll impact for the first full year that facilities are expected to be in service.	Volume 2 Section 3.2.1	--
3.	Confirmation that shippers have been apprised of the project and toll impact, their concerns and plans to address them.	Volume 2 Section 3.2.1	--
4.	Additional toll details for applications with significant toll impacts.	Volume 2 Section 3.2.1	
A.3.5 Non-NEB Regulatory Approvals			
1.	Confirm that all non-NEB regulatory approvals required to allow the applicant to meet its construction schedule, planned in-service date and to allow the facilities to be used and useful are or will be in place.	Volume 2 Section 1.5	--
2.	If any of the approvals referred to in #1 may be delayed, describe the status of those approval(s) and provide an estimation of when the approval is anticipated.	Volume 2 Section 1.5	--

GUIDE A – A.4 LANDS INFORMATION

Filing #	Filing Requirement	In Application? References	Not in Application? Explanation
A.4.1 Land Areas			
1.	• Width of right-of-way and locations of any changes to width • Locations and dimensions of known temporary work space and drawings of typical dimensions • Locations and dimensions of any new lands for facilities	Volume 2 Section 5.2	--
A.4.2 Land Rights			
1.	The type of lands rights proposed to be acquired for the project.	Volume 2 Section 5.3	--
2.	The relative proportions of land ownership along the route of the project.	Volume 2 Section 5.3.2	--
3.	Any existing land rights that will be required for the project.	Volume 2 Section 5.4	--
A.4.3 Lands Acquisition Process			
1.	The process for acquiring lands.	Volume 2 Section 5.4.1, 5.4.2	--
2.	The timing of acquisition and current status.	Volume 2 Section 5.4.3	--
3.	The status of service of section 87(1) notices.	Volume 2 Section 5.4.4	--
A.4.4 Land Acquisition Agreements			
1.	A sample copy of each form of agreement proposed to be used pursuant to section 86(2) of the NEB Act.	Volume 2 Section 5.4.2	--
2.	A sample copy of any proposed fee simple, work space, access or other land agreement.	Volume 2 Section 5.5.2	--
A.4.5 Section 87 Notices			
1.	A sample copy of the notice proposed to be served on all landowners pursuant to section 87(1) of the NEB Act.	Volume 2 Section 5.4.4, Appendix D	--
2.	Confirmation that all notices include a copy of Pipeline Regulation in Canada: A Guide for Landowners and the Public.	Volume 2 Section 5.4.4	--
A.4.6 Section 58 Application to Address a Complaint			
1.	The details of the complaint and describe how the proposed work will address the complaint.	N/A	N/A

CONCORDANCE TABLE WITH THE *CEA ACT, 2012*

***CEA Act, 2012* Requirement**	**Section in *CEA Act, 2012***	**Application Volume and Section**
The environmental effects of the designated project, including:		
the environmental effects of malfunctions or accidents that may occur in connection with the designated project;	s.19.1(a)	Volume 5A ESA - Biophysical: • Section 7.0 Volume 5B ESA - Socio-economic: • Section 7.0 Volume 7 Risk Assessment and Management of Pipeline and Facility Spills **Volume 8A Marine Transportation:** • **Sections 4.3 and 5.0**
any cumulative environmental effects that are likely to result from the designated project in combination with other physical activities that have been or will be carried out;	s.19.1(a)	Volume 5A ESA - Biophysical: • Section 8.0 Volume 5B ESA - Socio-economic: • Section 8.0 **Volume 8A Marine Transportation:** • **Section 4.4**
the significance of the effects referred to in paragraph (a);	s.19.1(b)	Volume 5A ESA - Biophysical: • Sections 7.0 and 8.0 Volume 5B ESA - Socio-economic: • Sections 7.0 and 8.0 **Volume 8A Marine Transportation:** • **Sections 4.3 and 4.4**
comments from the public – or, with respect to a designated project that requires that a certificate be issued in accordance with an order made under section 54 of the *National Energy Board Act*, any interested party – that are received in accordance with this *act*;	s.19.1(c)	Volume 3A Public Consultation Volume 3B Aboriginal Engagement Volume 3C Landowner Relations Volume 5A ESA - Biophysical: • Section 3.0 Volume 5B ESA - Socio-economic: • Section 3.0 **Volume 8A Marine Transportation:** • **Section 3.0**
mitigation measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the designated project;	s.19.1(d)	Volume 5A ESA - Biophysical: • Sections 7.0 and 8.0 Volume 5B ESA - Socio-economic: • Sections 7.0 and 8.0 Volume 5C ESA – Biophysical Technical Reports Volume 5D ESA - Socio-economic Technical Reports Volume 6B Pipeline Environmental Protection Plan Volume 6C Facilities Environmental Protection Plan Volume 6D Westridge Marine Terminal Environmental Protection Plan Volume 6E Environmental Alignment Sheets **Volume 8A Marine Transportation:** • **Sections 4.3, 4.4 and 5.0** Volume 8B Technical Reports
the requirements of the follow-up program in respect of the designated project;	s.19.1(e)	Volume 5A ESA - Biophysical: • Section 10.0 Volume 5B ESA - Socio-economic: • Section 10.0
the purpose of the designated project;	s.19.1(f)	Volume 5A ESA - Biophysical: • Section 2.0 Volume 5B ESA - Socio-economic: • Section 2.0 **Volume 8A Marine Transportation:** • **Section 1.1**

CONCORDANCE TABLE WITH THE *CEA ACT, 2012*

***CEA Act, 2012* Requirement**	**Section in *CEA Act, 2012***	**Application Volume and Section**
alternative means of carrying out the designated project that are technically and economically feasible and the environmental effects of any such alterative means;	s.19.1(g)	Volume 5A ESA - Biophysical: • Sections 2.0 and 4.0 Volume 5B ESA - Socio-economic: • Sections 2.0 and 4.0 **Volume 8A Marine Transportation:** • **Section 2.2**
any change to the designated project that may be caused by the environment;	s.19.1(h)	Volume 5A ESA - Biophysical: • Section 7.10 **Volume 8A Marine Transportation:** • **Section 4.3**
the results of any relevant study conducted by a committee established under section 73 or 74; and	s.19.1(i)	N/A
any other matter relevant to the environmental assessment that the responsible authority, or, – if the environmental assessment is referred to a review panel – the Minister, requires to be taken into account.	s.19.1(j)	**Volume 8A Marine Transportation** Volume 8B Technical Reports Volume 8C TERMPOL Reports These volumes take into consideration the *Filing Requirements Related to the Potential Environmental and Socio-Economic Effects of Increased Marine Shipping Activities, Trans Mountain Expansion Project* (September 10, 2013) (NEB 2013)
The environmental assessment of a designated project may take into account community knowledge and Aboriginal traditional knowledge.	s 19.3	Volume 5A ESA - Biophysical: • Sections 5.0, 6.0, 7.0 and 8.0 Volume 5B ESA - Socio-economic: • Sections 5.0, 6.0, 7.0 and 8.0 Volume 5C ESA - Biophysical Technical Reports Volume 5D ESA - Socio-economic Technical Reports **Volume 8A Marine Transportation:** • **Sections 4.2, 4.3 and 4.4** Volume 8B Technical Reports
Subsection 5(1) of *CEA Act, 2012* defines environmental effects as a change that may be caused to the following components of the environment that are within the legislative authority of Parliament:		
fish as defined in section 2 of the *Fisheries Act* and fish habitat as defined in subsection 34(1) of that *Act*;	s.5(1)(a)(i)	Volume 5A ESA - Biophysical: • Sections 5.0, 6.0, 7.0 and 8.0 Volume 5C ESA - Biophysical Technical Reports **Volume 8A Marine Transportation:** • **Sections 4.2, 4.3, 4.4 and 5.0** Volume 8B Technical Reports
aquatic species as defined in subsection 2(1) of the *Species at Risk Act;*	s.5(1)(a)(ii)	Volume 5A ESA - Biophysical: • Sections 5.0, 6.0, 7.0 and 8.0 Volume 5C ESA - Biophysical Technical Reports **Volume 8A Marine Transportation:** • **Sections 4.2, 4.3, 4.4 and 5.0** Volume 8B Technical Reports
migratory birds as defined in subsection 2(1) of the *Migratory Birds Convention Act, 1994*, and	s.5(1)(a)(iii)	Volume 5A ESA - Biophysical: • Sections 5.0, 6.0, 7.0 and 8.0 Volume 5C ESA - Biophysical Technical Reports **Volume 8A Marine Transportation:** • **Sections 4.2, 4.3, 4.4 and 5.0** Volume 8B Technical Reports
any other component of the environment that is set out in Schedule 2.	s.5(1)(a)(iv)	N/A
Subsection 5(1) of the *CEA Act, 2012* defines environmental effects as (b) a change that may be caused to the environment that would occur		
on federal lands,	s.5(1)(b)(i)	Volume 5A ESA - Biophysical: • Section 7.0 Volume 5B ESA - Socio-economic: • Section 7.0

CONCORDANCE TABLE WITH THE *CEA ACT, 2012*

***CEA Act, 2012* Requirement**	**Section in *CEA Act, 2012***	**Application Volume and Section**
in a province other than the one in which the *act* or thing is done or where the physical activity, the designated project or the project is being carried out, or	s.5(1)(b)(ii)	N/A No changes are anticipated in provinces other than Alberta and BC in relation to the ESA.
outside Canada.	s.5(1)(b)(iii)	**Volume 8A Marine Transportation:** • **Sections 4.3, 4.4 and 5.0**
Subsection 5(1) of the *CEA Act, 2012* defines environmental effects as (c) with respect to aboriginal peoples, an effect occurring in Canada of any change that may be caused to the environment on:		
health and socio-economic conditions;	s.5(1)(c)(i)	Volume 5B ESA - Socio-economic: • Sections 5.0, 6.0, 7.0 and 8.0 Volume 5D ESA - Socio-economic Technical Reports **Volume 8A Marine Transportation:** • **Sections 4.3 and 4.4** Volume 8B Technical Reports
physical and cultural heritage;	s.5(1)(c)(ii)	Volume 5B ESA - Socio-economic: • Sections 5.0, 6.0 and 7.0
the current use of lands and resources for traditional purposes; or	s.5(1)(c)(iii)	Volume 5B ESA - Socio-economic: • Sections 5.0, 6.0, 7.0 and 8.0 Volume 5D ESA - Socio-economic Technical Reports **Volume 8A Marine Transportation:** • **Sections 4.3 and 4.4** Volume 8B Technical Reports
any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.	s.5(1)(c)(iv)	Volume 5B ESA - Socio-economic: • Sections 5.0, 6.0 and 7.0

1.0 INTRODUCTION

1.1 Project Overview

Trans Mountain Pipeline ULC (Trans Mountain) is a Canadian corporation with its head office located in Calgary, Alberta (AB). Trans Mountain is a general partner of Trans Mountain Pipeline L.P., which is operated by Kinder Morgan Canada Inc. (KMC), and is fully owned by Kinder Morgan Energy Partners, L.P. Trans Mountain is the holder of the National Energy Board (NEB) certificates for the Trans Mountain pipeline system (TMPL system).

The TMPL system commenced operations 60 years ago and now transports a range of crude oil and petroleum products from Western Canada to locations in central and southwestern British Columbia (BC), Washington State and offshore. The TMPL system currently supplies much of the crude oil and refined products used in BC. The TMPL system is operated and maintained by staff located at Trans Mountain's regional and local offices in Alberta (Edmonton, Edson, and Jasper) and BC (Clearwater, Kamloops, Hope, Abbotsford, and Burnaby).

The TMPL system has an operating capacity of approximately 47,690 m^3/d (300,000 bbl/d) using 23 active pump stations and 40 petroleum storage tanks. The expansion will increase the capacity to 141,500 m^3/d (890,000 bbl/d).

The proposed expansion will comprise the following:

- Pipeline segments that complete a twinning (or "looping") of the pipeline in Alberta and BC with about 987 km of new buried pipeline.
- New and modified facilities, including pump stations and tanks.
- Three new berths at the Westridge Marine Terminal in Burnaby, BC, each capable of handling Aframax class vessels.

The expansion has been developed in response to requests for service from Western Canadian oil producers and West Coast refiners for increased pipeline capacity in support of growing oil production and access to growing West Coast and offshore markets. NEB decision RH-001-2012 reinforces market support for the expansion and provides Trans Mountain the necessary economic conditions to proceed with design, consultation, and regulatory applications.

Application is being made pursuant to Section 52 of the *National Energy Board Act* (*NEB Act*) for the proposed Trans Mountain Expansion Project (referred to as "TMEP" or "the Project"). The NEB will undertake a detailed review and hold a Public Hearing to determine if it is in the public interest to recommend a Certificate of Public Convenience and Necessity (CPCN) for construction and operation of the Project. Subject to the outcome of the NEB Hearing process, Trans Mountain plans to begin construction in 2015/2016 and go into service in 2017.

Trans Mountain has embarked on an extensive program to engage Aboriginal communities and to consult with landowners, government agencies (*e.g.*, regulators and municipalities), stakeholders, and the general public. Information on the Project is also available at www.transmountain.com.

While Trans Mountain does not own or operate the vessels calling at the Westridge Marine Terminal, it is responsible for ensuring the safety of the terminal operations. In addition to Trans Mountain's own screening process and terminal procedures, all vessels calling at Westridge

must operate according to rules established by the International Maritime Organization (IMO), Transport Canada, the Pacific Pilotage Authority (PPA), and Port Metro Vancouver (PMV). Although Trans Mountain is not responsible for vessel operations, it is an active member in the maritime community and works with BC maritime agencies to promote best practices and facilitate improvements to ensure the safety and efficiency of tanker traffic in the Salish Sea. Trans Mountain is a member of the Western Canada Marine Response Corporation (WCMRC), and works closely with WCMRC and other members to ensure that WCMRC remains capable of responding to spills from vessels loading or unloading product or transporting it within their area of jurisdiction.

Currently, in a typical month, five vessels are loaded with heavy crude oil, primarily diluted bitumen, at the terminal. The expanded system will be capable of serving 34 Aframax class vessels per month, with actual demand driven by market conditions. The maximum size of vessels (Aframax class) served at the terminal will not change as part of the Project. Similarly, the future cargo will continue to be crude oil, primarily diluted bitumen. Of the 141,500 m^3/d (890,000 bbl/d) capacity of the expanded system, up to 100,200 m^3/d (630,000 bbl/d) may be delivered to the Westridge Marine Terminal for shipment.

In addition to tanker traffic, the terminal typically loads three barges with oil per month and receives one or two barges of jet fuel per month for shipment on a separate pipeline system that serves Vancouver International Airport (YVR). Barge activity is not expected to change as a result of the expansion.

1.2 Scope of Volume 8A

To understand the potential effects of the Project-related increase on marine traffic, Trans Mountain undertook an Environmental and Socio-Economic Assessment (ESA), as well as a quantitative marine risk assessment of the potential for oil spills in the marine environment. The results of these activities are incorporated in Volume 8A, Marine Transportation, and address the requirements of the NEB's List of Issues (July 29, 2013), the Canadian Environmental Assessment Act, 2012 (CEA Act 2012), and the NEB's Filing Requirements Related to the Potential Environmental and Socio-Economic Effects of Increased Marine Shipping Activities, Trans Mountain Expansion Project (September 10, 2013). Trans Mountain has initiated the Technical Review Process of Marine Terminal Systems and Transshipment Sites (TERMPOL) under Transport Canada's jurisdiction. TERMPOL is a federal review process focusing on safety and marine transportation components of a project (Section 1.4.1.8).

Trans Mountain has contracted a number of studies, including the previously mentioned quantitative risk assessment, to provide recommendations to Transport Canada, the TERMPOL Review Committee, and other relevant responsible authorities to improve the safety of marine transportation related to the Project. These studies were also used as the basis for Volume 8A, Marine Transportation.

The purpose of Volume 8A, Marine Transportation, is to provide the NEB with information to understand the environmental and socio-economic effects resulting from the increase in marine traffic related to the Project. The results of the studies to meet the TERMPOL requirements have been incorporated into the ESA where relevant and the referenced studies are included in Volume 8C.

Volume 8A, Marine Transportation, is supported by two volumes of technical studies:

- Volume 8B: Technical Reports includes all of the technical reports developed in support of the ESA in Volume 8A.
- Volume 8C: TERMPOL Study Reports includes all of the technical reports prepared in support of the TERMPOL process.

1.3 Geographic Considerations

The discussion of the increase in marine transportation related to the Project takes place within a geographic area extending between the Westridge Marine Terminal and a location known as "Buoy J" (*i.e.*, the 12 mile nautical territorial limit) at the entrance to the Juan de Fuca Strait, covering the internationally established shipping lanes and the waters and lands closely adjoining these lanes (Figure 1.3.1).

Figure 1.3.1 shows the established international vessel traffic separation scheme (TSS) that is the foundation of the existing marine transportation network in the Salish Sea, including tankers and vessels bound for and leaving the Westridge Marine Terminal.

TRANS MOUNTAIN

FIGURE 1.3.1

REGIONAL LOCATION OF MARINE SHIPPING LANES

TRANS MOUNTAIN EXPANSION PROJECT

- Reference Kilometre Post (RK)
- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Terminal
- Existing Pump Station
- Highway
- Road
- 12 Nautical Mile Limit (Territorial Sea)
- Limit of Exclusive Economic Zone (EEZ)
- International Boundary
- Marine Vessel Outbound Shipping Lane
- Marine Vessel Inbound Shipping Lane
- Traffic Separation Scheme
- City / Town / District Municipality
- Indian Reserve / Métis Settlement
- National Park
- Provincial / State Park
- Protected Area/Natural Area/ Provincial Recreation Area/Wilderness Provincial Park/Conservancy Area

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Projection: UTM Zone 10N.
Routing:Baseline TMPL & Facilities: provided by KMC, 2012; Proposed Pipeline Corridor V6: provided by UPI, Aug. 23, 2013; Facilities: provided by KMC, 2012; Transportation: BC Forests, Lands and Natural Resource Operations, 2012 & ESRI, 2005; Geopolitical Boundaries: IHS Inc., 2011, BC FLNRO, 2007 & ESRI, 2005, Natural Resources Canada, 2012; First Nation Lands: Government of Canada, 2013 & IHS Inc., 2011; Hydrology: IHS Inc., 2004, United States National Imagery and Mapping Agency, 2000, Natural Resouces Canada, 2010; Parks and Protected Areas: Natural Resources Canada, 2013, BC FLNRO, 2008; CHS: provided by KMC, 2013; Marine Shipping Lanes: Moffatt and Nichol, 2013; Hillshade: TERA, derived from Geobase; US Hillshade: ESRI, 2009.

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MAP NUMBER: 201310_MAP_TERA_MR_00466_REV0		PAGE: SHEET 1 OF 1
DATE: December 2013	TERA REF.: 7894	REVISION: 0
SCALE: 1:650,000	PAGE SIZE: 11x17	DISCIPLINE: MR
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ALL LOCATIONS APPROXIMATE

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1.4 Regulatory Framework for Marine Transportation

An existing regulatory framework emphasizing navigational safety, accident prevention, emergency preparedness and response, and financial liability/compensation in the case of an oil spill in a marine environment in Canada governs existing and future marine vessel traffic calling at the Westridge Marine Terminal.

The following sub-sections provide an overview of the legislative tools and international conventions relevant to the Project-related increase in marine traffic (Section 1.4.1), and the roles and responsibilities of the Canadian and American organizations that would be involved in managing the increase in marine traffic related to the Project (Section 1.4.2).

Section 1.4.3 illustrates how the various legislative instruments and agencies work together to ensure the navigational safety, and thus spill prevention, for a tanker transiting Canadian waters to and from the Westridge Marine Terminal.

Section 1.4.4 illustrates how the various parties described in Section 1.4.2 work together to provide emergency preparedness and response capability in the event of an oil spill in a marine environment in Canadian waters.

Lastly, Section 1.4.5 describes the various federal and provincial initiatives underway to improve marine transportation in Canada.

1.4.1 Legislation and Conventions

Shipping activities within the jurisdiction of Canada are regulated through various legislative tools. Acts, regulations and international conventions that are relevant to Project-related marine transportation are briefly described in the following sub-sections.

1.4.1.1 Canada Shipping Act, 2001 and Regulations

The *Canada Shipping Act, 2001* is the principal legislation governing safety in marine transportation, as well as protection of the marine environment in Canada. It applies to Canadian vessels operating in all waters and to all vessels operating in Canadian waters, including those calling at the Westridge Marine Terminal.

The *Canada Shipping Act, 2001* makes use of modern legislative practices and supports the application of risk management techniques. The *Canada Shipping Act, 2001*, combined with international conventions, provides the legislative framework for Transport Canada to fulfill its mandate related to marine safety, pollution prevention, enforcement, and oil spill preparedness and response programs (Section 1.4.2).

The *Response Organizations and Oil Handling Facilities Regulation* under the *Canada Shipping Act, 2001* establishes certified response organizations to provide emergency response capability, leadership and support in the case of an oil spill in a marine environment. With respect to the Project, WCMRC is certified by Transport Canada to respond to oil spills on the West Coast of Canada (Section 1.4.2, WCMRC). Trans Mountain is a shareholder and member of WCMRC.

Under the *Canada Shipping Act, 2001*, the following parties must have an arrangement for emergency response services in place with a certified response organization in order to operate in Canadian waters:

- ships and barges greater than 150 gross tonnage carrying oil as a cargo;
- all other ships greater than 400 gross tonnage that carry oil as fuel for their own use; and
- oil handling facilities (*i.e.*, terminals, such as the Westridge Marine Terminal) that transfer oil to or from the ships.

Canada Shipping Act, 2001 recognizes and incorporates international shipping conventions (Section 1.4.1.9), which include those on ship construction (*i.e.*, oil tankers in Canadian Waters must be double-hulled), safety, prevention of pollution, training of seafarers, ship routing, salvage, search and rescue, minimum crewing requirements and crew welfare. *Canada Shipping Act, 2001* harmonizes Canada's shipping rules and regulations with international shipping laws, rules and regulations. *Canada Shipping Act, 2001* is applicable to persons, ships and oil handling facilities, and any individual or corporation violating the law may be assessed penalties that are determined based on the seriousness of each violation.

The *Canada Shipping Act, 2001* could be further strengthened by the Government of Canada's proposed amendments (Bill C-3) that would (Transport Canada 2013a):

- strengthen the current requirements for pollution prevention and response at oil handling facilities;
- increase Transport Canada's oversight and enforcement capacity by equipping marine safety inspectors with the tools to enforce compliance;
- introduce new offences for contraventions of the *Canada Shipping Act, 2001* and extend penalties relating to pollution; and
- enhance response to oil spill incidents by removing legal barriers that could otherwise block agents of Canadian response organizations from participating in clean-up operations.

1.4.1.2 Canada Marine Act

Pursuant to the *Canada Marine Act,* in January 2008 the Government of Canada established the Vancouver Fraser Port Authority, doing business as PMV. PMV is a non-shareholder, financially self-sufficient corporation accountable to the federal Minister of Transport. The Westridge Marine Terminal is within PMV and calling vessels are subject to PMV's rules and regulations (Section 1.4.2.4).

1.4.1.3 Pilotage Act

As established within the *Pilotage Act,* the PPA is responsible for enacting regulations regarding the operation, maintenance and administration of pilotage services (*i.e.*, marine pilots for certain types of vessels in designated areas) including compulsory pilotage and the qualifications for holders of Licences and Pilotage Certificates within the PPA's jurisdiction.

A marine pilot is a mariner who guides vessels through hazardous or congested waters. Marine pilots are expert ship-handlers who possess detailed navigational knowledge of local waterways and have control over the speed, direction, and movement of a vessel to ensure it safely reaches its destination.

The transit of inbound and outbound tankers (*i.e.,* tankers carrying oil) to and from the Westridge Marine Terminal is also governed by the rules established by the PPA and in cooperation with PMV. With respect to tankers inbound and outbound from the Westridge Marine Terminal, the rules include:

- Mandatory pilotage for empty tankers inbound to the Westridge Marine Terminal. Tankers pick up a pilot from the Victoria pilot station at Brotchie Ledge. Empty tankers inbound to the Westridge Marine Terminal do not require a tug escort prior to entering PMV; however, a tug escort is required through the Second Narrows Movement Restriction Area (MRA).

- Tankers of the Aframax size are limited to crossing the Second Narrows MRA during daylight hours only, whether empty or laden. This rule and other requirements for the MRA including tug escorts and draft limitations are defined in PMV's Harbour Operations Manual which was developed with input from the PPA.

- Mandatory dual pilotage for laden tankers outbound from the Westridge Marine Terminal. Two pilots, each carrying a Portable Pilotage Unit (PPU), guide laden tankers from the Westridge Marine Terminal back to the Victoria pilot station near Brotchie Ledge, from where the laden tanker proceeds out to the Pacific Ocean under the guidance of the shipmaster, monitored by the Canadian Coast Guard (CCG) and United States (US) Coast Guard (USCG). The PPU is a computer based portable navigation system that incorporates GPS and other technology to provide the pilot an accurate navigation system that is independent of the ship's own systems.

- The PPA requires all laden bulk liquid vessels, including crude oil tankers, over 40,000 dead weight tonnage (DWT) (*i.e.,* this would include all tankers outbound from the Westridge Marine Terminal) to have a tethered tug escort from 2.0 nautical miles (NM) north of East Point in the Boundary Pass/Haro Strait to Victoria. The tug is untethered after Victoria, but remains in close proximity escort of the tanker until it clears Race Rocks.

1.4.1.4 Canadian Environmental Protection Act

The *Canadian Environmental Protection Act* (CEPA) declares that the protection of the environment is essential to the well-being of Canadians and that the primary purpose of the CEPA is to contribute to sustainable development through pollution prevention. CEPA recognizes the responsibility of users and producers in relation to toxic substances, pollutants and wastes, and has adopted the "polluter pays" principle. If an enforcement officer has reasonable grounds to believe that the owner or master of a ship has committed an offence under the CEPA, the enforcement officer may make a detention order in respect of the ship. The CEPA applies to all vessels calling at the Westridge Marine Terminal.

1.4.1.5 Transportation of Dangerous Goods Act and Regulation

Transport Canada, based on risks, develops safety standards and regulations, provides oversight and gives expert advice through the Canadian Transport Emergency Centre, on accidents related to dangerous goods that are transported by all modes and regulated under the *Transportation of Dangerous Goods Act* and associated regulations (Transport Canada 2013b).

1.4.1.6 Marine Liability Act

The *Marine Liability Act* (*MLA*) establishes the framework for handling marine liability and compensation in Canada and reflects Canada's membership to international conventions administered by the International Oil Pollution Compensation (IOPC) Funds (*i.e.*, the IOPC Fund and the Supplementary Fund Protocol; or the international funds) and the *Civil Liability Convention*.

The *MLA* also establishes the Ship-source Oil Pollution Fund (SOPF) that provides funding for spills from all classes of vessels in Canadian waters. The SOPF provides funding in addition to the funding available under the international funds. The classes of claims for which the SOPF may be liable include: claims for oil pollution damage; claims for costs and expenses of oil spill clean-up, preventive measures and monitoring; and claims for oil pollution damage and clean-up costs where the cause of the oil pollution damage is unknown (Transport Canada 2013c). As well, a widely defined class of parties in the Canadian fishing industry may claim against the SOPF for loss of income caused by an oil spill from a vessel and not recoverable otherwise under the *MLA* (Transport Canada 2013d).

Both Canada's and the international frameworks are based on the principle of "polluter pays", which makes the polluter liable for all response costs and damages associated with an oil spill (Transport Canada 2013c). In the event of an oil spill from a tanker in Canadian waters, the owner of a tanker (*i.e.*, the Responsible Party) would be liable for the cost of clean-up and compensation to affected parties subject to the limits of their liability.

The international funds are financed through levies paid by parties in member countries, such as Canada, that receive crude or fuel oil. In Canada the contribution is paid by the SOPF on behalf of Canadian oil receivers. Under the *MLA*, it is mandatory for a party that receives more than 150,000 tons of oil annually to report the quantity to the SOPF administrator who consolidates the national figure and makes payment to the international funds.

The unit of account in the international funds is the Special Drawing Right (SDR). The International Monetary Fund calculates SDR currency amounts daily by summing the value of a number of currencies (*i.e.,* the US dollar, the Japanese Yen, the Euro, and pound sterling), based on market values and in US dollars (International Monetary Fund 2013, International Oil Pollution Fund Compensation Funds 2012). The currency conversions provided in the following paragraphs are in Canadian dollars and are based on the amounts reported by the Ship-source Oil Pollution Fund Annual Report 2012 to 2013 (Chenier pers. comm.).

In the event of an oil spill in a marine environment, funding is available in a tiered system:

- The first level of funding for emergency response, clean-up and compensation to affected parties is from the responsible party's protection and indemnity insurance. Ship owners and operators obtain insurance coverage against third-party liability through a protection and indemnity association of ship owners and operators (P&I Club), which would be a member of the International Group of

P&I Clubs (Transport Canada 2013c). The responsible party's liability is limited based on vessel tonnage to a maximum of about $136.76 million.

- If the responsible party's insurance is not adequate to cover costs and compensation, funds are available through the International Oil Pollution Compensation Fund ($172.50 million) and the Supplementary Fund Protocol ($833.34 million).

- Lastly, Canada maintains its own source of funding called the SOPF, which has up to $161.29 million of funding available.

In total, there is approximately $1.3 billion in funding available to address the costs of emergency response, clean-up and compensation in the event of an oil spill from a tanker.

The SOPF can also be a fund of first resort for claimants, including the Crown. Any party may file a claim with the SOPF administrator respecting loss or damage related to oil pollution from a vessel in Canadian waters. The SOPF administrator has the duty to investigate and assess claims filed with the SOPF. While a potential claim is paid out of the SOPF, the administrator is obliged to take all reasonable measures to recover the amount of compensation paid to the claimant from the responsible party.

1.4.1.7 Marine Transportation Security Act

The *Marine Transportation Security Act* (MTSA) provides for the security of marine transportation and is aligned with similar international regulations. In accordance with regulations established under the MTSA, PMV and the Westridge Marine Terminal established a Marine Security Level relevant to the conditions at the time. All vessels arriving at PMV or Westridge Marine Terminal must ensure that those conditions are in effect onboard prior to the vessel's arrival. The MTSA will continue to apply to tankers calling at the Westridge Marine Terminal after the Project is in operation.

1.4.1.8 TERMPOL

As noted, Trans Mountain requested to undertake a TERMPOL process focused on the increase in marine transportation related to the Project. The review process is chaired and led by Transport Canada and has involved other federal departments and stakeholders, as required. The review may consider safety measures above and beyond existing regulations to address site-specific circumstances.

In general and for any project, the TERMPOL process focuses on the marine transportation components of a project and examines the safety of tankers entering Canadian waters, navigating through channels, approaching berthing at a marine terminal and loading or unloading oil or gas.

With respect to the increase in existing marine traffic related to the TMEP, the TERMPOL process focuses on the effects of the incremental increase in marine traffic related to the Project. To fulfill the requirements of TERMPOL, Trans Mountain undertook a number of studies (Table 1.4.1). The relevant results of these studies have been incorporated into the ESA (Volume 8A, Sections 4.0 and 5.0). In particular, the results of a quantitative risk assessment informed the assessment of accidents and malfunctions, the description of spill prevention, emergency preparedness and response, and the identification of improved practices

(Volume 8A, Section 5.0). The relevant TERMPOL studies referenced in Volume 8A are provided in Volume 8C.

TABLE 1.4.1

TERMPOL STUDIES COMPLETED FOR TMEP

TERMPOL Identifier	Title of Study	Where to Find in Volume 8C
TERMPOL 3.1	Introduction	8C-1
TERMPOL 3.2	Origin, Destination and Marine Traffic Volume Survey	8C-2
TERMPOL 3.3	Fishery Resources Survey	8C-3
TERMPOL 3.5	Route Analysis, Approach Characteristics and Navigability Survey	Combined with TERMPOL 3.12
TERMPOL 3.6	Special Underkeel Clearance Survey	8C-4
TERMPOL 3.7	Transit Time and Delay Survey	8C-5
TERMPOL 3.8	Casualty Data Survey	8C-6
TERMPOL 3.9	Ship Specifications	8C-7
TERMPOL 3.10	Site TERMPOL Plans and Technical Data	8C-8
TERMPOL 3.11	Cargo Transfer and Transshipment Systems	8C-9
TERMPOL 3.12	Channel, Manoeuvring, and Anchorage Elements	8C-10
TERMPOL 3.13	Berth Procedures and Provisions	8C-11
TERMPOL 3.15	General Analysis and Intended Methods of Reducing Risks	8C-12
TERMPOL 3.16	Port Information Book	8C-13
TERMPOL 3.17	Terminal Operations Manual	8C-14
TERMPOL 3.18	Contingency Planning	8C-15
TERMPOL 3.19	Oil Handling Facilities Requirements	8C-16

Note: TERMPOL 3.4 and 3.14 are not relevant to the Project. Due to similarities in content the requirements of 3.5 and 3.12 have been combined into a single study to avoid repetition.

Trans Mountain has provided all of the TERMPOL studies listed in Table 1.4.1 to Transport Canada for review. In addition, Trans Mountain is seeking endorsement from Transport Canada on the proposed measures to improve navigational safety outlined in Volume 8A, Section 5.4.2, as Trans Mountain has no regulatory authority to implement the proposed measures. A summary of the TERMPOL process is provided in Volume 8C-1 (TERMPOL 3.1, TR 8C-1).

1.4.1.9 International Conventions

International conventions and standards developed by the IMO, in conjunction with regulatory instruments of its members such as Canada, aim to promote cooperation in reducing pollution and the risk of major incidents worldwide related to marine transportation. These international conventions address issues such as standards for ship construction, training and qualification of crew, and the safety of navigation.

Canada is a founding member of the IMO and has ratified all IMO conventions. There are several IMO conventions relevant to the Project that allow Transport Canada to fulfill its role regulating marine matters and also in the prevention and preparedness of marine oil pollution incidents (Transport Canada 2013e).

Some of the conventions more commonly referred to are listed below:

- The International Convention for the Prevention of Pollution from Ships (MARPOL) seeks to eliminate intentional pollution of the marine environment resulting from vessel operations and to minimize accidental discharges of pollutants. Transport Canada administers and enforces this convention through the *Canada Shipping Act, 2001* and regulations, which apply to all vessels calling at Westridge Marine Terminal.

- The International Convention on Oil Pollution Preparedness, Response and Cooperation is a framework that allows Canada to provide assistance to major incidents in other member states when requested and to seek assistance of international parties if required.

- The International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), sets qualification standards for masters, officers and watch personnel on seagoing merchant ships. It has established global standards for basic and advanced requirements on training, certification and watchkeeping for seafarers on an international level. Tanker crews have to carry special STCW qualification certification in order to be employed on such vessels. The IMO audits the training standards of countries to ensure uniform standards are being met across the shipping industry.

- The International Convention for the Safety of Life at Sea (SOLAS) specifies minimum standards for the construction, equipment and operation of ships, compatible with their safety. Flag states are responsible for ensuring that ships under their flag comply with the requirements of SOLAS, and a number of certificates are prescribed in the convention as proof that this has been done. Control provisions also allow signatory governments, such as Canada, to inspect ships of other signatory states if there are clear grounds for believing that the ship and its equipment do not substantially comply with the requirements of the convention - this procedure is known as Port State Control (IMO 2013a).

- Canada is a signatory to both the Paris and Tokyo memoranda of understanding (MOU) on Port State Control. Port State Control is the inspection of foreign ships in national ports to verify that the condition of the ship and its equipment complies with the requirements of international regulations and that the ship is manned and operated in compliance with these rules (IMO 2013b). This mechanism enables Transport Canada to inspect foreign vessels before they enter Canadian waters, with the objective of barring the entry of sub-standard vessels.

1.4.1.10 Trans-boundary Cooperation

Canada participates in joint activities with the US to manage vessel traffic in the trans-boundary waters of the Juan de Fuca Strait. The current regulations, procedures and practices for marine navigation to and from the Westridge Marine Terminal through the Juan de Fuca Strait, described in Volume 8A, Sections 1.3 and 1.4, are based in part on the 1979 Agreement for the Cooperative Vessel Management System for the Juan de Fuca Region.

Canada, through the CCG, participates with the USCG to establish emergency preparedness and response capability in the event of an oil spill in or affecting trans-boundary waters. This cooperation was established formally under the Canada-US Joint Marine Pollution Contingency Plan.

1.4.2 Roles and Responsibilities for Navigational Safety, Emergency Response and Preparedness

1.4.2.1 Transport Canada

Transport Canada is responsible for Canada's transportation policies and programs whereby it promotes safe, secure, efficient and environmentally responsible transportation. With respect to marine transportation, Transport Canada's regulations and standards fall under the *Canada Shipping Act, 2001* and the *Arctic Waters Pollution Protection Act*. Marine transportation in Canadian waters is also regulated by complementary international regulations established by the IMO. All of these regulatory tools provide the framework for Transport Canada's comprehensive marine safety inspection and enforcement programs. Transport Canada is also responsible for the *Navigable Waters Protection Act*, which requires approval for any works that may affect the navigability of certain navigable waters in Canada by a vessel of any size.

Canada is a signatory of the Paris and Tokyo MOU and conventions on international coordination of inspection requirements, and these requirements are also reflected in the *Canada Shipping Act, 2001*. Transport Canada inspects all foreign tankers before they enter Canadian waters on their first arrival, and annually after that. The use of international databases has helped prevent sub-standard vessels from accessing Canada's ports. Under international MOUs, Transport Canada can access the records from inspections by other signatory jurisdictions and shares Canadian results. Convention signatories publish annual reports ranking the performance of flag states, which are used as a basis to accept or deny entry of vessels.

Transport Canada has a National Aerial Surveillance Program for vessels within Canadian waters. Under the National Aerial Surveillance Program, Transport Canada performs aerial surveillance over all Canadian waters to detect pollution from ships, deterring potential polluters from dumping oil and other pollution while transiting Canadian waters. In 2011 to 2012, Transport Canada crews observed more than 12,000 vessels and detected 135 pollution occurrences nationally, with an estimated total volume of 1,014 litres of oil. There is an obligation for owners of vessels and operators of oil handling facilities to report marine spills to the CCG.

Transport Canada may recommend that marine polluters be prosecuted under the related acts based on evidence gathered by the National Aerial Surveillance Program crew as part of its duties to help enforce domestic and international laws. Transport Canada investigations have led to numerous successful prosecutions against marine polluters over the years, with some financial penalties reaching more than $100,000.

One part of Transport Canada's broad mandate that is relevant to the Project-related increase in marine transportation is Canada's Marine Oil Spill Preparedness and Response Regime (the Regime). Transport Canada is the lead federal regulatory agency response for the Regime, which was established in 1995 and is built on a partnership between industry and other government agencies, such as the CCG (Transport Canada 2013f).

Within the framework of the regime, Transport Canada sets the guidelines and regulatory structure for the preparedness and response to marine oil spills. Specific activities include (Transport Canada 2013g):

- regime management and oversight;
- development of regulations and standards;
- enforcement and implementation of regulations relating to response organizations (*e.g.*, WCMRC);
- enforcement and implementation of regulations relating to oil handling facilities;
- overseeing an appropriate level of national preparedness;
- monitoring marine activity levels, conducting risk assessments and making adjustments to the Regime, as required;
- monitoring and prevention of marine oil spills through the implementation of the National Aerial Surveillance Program;
- implementation and facilitation of the Regional Advisory Council;
- providing leadership within the IMO;
- providing leadership on Canadian Arctic interests relating to marine transportation; and
- providing post-incident reporting for oil spill response exercises and incidents, both nationally and internationally, to ensure that recommendations or lessons learned are considered and implemented as appropriate to enhance the Regime.

In order to demonstrate to Transport Canada that parties are in compliance with the *Canada Shipping Act, 2001* and the Regime, the following must be in place:

- for vessels: a Shipboard Oil Pollution Emergency Plan (SOPEP);
- for oil handling facilities such as the Westridge Marine Terminal: an Oil Pollution Emergency Plan (OPEP) and an on-site Oil Pollution Prevention Plan (OPPP); and
- for both vessels and oil handling facilities:
  - a certificate outlining the arrangement with a response organization;
  - proof of financial responsibility; and
  - the name of the person(s) authorized to implement the plan.

Currently, Transport Canada certifies the response organization based on its capacity to respond to marine oil pollution incidents in Canada on a tiered basis. The highest tier (Tier 4) certified response organization is deemed capable of responding to a 10,000 tonne oil spill

within prescribed timelines, standards, and operating environments. In addition to other issues, the threshold of 10,000 tonnes is currently under review by the Federal Tanker Safety Expert Panel (the Panel) (Section 1.4.5). The response organization's emergency plan and procedures are documented in its information handbook and in its Oil Spill Response Plan (OSRP).

The Regime is built on the principle of cascading resources, which means that in the event of a spill, the resources from a specific area can be supplemented with those from other regions or from international partners, as needed.

1.4.2.2 Fisheries and Oceans Canada – Canadian Coast Guard

The CCG, as a Special Operating Agency of Fisheries and Oceans Canada (DFO), owns and operates the federal government's civilian fleet, and provides various maritime services related to navigation, spill response, communication, security, and search and rescue. The CCG supports Canada's Marine Oil Spill Preparedness and Response Regime by providing preparedness capacity through a National Response Team.

In the event of an oil spill in a marine environment in Canadian waters, CCG would assume the role of the Federal Monitoring Officer, monitoring the overall response effort of the response organization to ensure it is timely, effective, and appropriate to the incident. In the event the Responsible Party (*i.e.*, the polluter) is unable or unwilling to assume the lead role (*i.e.*, on-scene commander) to respond to an oil spill from a vessel, CCG would step in to assume the lead role in managing the response (Section 1.4.4).

Fisheries and Oceans Canada supports international marine transportation by providing necessary information on tides, currents and weather data. The Canadian Hydrographic Service provides nautical charts and navigational products that help ensure the safe navigation of Canada's waterways. The Canadian Hydrographic Service collaborates and shares these charts with other national organizations and hydrographic service organizations, as they are the road maps that guide mariners safely from port to port.

1.4.2.3 Pacific Pilotage Authority

The PPA is the federal organization responsible for the administration of the *Pilotage Act* on the West Coast of Canada. The mandate of the PPA is to provide safe, reliable and efficient marine pilotage and related services in the Coastal Waters of BC including the Fraser River.

The British Columbia Coast Pilots Association (BCCPA) is the organization that provides service to the PPA under the *Pilotage Act* and the *Canada Shipping Act, 2001*. Pilots have to meet rigorous knowledge and experience requirements and then be examined and licensed by the PPA.

Empty tankers inbound for Westridge Marine Terminal are required to pick up a pilot at the Victoria pilot station at Brotchie Ledge. Under the pilot's guidance, and with the supervision from the CCG's Marine Communications Traffic Services (MCTS), the tanker navigates through established shipping lanes to PMV and the Westridge Marine Terminal. Laden tankers leaving the Westridge Marine Terminal are required to have two pilots to guide navigation on the return trip to the Pacific Ocean, through the Burrard Inlet, Strait of Georgia, and the Juan de Fuca Strait. The two pilots on the laden tanker leaving Westridge Marine Terminal disembark from the tanker at the Victoria pilot station at Brotchie Ledge (Section 1.4.3). The PPA also sets in place escort requirements for tankers transiting the Haro Straits and Boundary Pass. In addition,

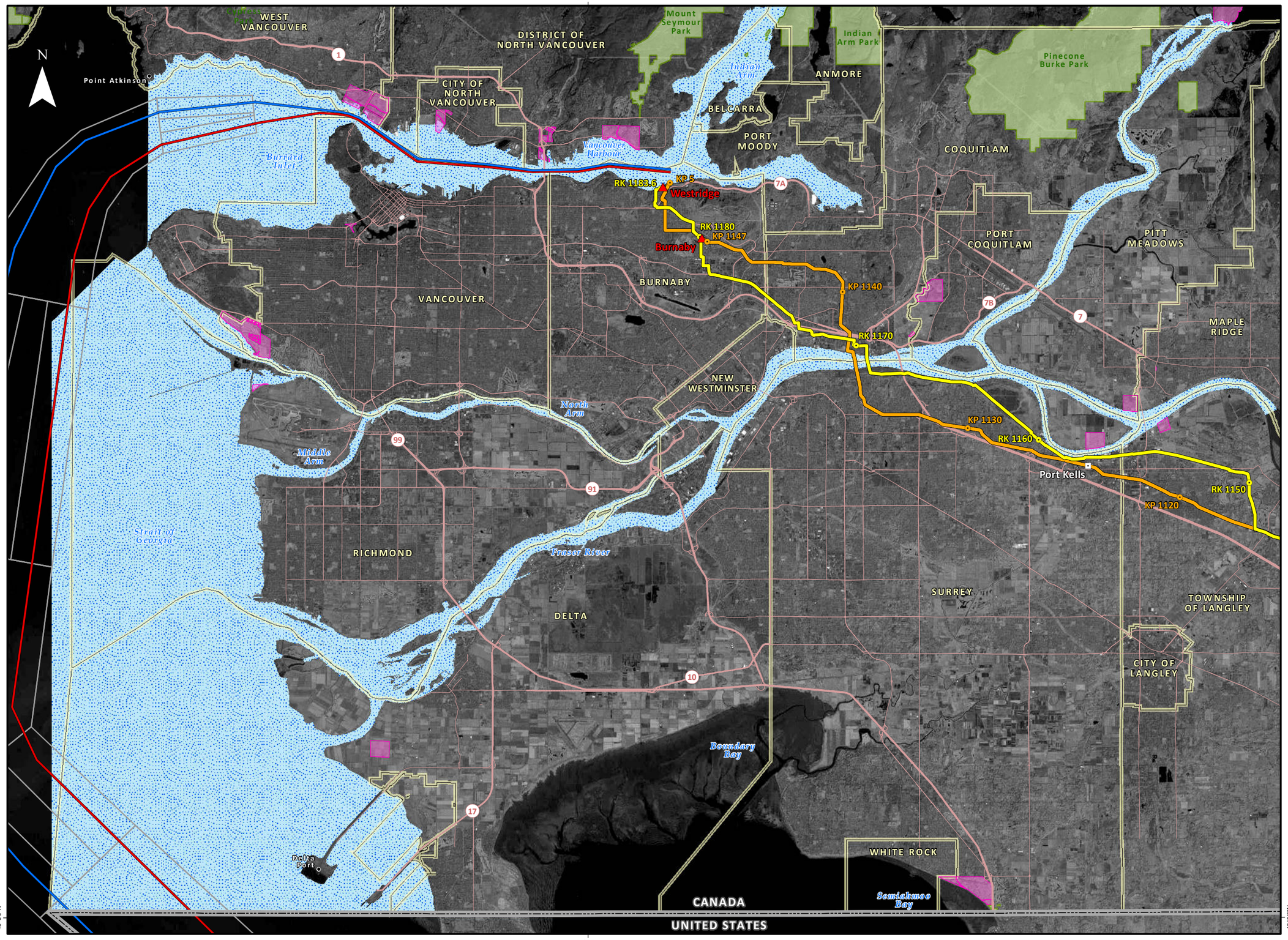
through Instructions to Pilots, the PPA establishes procedures that guide the pilots' actions in specific areas along the coast of BC.

1.4.2.4 Port Metro Vancouver

Port Metro Vancouver is the busiest port in Canada and the fourth largest tonnage port in North America. PMV facilitates trade with more than 160 world economies, with 95 per cent of port activity focused on Canadian import/export markets. In 2011, PMV moved a record 122 million tonnes of cargo (PMV 2013a).

Under the *Canada Marine Act*, PMV sets rules and regulations within its jurisdiction focused on maintaining the safe and efficient movement of marine traffic and cargo. PMV's marine operation responsibilities range from the administration of all waterborne activities, to the development of marine safety rules and procedures, to a rotating on-call duty Harbour Master to deal with incidents. Waterborne activities include managing vessel movements within PMV's jurisdiction in order to ensure navigation and environmental safety, and undertaking marine patrols, ship inspections, upgrade projects, and permitting of dangerous goods movements. The extent of PMV's jurisdiction is generally bounded by a line south from Point Atkinson, in West Vancouver, to the Canada-US border, encompassing the inlet waters to the east of this imaginary north-south line (Figure 1.4.1). The Westridge Marine Terminal is located within PMV.

123°0'0"W



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TRANS MOUNTAIN

FIGURE 1.4.1

JURISDICTION OF PORT METRO VANCOUVER

TRANS MOUNTAIN EXPANSION PROJECT

- Kilometre Post (KP)
- Reference Kilometre Post (RK)
- Trans Mountain Pipeline (TMPL)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Terminal
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- Traffic Separation Scheme
- International Boundary
- Municipal Boundary
- Port of Metro Vancouver Navigational Jurisdiction
- Indian Reserve
- Provincial Park

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Projection: NAD 1983 UTM Zone 10N. Baseline TMPL & Facilities: provided by KMC, 2012; Proposed Pipeline Corridor V6: provided by UPI, Aug. 23, 2013; Roads: BC FLNRO, 2012; Populated Places: BC FLNRO, 2007; Hydrology: BC FLNRO 2008, IHS 2004; First Nation Lands: Geobase, 2013; Parks and Protected Areas: BC FLNRO, 2008, Natural Resources Canada, 2013, ESRI 2005; US State Boundary: ESRI, 2005; Marine Vessel Traffic Lanes: Moffat and Nichol, 2013; Port Metro Vancouver Navigational Jurisdiction: Port Metro Vancouver, November 2013; B/W Imagery: NASA Geospatial Interoperability Program 2005.

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MAP NUMBER: 201310_MAP_TERA_MR_00467_Rev0		PAGE: SHEET 1 OF 1
DATE: December 2013	TERA REF.: 7894	REVISION: 0
SCALE: 1:160,000	PAGE SIZE: 11x17	DISCIPLINE: MR
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ALL LOCATIONS APPROXIMATE

Port Metro Vancouver works in partnership with a broad range of stakeholders including local municipalities, police forces and federal agencies.

Port Metro Vancouver operates five working harbour patrol vessels with crew and offers 24-hours per day, 7-day per week on-water services including emergency response, vessel inspections, harbour monitoring and various support services to the marine community.

Key requirements for operating within PMV are described within the Harbour Operations Manual: Practices and Procedures for the Vancouver Fraser Port Authority (or the *"Harbour Operations Manual"*). The Harbour Operations Manual is a collection of practices and procedures covering a wide range of port operation safety matters. The practices and procedures relevant to the movement of tankers into and out of the Westridge Marine Terminal include:

- The Second Narrows MRA: this document regulates the movement of vessel traffic within the Second Narrows, a geographically constricted area within the Burrard Inlet through which vessels calling at the Westridge Marine Terminal must pass. Regulations restrict the size and draft of tankers in relation to the available width of the channel, which is controlled by the tidal cycle. Aframax tankers are only permitted to transit during daylight regardless of whether they are empty or laden. Trans Mountain's Tanker Acceptance Standard reflects the size and draft restrictions stated in the Harbour Operations Manual. As well, Trans Mountain's scheduling process abides by the tidal timing restrictions in the Second Narrows MRA.

- Ship Anchoring: PMV manages anchoring of vessels in the waters within its jurisdiction and maintains the safe operating procedures for ships using these anchorages. Anchorages may be used by tankers calling at the Westridge Marine Terminal to wait in the event that scheduling does not permit direct berthing of a vessel at the Westridge Marine Terminal.

- Bunkering Operations: the Harbour Operations Manual contains regulations on bunkering of ships within PMV to ensure that bunkering is undertaken safely and without harm to the marine environment. Bunkering is the process of re-fuelling a vessel. The majority of bunkering operations in PMV involves transfer of fuel from a bunker barge to a vessel at anchor. In the event of an oil spill within PMV's jurisdiction, WCMRC will respond upon notification and call-out by the master of the vessel. PMV staff would become part of the Unified Command in the ICS.

1.4.2.5 Western Canada Marine Response Corporation

Western Canada Marine Response Corporation (formerly Burrard Clean Operations) is certified by Transport Canada as a response organization under the *Canada Shipping Act, 2001* with a mandate to ensure emergency preparedness and response capacity in the event an oil spill occurs in the marine environment on the West Coast of BC. In the event of an oil spill in the marine environment, WCMRC would focus its response efforts to recover the spilled oil and mitigate the consequences of the spill on the public and the environment. WCMRC is federally certified as having the capacity to undertake response for an oil spill of 10,000 tonnes and its actual capacity exceeds this.

Western Canada Marine Response Corporation maintains its certification under the *Canada Shipping Act, 2001* by undertaking a number of equipment deployment exercises, tabletop exercises, and oil spill response training courses and scenarios within the certification period (WCMRC 2013a). The current capacity of WCMRC to respond to an oil spill is further detailed in Section 5.5.1.

All large vessels and oil handling facilities in Canadian waters are required to maintain an arrangement with a certified spill response organization. The arrangement (or membership) is a commitment from WCMRC to provide oil spill response services if called upon by the holder. WCMRC has over 2,000 members including oil handling facilities, barging companies, tankers, ferries, cruise ships, vessels undertaking innocent passage through western Canadian waters, forest industry facilities, fish camps, and float plane companies. While these memberships are an important source of revenue for WCRMC, the majority of funding for the corporation comes from a Bulk Oil Cargo Fee that is charged at oil handling faculties on a per tonne basis for oil that is unloaded within or exported from WCMRC's Geographic Area of Response. The revenues from membership fees and the Bulk Oil Cargo fee essentially fund the corporation's standby capability. If called upon to respond to a spill, WCMRC charges members for response services based on published rates. The corporation is run on a cost-of-service basis.

As a shareholder of WCMRC, Trans Mountain is a co-founder of Burrard Clean Operations, an industry co-op created in 1976. Following changes to the *Canada Shipping Act* in 1995 which mandated the use of response organizations, Burrard Clean Operations was transformed into WCMRC and its mandate expanded to serve all shipping and oil handling facilities on the West Coast.

As a member of WCMRC, Trans Mountain maintains an oil handling facility arrangement with WCMRC with respect to the Westridge Marine Terminal operations. Trans Mountain collects the Bulk Oil Cargo fee from pipeline shippers who use the terminal and remits these funds to WCMRC.

In the event of an oil spill in the marine environment on the West Coast of Canada, WCMRC would support the Incident Commander of the emergency response by providing the equipment and resources to clean up the spill (Section 1.4.4).

With respect to the Project, Trans Mountain will continue to work with WCMRC to implement relevant recommendations from the TERMPOL process, any recommendations from the Panel and any mandated improvements to existing emergency preparedness and response measures as necessary to address the effects of the Project-related increase in tanker traffic (Section 5.5.2).

1.4.2.6 Province of British Columbia

The BC Ministry of Environment has an Environmental Emergency Management Program (EEMP) to lead the province's commitment to prevent, prepare for, mitigate, and respond to spills that affect the environment (WCMRC 2012). Spill response plans and operational guidelines are the foundation of the EEMP and the province, through the Ministry of Environment staff, plays a direct role with spills that threaten or impact shorelines. WCMRC's spill response activities and planning are complementary to the ministry's spill response planning. In addition, the ministry staff cooperate on the Regional Environmental Emergency Team (REET), providing expert advice about local sensitivities to WCMRC and the incident commander in the event of an oil spill.

1.4.2.7 Regional Environmental Emergency Team

The REET is a multi-agency, multi-disciplinary group specializing in environmental emergencies. A REET is designed to provide consolidated, locally relevant environmental advice in the event of an environmental emergency such as an oil spill (WCMRC 2012). REET members include federal, provincial, and municipal departments, Aboriginal communities, private sector agencies, and local individuals. Environment Canada and the BC Ministry of Environment co-chair the REET in BC. In the event of an oil spill in a marine environment on the West Coast of BC, the REET would provide advice to WCMRC and the incident commander.

1.4.2.8 Canada-US

As described in Section 1.4.1, Canada and the US jointly manage vessel traffic in the trans-boundary waters in the Juan de Fuca Strait to ensure vessels calling at Canadian and American ports in the Salish Sea region are managed in a manner that avoids collisions and accidents, which could result in an unplanned release of oil or other pollutants into the marine environment.

In addition, Canada, through the CCG, currently cooperates with the US, through the USCG, to ensure there is adequate emergency preparedness and response capability in the event of an oil spill in trans-boundary waters. The CCG and USCG hold joint planning and response exercises in the Juan de Fuca Strait on an annual basis. In the event of an oil spill in Canadian or trans-boundary waters that exceeds the response capacity of the CCG and WCMRC, the USCG could be called on for support.

1.4.2.9 Tanker Owners and Operators

Tanker owners and operators and the authorities of countries where the vessels are registered (ship registering countries are referred to as the vessel's flag state; they are all members of the IMO, as is Canada) are ultimately responsible for the safety of their vessels and the navigation of their vessels within Canadian waters, meeting all applicable regulations, standards, and procedures under the jurisdiction of Transport Canada, and also under PMV while transiting the Burrard Inlet.

All foreign vessels entering Canadian waters must be initially inspected and regugarly on an annual basis by Transport Canada. As well, under the *Canada Shipping Act, 2001*, all tankers must maintain membership for oil spill response support with a certified response organization, which is WCMRC on the BC Coast. Under the *Canada Shipping Act, 2001*, all vessels must maintain a SOPEP pproved by its classification society.

A Classification Society is an organization that establishes and maintains technical standards for the construction and operation of ships. The society validates that construction is according to these technical standards and carries out regular inspections and surveys to ensure compliance with the standards. Often flag states authorise classification societies to certify and inspect the vessels in their registry on their behalf.

In the event of an accident resulting in an oil spill from a vessel in Canadian waters, the master of the tanker, as the responsible party (RP) and in accordance with the law, would notify CCG as per the procedure in the approved SOPEP. As the RP, the tanker's master or a representative of the tanker owner would assume the role of incident commander. If the tanker operator were unable or unwilling to assume the role of incident commander, the role would automatically transfer to the CCG. The designation of incident commander is typically clarified in the SOPEP to avoid confusion. Response in such case would involve the RP activating the

response organization (*i.e.*, WCMRC) mentioned in the prior paragraph to provide the equipment and resources to respond to the oil spill (Section 1.4.4). If the RP does not activate the prior agreed response organization and the CCG determines that response was inadequate or required the response organization to be activated, the CCG is empowered to activate the response organization.

Ultimately, the tanker owner is liable to pay for the costs of emergency response, clean-up, damage to the environment, compensation to affected parties and all other costs related to an oil spill (Section 1.4.1.6) subject to the limits of liability. As the tanker owner reaches its limits of liability, it would then pass to the international and Canadian regime for oil spill compensation as described in Sections 1.4.2 and 5.5.3.

1.4.2.10 Pipeline Shippers

Pipeline shippers are the parties that own the product shipped on the TMPL system. They pay a fee to ship their product from Edmonton, AB, to the Westridge Marine Terminal on the pipeline. Pipeline shippers are also responsible for chartering tankers to call at the Westridge Marine Terminal to transport the product that arrives at the Westridge Marine Terminal.

As directed in Trans Mountain's Tanker Acceptance Standard, pipeline shippers are required to submit a Vessel Proposal Form to Trans Mountain prior to the pipeline shipper's first batch of product leaving from Edmonton, AB, to the Westridge Marine Terminal. Based on the information in the Vessel Proposal Form, and on the history of inspection activities for the vessel, which are maintained on an international database, Trans Mountain has the right to reject any vessel proposed by the pipeline shipper that does not meet the standards and criteria set by the harbour master for PMV, and/or by Trans Mountain.

Pipeline shippers also have their own tanker screening and selection process, which ensures that tankers calling on the Westridge Marine Terminal meet international regulations and Trans Mountain's Tanker Acceptance Standard.

1.4.2.11 Trans Mountain

Trans Mountain is responsible for the safe operation of the Westridge Marine Terminal, ensuring the public, workers, and the environment are protected during the operation, maintenance, and expansion of this facility. While Trans Mountain is not responsible for the operation of the vessels that call at the Westridge Marine Terminal, Trans Mountain continues to play a supporting and influencing role to promote safety in marine transportation. This includes the promotion of navigation and operational safe practices, which help minimize the possibility of navigation accidents that may result in an oil spill. Trans Mountain, directly and through its involvement with WCMRC, supports capacity development for emergency preparedness and response on the West Coast of Canada, where the vessels that call at the Westridge Marine Terminal transit.

As noted in Section 1.4.2.10, Trans Mountain maintains a Tanker Acceptance Standard, which governs the acceptance or rejection of all tankers calling at the Westridge Marine Terminal. Prior to any cargo transfers involving a tanker berthed at the Westridge Marine Terminal, Trans Mountain conducts a two-stage acceptance process.

First, when a tanker is nominated Trans Mountain conducts a pre-screening, reviewing information provided by the pipeline shipper and information available through international

databases. Once Trans Mountain deems the tanker acceptable to call at the Westridge Marine Terminal, the tanker can be scheduled for berthing.

Second, prior to commencing any cargo operation, the tanker is physically inspected by the Trans Mountain loading master to confirm both the information presented in the pre-screening and the condition of the vessel. Any deficiencies noted have to be rectified before cargo loading can commence.

This two-stage process is performed every time a tanker is scheduled to arrive in PMV for the purpose of cargo transfer at the Westridge Marine Terminal. The process is conducted regardless of whether or not the vessel has been accepted at the Westridge Marine Terminal during a previous voyage. However, once accepted, and if the schedule requires, the vessel may berth multiple times during a single voyage to allow cargo to be transferred in separate loadings.

Trans Mountain has the final decision whether a vessel would be accepted or denied to call at the Westridge Marine Terminal.

Trans Mountain is of the view that the current emphasis on navigational safety in the Salish Sea region prevents tanker-vessel collisions and accidents involving tankers that could result in an accidental release of oil from the tanker's hull. Despite the existing highly effective navigational safety measures in place, there remains a low probability that an incident would occur resulting in an oil spill in the marine environment. With respect to ensuring there is the capability to respond to an oil spill in the marine environment and to help mitigate the effects and consequences of such an oil spill, should it occur, Trans Mountain is an active shareholder and member of WCMRC.

As an oil-handling facility member of WCMRC, Trans Mountain collects fees from pipeline shippers and provides those to WCMRC to ensure it continues to be a certified response organization with the capacity to effectively respond to an oil spill in the event one should occur in the marine environment on the West Coast. Annual fees are also collected by WCMRC from other petroleum terminals on the West Coast. With respect to the Project, Trans Mountain will continue to work with WCMRC to implement relevant recommendations from the TERMPOL process, identifying where improvements to existing emergency preparedness and response measures are necessary to address the effects of the Project-related increase in tanker traffic should the Project proceed (Section 5.5.2).

In addition to being a shareholder and member of WCMRC, Trans Mountain has been an active participant in other initiatives to improve navigational safety in the Salish Sea Region:

- Participated in PMV's review of the Harbour Operations Manual including the Second Narrows MRA rules (2004 to 2010). This initiative resulted in a modernization of the Second Narrows MRA rules and the escort techniques used in the harbour. Following this initiative, a similar process was undertaken by the PPA to improve escort requirements for Boundary Pass and Haro Strait.
- Contributed to the expert review of escort techniques in the Salish Sea region (2007).
- Contributed to the logistics for the live trial of escort techniques (2007).
- Contributed to improved pilotage equipment (purchase of PPUs) (2009).

- Supported the joint pilot and tug master training program (2009).
- Supported the improvement of navigational aids for the Second Narrows MRA (2010).
- Contributed to the British Columbia Institute of Technology (BCIT) Marine Simulator upgrade (2011).

Lastly, Trans Mountain has been active in providing input to the Panel that was appointed by the Government of Canada earlier in 2013. A copy of Trans Mountain's submission to the Panel is included in Appendix A (Section 1.4.5). Trans Mountain anticipates that improvements recommended by the Panel that are relevant to tankers calling at the Westridge Marine Terminal would be known and implemented or planned for implementation prior to the Project commencing operation in Q4 2017.

1.4.3 Journey of a Tanker

The following description follows the journey of a tanker to and from the Westridge Marine Terminal, illustrating the current roles, responsibilities and requirements set out in Sections 1.4.1 and 1.4.2 that contribute to navigational safety and thus spill prevention in Canadian waters.

Before coming to Canada, tankers are required to meet high standards of design and construction:

- Tankers are built according to regulations established by the IMO and adopted by their flag state.
- Ship construction and repairs are inspected and documented by a classification society to ensure construction meets these regulations and specifications.
- Tankers are built with double hulls and segregated cargo holds to reduce the possibility of cargo spills and to minimize any potential spill volume, if the tanker were to collide with another vessel or run aground, damaging the structure of the tanker.
- With respect to oil tankers calling at the Westridge Marine Terminal, all oil tankers are of double-hull construction, (*i.e.,* the cargo tanks are protected within the ship's outer hull by an inner steel hull) and have segregated cargo holds. When the tanker is loaded, the space between the outer and inner hulls (*i.e.*, outside boundary of the cargo tanks) is kept empty. TERMPOL 3.9 Ship Specifications in Volume 8C (TR 8C-7) illustrates the general specifications for a double-hulled tanker, including Aframax and Panamax class tankers that would call at the Westridge Marine Terminal.

On an ongoing basis throughout operations, tankers are:

- Inspected by their flag state, by classification societies and by insurers.
- Vetted by charterers and terminals.
- Inspected in other ports of call by inspectors of the respective local national authorities, including those that are signatories to the various international

conventions on port state control (ship inspection programs) to which Canada is also a member.

Upon coming to Canada, tankers are scrutinized to ensure they are compliant with Canadian and Trans Mountain's requirements. These requirements include:

- Vessels proposed by a pipeline shipper to receive oil at the Westridge Marine Terminal are pre-screened by the Trans Mountain loading master using industry databases and the company's own records before being accepted or rejected for scheduling purposes.
- The pipeline shipper arranges for a local shipping agent to assist the vessel with local logistical requirements, interactions with local authorities, check and pass information on the vessel's certificates to the authorities and pay any fees, dues or invoices on behalf of the vessel's owner/operator.
- The *Canada Shipping Act, 2001* requires that a tanker must have an arrangement with a Transport Canada certified response organization (*e.g.*, WCMRC) for spill response services and a SOPEP before entering Canadian waters.
- A tanker must contact the CCG for permission to enter Canadian waters before entry.

Upon arrival in Canadian waters, tankers must follow strict communications and guidance protocols:

- The tanker is only allowed to travel into the Juan de Fuca Strait using the IMO approved traffic separation scheme, which is managed by the Joint Coordinating Group of the Cooperative Vessel Traffic Service (CVTS) between Canada and the US. Traffic Separation Schemes are used worldwide and have been proven to reduce the possibility of collision between vessels by regulating the flow of crossing traffic (Figure 1.3.1).
- The CCG and USCG monitor ship traffic through the shipping lanes in the Salish Sea Region. Four traffic zones are monitored:
  - Tofino traffic (entrance to Juan de Fuca Strait, CCG);
  - Seattle traffic (Juan de Fuca Strait, USCG);
  - Victoria traffic (Salish Sea, CCG); and
  - Vancouver traffic (Vancouver Harbour, CCG).
- The tanker remains in communication with the CCG MCTS and the tanker's position is monitored throughout the transit. It is handed off between traffic zones as it moves from one to the other. A combination of radar, automatic information system and direct radio communication is used to coordinate safe conduct of the vessel with other masters and pilots.

- Empty tankers headed for the Westridge Marine Terminal pick up a PPA certified BCCPA pilot at the Victoria pilot station near Brotchie Ledge (Figure 1.3.1).

- Under the pilot's guidance, and monitored by the MCTS, the ship continues to navigate through the established shipping lanes to PMV. Ships travelling to and from the Westridge Marine Terminal transit the Juan de Fuca Strait, Haro Strait, Boundary Pass, Strait of Georgia and the Burrard Inlet (Figure 1.3.1).

- The established shipping lanes maintain separation between inbound and outbound traffic, which is particularly important in different areas of the Juan de Fuca Strait and Strait of Georgia, where many different types of vessels use the shipping lanes to access the ports and terminals of the Puget Sound, various ferry terminals, Robert's Bank terminal, the mouths of the Fraser River, and the Burrard Inlet/Vancouver Harbour.

Once a tanker enters the jurisdiction of PMV (east of a line south from Point Atkinson in West Vancouver to the US border), a series of additional established operating rules and protocols currently apply. After the Project is in operation, these same practices are expected to apply subject to improvements resulting from the TERMPOL process and from other federal and provincial reviews currently underway:

- PMV rules for conduct of shipping within its jurisdictional area are documented in its Harbour Operations Manual.

- The agent would have requested PMV operations to assign an anchorage for the tanker based on availability and operational requirements. A tanker may anchor at one of the designated locations in English Bay or off the Westridge Marine Terminal, depending on the timing of tides, the Westridge Marine Terminal loading schedule, and the tanker's own requirements for provisioning and maintenance. In some cases, the tanker may proceed directly to berth.

- Pilots leave the tanker when it is at anchor, but are aboard anytime it moves, even if from anchor to the dock and back.

- The tanker is inspected by Transport Canada upon its first arrival in Canada and once per year after that. This might occur at anchor or alongside the Westridge Marine Terminal.

When a tanker berths at the Westridge Marine Terminal:

- The tanker is assisted by docking and mooring tugs are tethered to the tanker at the Westridge Marine Terminal dock.

- The Trans Mountain loading master boards the tanker to conduct a physical inspection and to conduct a ship-shore safety meeting with the master and terminal operators.

- The Westridge Marine Terminal loading facility is operated in accordance with regulations established by the NEB, Transport Canada, and others as required.

- A spill containment boom is deployed to enclose the tanker and terminal. A second boom is on-hand as a back-up in case of an emergency. WCMRC moors a skimming vessel at Trans Mountain's utility dock west of the loading dock.

- Loading arms and vapour recovery lines are connected to the tanker. The Westridge Marine Terminal vapour destruction system is started and loading commences. Loading typically takes 24 to 36 hours depending on the size of the vessel.

- The Loading Master stays aboard the tanker throughout the loading process. The Trans Mountain loading master has the authority to request the vessel to rectify any issues that might develop during the vessel's stay and to stop the loading process at any time should concerns arise. The Loading Master also acts as the key shipside contact for communication with the terminal.

- Terminal operating procedures include an emergency response plan (Volume 7A). Terminal staff are trained in emergency response and regular exercises are held to practice these procedures.

- In addition to Trans Mountain's own spill response equipment and as required by Transport Canada, Trans Mountain has an arrangement with WCMRC for marine spill response services. WCMRC has spill response equipment staged on the water in Vancouver Harbour and a main base of operations very close to the Westridge Marine Terminal in Burnaby. Similarly, WCMRC maintains equipment caches on Vancouver Island for response in the Salish Sea.

When a tanker loading is complete and the vessel departs:

- The Loading Master stays on board until pilots come to move the vessel away from the dock.

- After the tugs are made fast, the tanker is cast off and typically goes to anchorage to wait for tide for the Second Narrows transit, as required by PMV's Harbour Operations Manual.

- Two PPA certified pilots come aboard to ensure the tanker safely navigates out of Canadian waters. The PPA requires laden tankers to have two PPA-certified pilots on board, one to ensure safe conduct of the vessel and one to monitor the bridge crew and ship systems. During the passage the two pilots would switch roles as part of an overall fatigue management process.

- PMV's Harbour Operations Manual defines the Second Narrows MRA and the rules for MRA transit, including daylight transit, size restrictions, required tug escorts, and speed restrictions. Only one vessel at a time is allowed in the Second Narrows MRA and First Narrows. The MCTS monitors the tankers' progress and other vessels' traffic in the Vancouver Harbour.

- Before the transit begins, MCTS declares a clear narrows and the CN Railway is contacted to raise their rail bridge, which spans the Second Narrows.

- PMV's rules require that two large tugs be tethered to the stern and at least one tug to the bow for the Second Narrows MRA transit. The two large tugs tethered to the stern are required for the transit through the remainder of Vancouver Harbour.

- After clearing the First Narrows, the escort tugs fall away and the tanker transits without escort until it approaches the East Point on Saturna Island.

- The PPA has established escort requirements for the Salish Sea region, in particular in Haro Strait through Boundary Pass. The PPA requires a single large tug to tether to the tanker 1.7 NM before East Point and remain tethered until Victoria. The tug remains in untethered escort until the tanker passes Race Rocks.

- The two PPA-certified pilots disembark at the Victoria pilot station near Brotchie Ledge.

- The tug leaves the tanker at Race Rocks as the tanker enters the Juan de Fuca Strait.

- No pilotage or escort is required through the Juan de Fuca Strait; however, as with all inbound traffic, the tanker and all other traffic are monitored by the MCTS.

- US industries fund a rescue tug at Neah Bay, Washington, to assist any vessels in distress in the Juan de Fuca Strait.

- Upon clearing the Juan de Fuca Strait, the tanker continues to its destination.

Figure 1.3.1 illustrates the separated shipping lanes used by tankers transiting to and from Westridge Marine Terminal.

1.4.4 Canada's Marine Oil Spill Preparedness and Response Regime

The initial procedures to respond to an oil spill in the marine environment are set out in the tanker's Ship Oil Pollution Emergency Plan and in the response organization's OSRP. These follow the principles of the ICS model. ICS is a management system used for the command, control and coordination of emergency response efforts. ICS provides the organizational structure for incident management, clearly identifying the roles and responsibilities for parties involved in emergency response, and it also provides the process for planning, building, and adopting the system.

All tankers are required to have a contract for spill response services in place with WCMRC before entering Canadian waters. In the event of a spill the tanker owner is the party responsible for initiating and directing the response efforts with guidance and assistance from WCMRC. CCG is the federal monitoring agency that oversees the response efforts and is empower to take over and lead response efforts in the event that the tanker owner is unable. Liability; however remains with the tanker owner as required under the MLA (section 1.4.1.6). Environment Canada is the federal agency designated to monitor and advise on environmental priorities. The British Columbia Ministry of Environment has regulatory authority for shorelines. Under ICS a Unified Command would be established to allow affected municipalities, Aboriginal groups, and other agencies to participate in leadership of the response.

1.4.5 Federal and Provincial Initiatives

1.4.5.1 Federal Tanker Safety Expert Panel

On March 18, 2013, the Government of Canada announced a number of measures toward the creation of a "World-Class Tanker Safety System" (Transport Canada 2013a). The new measures include:

- The number of inspections will increase to ensure that all foreign tankers are inspected on their first visit to Canadian waters, and annually thereafter, to ensure they comply with applicable rules and regulations, especially with respect to double hulls.
- An expanded national aerial surveillance program designed to monitor shipping traffic and detect oil spills.
- The establishment of a new CCG Incident Command System (ICS) to integrate its operations with key partners (Section 1.4.4).
- A review of the existing tanker escorting system.
- More ports designated for traffic control.
- Scientific research: the Government of Canada will conduct scientific research on non-conventional petroleum products, such as diluted bitumen, to enhance the understanding of these substances and how they behave when spilled in the marine environment.
- New and modified navigational aids: the CCG will ensure that a system of aids to navigation comprised of buoys, lights and other devices to warn of obstructions and to mark the location of preferred shipping routes is installed and maintained. The CCG will also develop options for enhancing Canada's current navigation system by fall 2013 for consideration by the Government of Canada.
- The establishment of a tanker safety panel.

The Panel was appointed in spring 2013 and is in the process of conducting an evidence-based review and assessment of Canada's tanker safety regime to make recommendations to the Government of Canada on the development of a world-class system. Specifically, the Panel is assessing the regime's structure, functionality, and its overall efficiency and effectiveness.

The Panel's review will have two components. The first component will focus on the system currently in place south of 60° north latitude, while the second component will focus on the requirements needed for the Arctic as well as a national review of the requirements for hazardous and noxious substances, including liquefied natural gas (Transport Canada 2013e).

In particular, the Panel will focus on three questions (Transport Canada 2013e):

- Is the current regulated response capacity of 10,000 tonnes a world-class standard and what would be the costs and benefits of changing this requirement?

- How effective is the current regime's structure, including the private-public model, funding and fee arrangements, and placement of response assets?

- Is there a need to expand the current system to other substances and create a cost-effective preparedness and response system in the north?

To date, Trans Mountain has provided input to the panel on June 21, 2013 (Appendix A, Trans Mountain Submission to the Federal Tanker Safety Expert Panel). Trans Mountain's recommendations in its June 21, 2013 submission to the panel are integrated into Sections 5.4.2 and 5.5.2. In parallel to the panel's assessment of Canada's tanker safety regime, Trans Mountain continues to work with WCMRC to identify improvements to WCMRC's existing capacity for emergency response to an oil spill from a tanker (Section 5.5.2).

1.4.5.2 Senate Standing Committee on Energy, the Environment and Natural Resources Report

Trans Mountain has reviewed the Senate Standing Committee on Energy, the Environment and Natural Resources Report released on August 22, 2013 and concurs with the recommendations included therein related to pipeline and tanker safety. In particular, Trans Mountain is supportive of the following recommendations:

- The Transportation Safety Board should expand and modernize its database to provide detailed information on ship-sourced spills, including the type of ship and the volume and type of product released.

- The current spill preparedness and response capacity of 10,000 tonnes within prescribed time frames should be increased to fit the assessed needs of each region as determined by Transport Canada.

- The federal government should provide umbrella protection to Canadian marine response organizations for all non-ship source spills including marine spills from pipelines, trains and trucks.

- The CCG's mandated spill preparedness and response capabilities should be certified by Transport Canada or an independent, third-party agency periodically.

- In certain areas and under specified circumstances, certified marine response organizations should be pre-approved to use dispersant, initiate controlled burning and take other prescribed counter-measures to control and clean-up an oil spill when they would result in a net environmental benefit.

1.4.5.3 BC Provincial Initiatives

In light of the different proposals to transport crude oil from the West Coast of BC, the Government of BC released a policy paper titled Requirements for British Columbia to Consider Support for Heavy Oil Pipelines (Government of British Columbia 2012). The document outlines five minimum conditions that would need to be met for the Government of British Columbia to consider supporting a proposed heavy oil pipeline. The document also outlines a number of recommendations the Government of British Columbia advances to improve marine spill preparedness and response systems in the province (Government of British Columbia 2012). Trans Mountain's views on provincial initiatives are discussed in detail in Volume 1.

2.0 DESCRIPTION OF MARINE TRANSPORTATION ACTIVITIES

2.1 Existing Marine Transportation

2.1.1 Existing Traffic Routes

The marine traffic network considered within Volume 8A is located on the West Coast of BC. Existing traffic calling at the Westridge Marine Terminal in this marine network will encounter other vessels and navigational features such as pilot boarding stations, restricted channels, channel bends, and marine traffic crossings. The vessels will also need to be aware of other activities occurring in these areas, such as military operations, exploratory work, seaplane activities, commercial fisheries, and recreational activities.

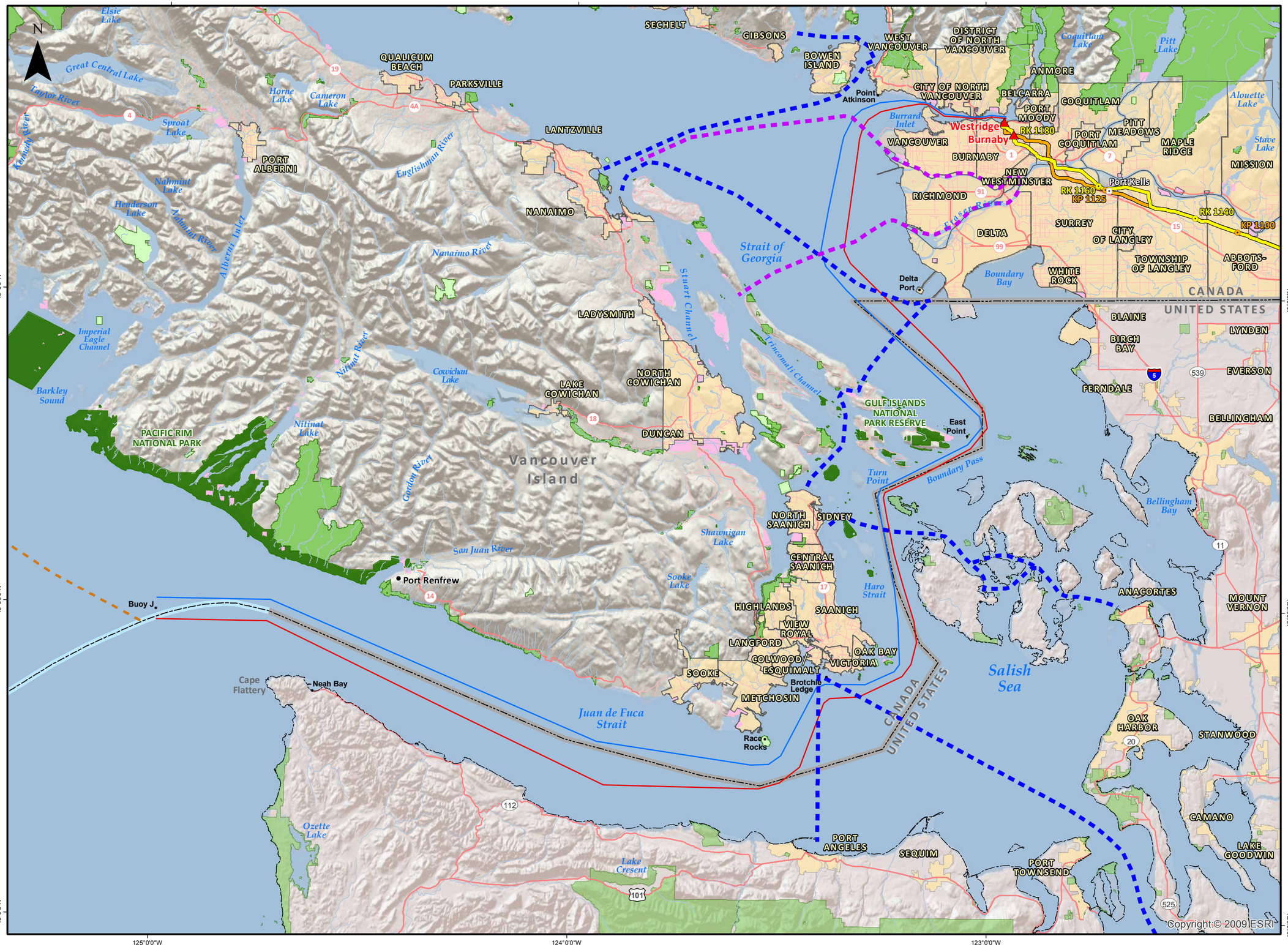
There are about 475,000 vessel movements per year on the West Coast, and tankers accounted for about 1,500 movements (0.3 per cent) in 2009 to 2010 (Transport Canada 2013h). Oil tankers have been moving safely and regularly along Canada's West Coast since the 1930s (Transport Canada 2013h). Oil is moved mostly via the ports of Vancouver, Prince Rupert and Kitimat. Transport Canada records show that in 2009, about 8.4 million tonnes of oil were shipped out of Vancouver (Transport Canada 2013h). Much of this oil is transported in barges to and from communities along the West Coast. Varying quantities of oil are also carried on board container ships, domestic and international ferries, and other types of commercial and private vessels, primarily as fuel (Transport Canada 2013h).

The major traffic route between the PMV area and the Pacific Ocean is an established shipping route for all types of vessels. The route transits the Salish Sea region, which includes the Vancouver Harbour, the Strait of Georgia, Boundary Pass, Haro Strait, and the Juan de Fuca Strait. Project-related marine traffic will continue to use these established shipping lanes inbound and outbound to and from the Westridge Marine Terminal (the Route), as shown on Figure 1.3.1.

The Route has many established traffic crossing locations due to ferry traffic and commercial traffic. Of particular note are six main passenger ferry routes transiting between the mainland and the islands (*i.e.,* the Gulf Islands, the San Juan Islands, and Vancouver Island). Five of these routes directly cross the Route to and from Vancouver Harbour. Ferry vessels do not have pilots but have crews that are familiar with the various waterways and all ferries are monitored by Vessel Traffic Services (VTS). The major ferry routes are outlined below:

- Victoria, BC - Port Angeles, WA;
- Victoria, BC - Seattle, WA;
- Sidney, BC - Anacortes, WA;
- Swartz Bay, BC - Tsawwassen, BC;
- Duke Point, BC - Tsawwassen, BC; and
- Horseshoe Bay, BC - Departure Bay, BC.

There are two main commercial traffic routes that cross the Route at the North and South Arm of the Fraser River. This commercial traffic is primarily barge traffic. Figure 2.1.1 shows in greater detail the other transit routes intersected by vessels calling at the Westridge Marine Terminal.



TRANS MOUNTAIN

FIGURE 2.1.1

TRANSIT ROUTES INTERSECTED BY WESTRIDGE MARINE TERMINAL VESSELS

TRANS MOUNTAIN EXPANSION PROJECT

- Reference Kilometre Post (RK)
- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Terminal
- Existing Pump Station
- Highway
- Road
- 12 Nautical Mile Limit (Territorial Sea)
- Ferry Traffic Route
- Commercial Traffic Route
- Limit of Exclusive Economic Zone (EEZ)
- International Boundary
- Marine Vessel Outbound Shipping Lane
- Marine Vessel Inbound Shipping Lane
- Traffic Separation Scheme
- City / Town / District Municipality
- Indian Reserve / Métis Settlement
- National Park
- Provincial / State Park
- Protected Area/Natural Area/ Provincial Recreation Area/Wilderness Provincial Park/Conservancy Area

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Projection: UTM Zone 10N.
Routing: Baseline TMPL & Facilities: provided by KMC, 2012; Proposed Pipeline Corridor V6: provided by UPI, Aug. 23, 2013; Facilities: provided by KMC, 2012; Transportation: BC Forests, Lands and Natural Resource Operations, 2012 & ESRI, 2005; Geopolitical Boundaries: IHS Inc., 2011, BC FLNRO, 2007 & ESRI, 2005, Natural Resources Canada, 2012; First Nation Lands: Government of Canada, 2013 & IHS Inc., 2011; Hydrology: IHS Inc., 2004, United States National Imagery and Mapping Agency, 2000, Natural Resouces Canada, 2010; Parks and Protected Areas: Natural Resources Canada, 2013, BC FLNRO, 2008; CHS: provided by KMC, 2013; Marine Shipping Lanes & Traffic Routes: Moffatt and Nichol, 2013; Hillshade: TERA, derived from Geobase; US Hillshade: ESRI, 2009.

tera ENVIRONMENTAL CONSULTANTS

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

MAP NUMBER		PAGE
201310_MAP_TERA_MR_00468_REV0		SHEET 1 OF 1
DATE	TERA REF.	REVISION
December 2013	7894	0
SCALE	PAGE SIZE	DISCIPLINE
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2.1.2 Marine Vessel Types and Design

There are a variety of vessel types that currently transit the West Coast. These different vessel types are described in Table 2.1.1. Pictures of each vessel type are provided in Appendix B (Marine Vessel Types).

TABLE 2.1.1

DESCRIPTION OF MARINE VESSELS TRANSITING PMV

Vessel Type	Purpose
General cargo vessels	• Carry a variety of goods such as machinery, forest products, vehicles, food, etc. • General cargo vessels in PMV import construction tools and materials such as rebar, heavy machinery, steel, and pipes, and export logs, lumber, wood pulp, and paper for example.
Dry-bulk cargo vessels (bulk carriers)	• Carry loose commodity materials such as coal, grain or ore. • Vessels are segmented into large holding bins to store various materials. • PMV primarily imports sugar and exports coal, grain, sulphur and potash.
Container cargo vessels	• Carry steel box containers designed to integrate with onshore semi-trucks. • Containers carry a wide variety of consumer goods. • PMV primarily imports household goods (electronics and clothing) and exports lumber and specialty crops such as peas and chickpeas.
Tankers	• Designed to carry a variety of liquid bulk materials including crude and refined petroleum oil, liquefied petroleum gas, ammonia, chlorine, fresh water, etc. • Carry a single type of cargo. • Transit is governed by unique requirements and restrictions depending on the area.
Tugs	• Smaller vessels designed to aid in the manoeuvrability of ships or to tow or push various materials. • Account of the majority of traffic movements on the coast of BC. • Capable of towing materials such as logs, barges, containers, dry bulk cargo, oil, etc.
Passenger vessels and pleasure craft	• Vessels or cruise ships designed to carry passengers for recreational voyages. Does not include commercial passenger ferries (see below). • Seasonal vessels typically used in the summer months. • Pleasure craft are specifically less than 30 m in length.
Government vessels and warships	• Include CCG vessels, government survey ships, larger frigates and destroyers.
Commercial passenger ferries	• Major contributor to traffic movement on the West Coast of BC and Washington State. • Six major ferry providers operate year-round with an increase in vessel sailings in the summer months. • Smaller ferry providers operate as a recreational service in the summer months.
Floatplanes	• Activity occurs primarily in the Vancouver Harbour Aerodrome, which is the 34th busiest in Canada (Statistics Canada 2012).
Commercial fishing vessels	• Three types of commercial fishing vessels: purse seine, gillnet, and troll. • Purse seine are the largest commercial fishing vessel and use a large hydraulic boom and a take-up drum mounted aft to pick up the net. • Gillnets are smaller commercial fishing vessels that extend nets designed to entangle fish. Fish are then removed as the net is hauled on board by a drum. These nets can extend as much as 550 m behind the vessel at 10 m depth. • Trollers fit long lines with leaders and lures that are paid out and trolled behind the vessel.

Source: PMV 2012

Within PMV, bulk carriers are the largest component of cargo traffic, making up 68 per cent of total cargo tonnage in 2012 (PMV 2012a).

Ships are subject to compulsory pilotage if the vessel is over 350 gross tonnes for non-pleasure craft vessels and over 500 gross tonnes for pleasure craft vessels. Compulsory pilotage does not apply to government vessels, ferries, or US government ships under 10,000 gross tonnes (Government of Canada 2009). The PPA licenses competent pilots to ensure safe, reliable, and efficient marine pilotage (Section 1.4.2.3). Licensed pilots are employed by the BCCPA.

MCTS communicates with vessels operating in Canadian waters and provides Vessel Traffic Service (VTS) to ensure navigational safety. Ships required to participate in VTS are 20 m or more in length, ships engaged in towing or pushing any vessel, combined length of the ship and any vessel or object towed or pushed by the ship is 45 m or more in length, or the length of the vessel or object being towed or pushed by the ship is 20 m or more in length. Exceptions to ships required to participate in VTS are towing or pushing inside a log booming grounds, pleasure yacht less than 30 m in length, fishing vessels that are less than 24 m in length and not more than 150 tonnes gross (CCG 2013a).

2.1.3 Existing Marine Traffic at Westridge Marine Terminal

The existing Trans Mountain Westridge Marine Terminal is located in the eastern portion of Burrard Inlet and to the east of the Second Narrows. Figure 2.1.2 shows the location of the Westridge Marine Terminal in relation to neighbouring terminals and anchorages within the Burrard Inlet.

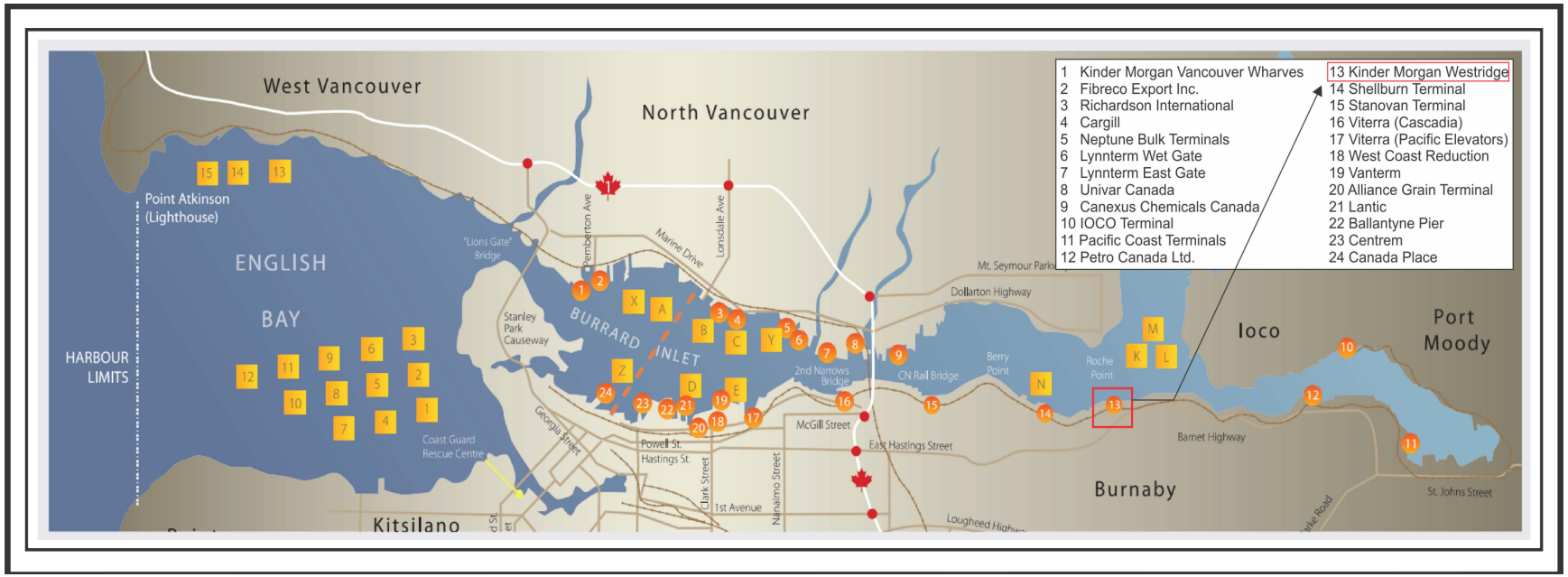
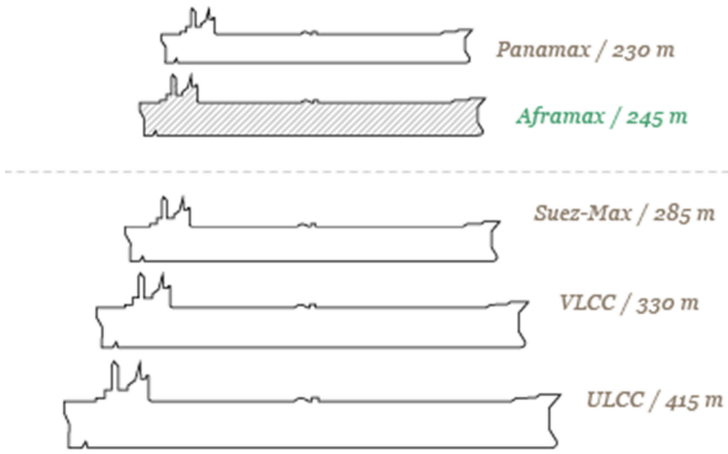


Figure 2.1.2 Location of Westridge Marine Terminal within Burrard Inlet

The size of tankers calling at the Westridge Marine Terminal is the Panamax (less than 75,000 metric tonnes DWT) or Aframax (75,000 to 120,000 metric tonnes DWT) class of vessel, the Aframax vessel being the larger of the two. Some Aframax tankers have a volumetric capacity of approximately 130,000 m^3 (or 820,000 barrels). All tankers calling Westridge Marine Terminal are constructed to meet global and Canadian standards for safety and pollution prevention, including double hull design and construction. TERMPOL 3.9 Ship Specifications in Volume 8C (TR 8C-7) provides additional information about the class of tankers calling at the Westridge Marine Terminal.

Figure 2.1.3 shows the different classes of tankers by size used throughout the world (http://www.transmountain.com/marine-plans).



Source: http://www.transmountain.com/marine-plans

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FIGURE 2.1.3
OIL TANKER CLASSES AND SIZES

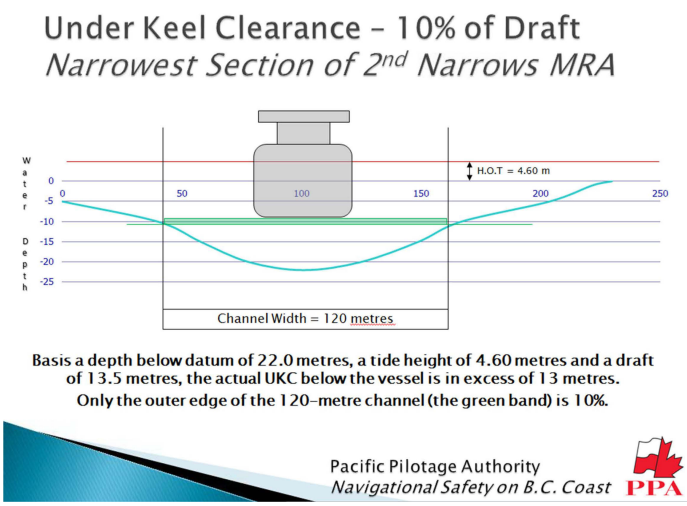
Figure 2.1.3 Oil Tanker Classes and Sizes

2.1.4 Considerations within the Second Narrows Marine Restricted Area

Restrictions on tanker movements to and from the Westridge Marine Terminal are stated in PMV's Harbour Operations Manual Second Narrows MRA Regulations. The maximum immersed depth (*i.e.,* draft) for vessels transiting the Second Narrows is limited by PMV's MRA rules to 13.5 m. In practice the allowable draft is currently limited to 13.0 m by the PPA as part of a phased implementation of the MRA rules following their revision in 2010 (PPA 2013a). It is reasonable to expect that the phased implementation will be complete by the time the Project comes into service and the 13.5 m limit will be in effect.

The MRA rules define the allowable beam (*i.e.,* width) and draft (*i.e.,* depth) of tankers in relation with the channel. Tankers have to maintain an under keel clearance of 10 per cent over a channel width of 2.85 times the vessel's beam and are restricted to daylight transit. Since the center of the channel is relatively deep in comparison to the vessel's draft it is typically the width

of the channel that determines the allowable draft and therefore the extent to which a tanker can be loaded. Figure 2.1.4 provides an illustration of the 10 per cent under keel clearance requirement (Obermeyer pers. comm.). Additional information on under keel clearance is provided in TERMPOL 3.6 Special Underkeel Clearance Survey in Volume 8C (TR 8C-4).



Source: Obermeyer pers. comm.

Note: This cross section represents the narrowest portion of the Second Narrows MRA passage.

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KINDER MORGAN CANADA

FIGURE 2.1.4
10 PER CENT UNDER KEEL CLEARANCE REQUIREMENT

Figure 2.1.4 10 Per Cent Under Keel Clearance Requirement

Since channel width varies with tidal height so then does the extent to which tankers can be loaded. Occasionally, under the largest high tides, Aframax tankers can load up to about 90,000 tonnes (approximately 80 per cent DWT capacity) of cargo and based on the average density of heavy crude oil loaded at Westridge Marine Terminal this is equivalent to about 98,000 m^3 (615,000 bbls). However, over the tidal cycle the average cargo loaded would be about 550,000 bbls (equivalent to about 70 per cent DWT capacity). The effect of the draft restrictions on cargo capacity were taken into consideration by Trans Mountain when estimating the extent of tanker traffic that might result from the Project. This estimate was used in the quantitative risk assessment (TERMPOL 3-15, Volume 8C-12) of an oil spill occurring from one of these tankers.

2.2 Project-Related Changes to Marine Transportation and Traffic Volumes

2.2.1 Vessel Type and Marine Traffic Volume

As a result of the Project, marine traffic volume calling at the Westridge Marine Terminal will increase. The types of vessels calling at the Westridge Marine Terminal (*i.e.*, barges, Panamax and Aframax size tankers) will not change as a result of the Project. As well, the vessels calling at the Westridge Marine Terminal after the Project is in operation will continue to use the existing marine transportation routes depicted in Figure 1.3.1.

The existing Westridge Marine Terminal typically loads five tankers and two or three barges per month. With approval of the Project only the number of tankers is expected to increase with the typical number of tanker loadings increasing to up 34 per month. In practice several factors will affect the actual number of tankers loaded monthly.

The design capacity of the dock includes an allowance for spot capacity, the use of which will vary with market conditions. If the spot capacity is not used the number of vessels will be lower. Through an "open season" process shippers have contracted with Trans Mountain for the majority of the 141,500 m^3/d (890,000 bbl/d) capacity of the expanded system and have indicated Westridge Marine Terminal as the preferred destination for up to 93,500 m^3/d (588,000 bbl/d). In addition to this firm capacity the Project includes an allowance for up to 6,700 m^3/d (42,000 bbl/d) of spot capacity for a total of up to 100,200 m^3/d (630,000 bbl/d). The actual deliveries of firm and spot volumes will be driven by market conditions and shippers will have the ability to redirect contracted volumes from Westridge to Puget Sound.

The number of vessels required to lift the delivered capacity depends on vessel size. Trans Mountain does not nominate, own, or operate the tankers that call Westridge Marine Terminal. Trans Mountain believes that the large majority of tankers nominated by shippers will be of the Aframax class, the largest size currently allowed by PMV, as these vessels will allow shippers the greatest economies of scale. The estimate of 34 tanker loadings per month is based on an all Aframax class case. However, the number could also be influenced by the substitution, by shippers, of some Panamax class tankers, which have less capacity than Aframax class tankers. If substitution occurs, there may be a slight increase in the number of loadings. Trans Mountain has calculated that a 25 per cent Panamax class substitution could add two or three loadings per month. These vessels and their characteristics are described in TERMPOL 3.9 in Volume 8C (TR 8C-7).

As described in Section 2.1.4, due to Second Narrows MRA restrictions, the extent of loading is determined by tidal height and varies with the tidal cycle. The number of vessels required will increase during periods of lower high tides and decrease during periods of higher high tides. Similarly draft is also affected by product density, which varies between petroleum types. There is also a general trend within the tanker industry to higher capacity tankers (within each class) and tankers carrying "light" synthetic crude oil will be able to load more cargo on a volumetric basis than those carrying "heavy" crude oil.

The maximum cargo loadable on a tanker is, therefore, subject to a combination of many factors, including the individual tanker's dimensions (*i.e.,* cargo capacity, draft, and breadth), the cargo density, and tidal cycle. While substitutions by Panamax class tankers would have the tendency to slightly increase the number of loadings, that tendency would be offset by fluctuations in demand and greater cargo volumes per tanker as a result of the combination of factors discussed. As a result of these factors, Trans Mountain believes that 34 Aframax tanker loadings per month is a reasonable estimate for purpose of assessing Project-related effects (Table 2.2.1).

TABLE 2.2.1

EXISTING AND FUTURE MARINE TRAFFIC AT WESTRIDGE MARINE TERMINAL

Vessel type	Existing (monthly average)	Predicted 2018 (monthly average)*	Predicted Increase
Tanker loading	5	34	+29
Barge (crude oil) loading	2 to 3	2 to 3	0
Barge (jet fuel) discharge	1 to 2	1 to 2	0

Note: * Based on Aframax tankers

The number of barges calling at the Westridge Marine Terminal is not expected to change as a result of the Project. Tables 2.2.2 and 2.2.3 show the Project-related increase in marine traffic in the context of predicted marine traffic volume within the Burrard Inlet and within the Juan de Fuca Strait (*i.e.*, including traffic to and from US ports).

TABLE 2.2.2

SUMMARY OF AVERAGE MONTHLY LARGE VESSEL MOVEMENTS WITHIN BURRARD INLET

Vessel Type	2012 (monthly average)	Predicted 2018 (monthly average)	Predicted Increase in Vessel Movements (2012 to 2018)	Per Cent of Each Vessel Type (2012)	Per Cent of Each Vessel Type (2018)
Cargo Vessels	264	278	14	78.6	67.0
Passenger Vessels (including ferries)	40	42	2	11.8	10.1
Tankers (not Project-related)	22	27	5	6.5	6.5
Tankers (Project-related)	10	68	58	3.0	16.4
All Large Vessels (Total)	336	414	78		

Source: Extrapolated from TERMPOL 3.2 in Volume 8C (TR 8C-2); information is based on inbound and outbound vessel movements

Within the Burrard Inlet, Trans Mountain predicts the Project-related increase in marine traffic will represent 16.4 per cent of total marine traffic volume, compared to the current 3.0 per cent. Within the Juan de Fuca Strait, Trans Mountain predicts the Project-related increase in marine traffic will represent 6.6 per cent of total marine traffic volume, compared to 1.1 per cent currently.

TABLE 2.2.3

SUMMARY OF AVERAGE MONTHLY LARGE VESSEL MOVEMENTS WITHIN THE JUAN DE FUCA STRAIT

Vessel type	2012 (monthly average)	Predicted 2018 (monthly average)	Predicted Increase in Vessel Movements (2012 to 2018)	Per Cent of Each Vessel Type (2012)	Per Cent of Each Vessel Type (2018)
Cargo Vessels	641	674	33	69.7	65.5
Passenger Vessels (including ferries)	179	188	9	19.4	18.3
Tankers (not Project-related)	90	99	9	9.8	9.6
Tankers (Project related)	10	68	58	1.1	6.6
All Large Vessels (Total)	920	1,029	109		

Source: Extrapolated from TERMPOL 3.2 in Volume 8C (TR 8C-2); information is based on inbound and outbound vessel movements

Existing marine traffic for the Salish Sea region was assessed based on Automated Information System (AIS) data and other vessel traffic information for 2012. Using a combination of economic forecasting, regional project announcements, and interviews, the amount of future traffic has been forecast for 2018, 2020, 2025, and 2030. These projected traffic volumes were used in TERMPOL 3.15 (Volume 8C, TR 8C-12) to estimate the probability of spills both with and without the proposed TMEP traffic for the years 2018 and 2028. The former is expected to be the first full year of service for TMEP; the latter is used to assess the effect of additional traffic growth on risk after 10 years of operation. The forecast is used to assess the effect of TMEP-related increased in marine traffic on other users of the waterways and vice versa. The traffic study is discussed in detail in TERMPOL 3.2 (Volume 8C, TR 8C-2).

The effect of increased tanker movements on other waterway users particularly at the Second Narrows MRA has been assessed and is expected to be minimal. This is because movement restrictions at the Second Narrows are more stringent for tankers, especially Aframax vessels, than for non-tankers and vessels of lesser size. These other vessels have significantly more opportunities to transit the Second Narrows MRA during each tidal cycle either before or immediately after laden tankers have passed. Furthermore, non-tankers are allowed to transit the Second Narrows MRA at night and avail of those tides as well. Un-laden tankers will also have a large number of transit opportunities.

The effect of increased tanker movements on anchorages was also assessed. It was concluded that the four existing anchorages are sufficient to meet the needs of the TMEP-related marine traffic as well as all other terminals east of Second Narrows MRA for the foreseeable future.

These assessments are described in TERMPOL 3.7 (Volume 8C, TR 8C-5), which also includes information that can be used by PMV and PPA to refine vessel traffic management plans including the management of Indian Arm anchorages if necessary.

2.2.2 Alternatives Considered

Although Trans Mountain does not have legal responsibility or authority over management of marine transportation related to the Project, Trans Mountain has played an influencing role with respect to the consideration of alternatives related to marine transportation and the Project,

engaging the public, Aboriginal communities, and regulatory authorities. The consideration of alternatives in this section was based on qualitative discussion, not a quantitative analysis.

Through its consultation activities, Trans Mountain identified one area for consideration of alternatives related to marine transportation and the Project: the class of tanker.

Currently, Aframax and Panamax class of tankers call at Westridge Marine Terminal to transport oil. The Aframax class of tanker is the largest size that is allowed into PMV. As well, the height of the Second Narrows Bridge poses a restriction and the Aframax class of tankers is the largest size tanker that could move through the Second Narrows MRA.

If vessels smaller than the Aframax or Panamax class of tanker were used as a result of the Project, the increase in volume of the product to be transported would require more tankers and thus, more tanker movements, as compared to using the Aframax or Panamax class of tanker. In addition, Trans Mountain identified the following effects from using smaller tankers *vs.* Aframax or Panamax classes of tankers as a result of discussions with stakeholders and its own qualitative assessment:

- More tanker movements related to the use of smaller vessels would mean the probability of an oil spill would increase; however, there would be a decrease in the size of a potential oil spill as the smaller vessel would carry less oil cargo.
- The number of movements through the Second Narrows MRA would increase, creating more pressure on PMV and other users of this waterway in PMV, such as the CN rail bridge, to manage the increase in transportation and anchorages.
- Due to economies of scale, the cost of shipping multiple smaller loads may be less economic over long distances where larger vessels have typically been used to reduce the per barrel freight cost of oil. The increase in freight rates combined with smaller cargo size would result in an increased cost of transportation on a per-barrel-of-oil basis, affecting the total delivered cost of Canadian oil in overseas markets.

Based on these considerations, Trans Mountain concluded that using a majority of Aframax with some Panamax size tankers as opposed to smaller tankers would strike an acceptable balance between the frequency of tanker movements, the increased management of marine transportation as a result of the Project, and probability of an oil spill from an oil tanker in transit from the Westridge Marine Terminal.

Alternatives related to the tanker shipping lanes and traffic patterns were not considered as the shipping lanes established in the Salish Sea region have proven effective at safely managing the existing volumes of marine traffic in this region.

3.0 PUBLIC CONSULTATION AND ABORIGINAL ENGAGEMENT

Trans Mountain has implemented and continues to conduct open, extensive and thorough public consultation and Aboriginal engagement programs. These programs were designed to reflect the unique nature of the TMEP as well as the diverse and varied communities along the proposed pipeline and marine corridors. These programs were based on Aboriginal community and stakeholder group interests and inputs, knowledge levels, time and preferred method of engagement. In order to build relationships for the long-term, these programs were based on the principles of accountability, communication, local focus, mutual benefit, relationship building, respect, responsiveness, shared process, sustainability, timeliness, and transparency.

This section provides a summary of the design of the stakeholder engagement (Section 3.1) and Aboriginal engagement (Section 3.2) programs, as well as outcomes specific to the marine transportation elements considered in the ESA (Section 4.0). The full description of the Public Consultation and Aboriginal Engagement programs are located in Volumes 3A and 3B, respectively. The outcomes of the consultation and engagement activities for the pipeline and facilities component of the Project are located in other volumes of the application. Table 3.1 provides information on where other consultation and engagement considerations are located.

TABLE 3.1

CONSULTATION INFORMATION LOCATION

Consultation Information	Application Location
Pipeline and Facilities	
Public Consultation	Volume 3A Section 3.1 of Volume 5A Section 3.1 of Volume 5B
Aboriginal Engagement	Volume 3B Section 3.2 of Volume 5A Section 3.2 of Volume 5B
Landowner Relations	Volume 3C Section 3.3 of Volume 5A Section 3.3 of Volume 5B
Marine Transportation	
Public Consultation	Volume 3A Volume 8A (Sections 3.1 and 3.2)
Aboriginal Engagement	Volume 3B Volume 8A (Section 3.3)

3.1 Public Consultation

The principles of the stakeholder engagement program are based on public input as well as various stakeholder groups' interests, knowledge levels, time and preferred method of engagement. This subsection provides information on the stakeholder engagement program for the marine transportation aspects of the Project and describes how stakeholder and public comments relating to the Marine Transportation ESA were gathered as well as how these comments have been incorporated into the application.

3.1.1 Design of Marine Public Consultation Program

In consideration of the potential effects to the marine environment from the proposed increase in tanker traffic as a result of the Project, Trans Mountain extended the stakeholder engagement program to include coastal communities, beyond the pipeline terminus at Westridge Marine Terminal (Burnaby, BC). In recognition of this and the high level of stakeholder interest in marine shipments of petroleum products, Trans Mountain has engaged communities on Vancouver Island and the Gulf Islands along established marine shipping corridors transited by oil tanker traffic, as well as communities in and around PMV. Engagement with these communities has broadly discussed the greater terrestrial (pipeline) Project effects, but more specifically in this coastal region, consultation efforts have focused on maritime matters related to the proposed increase in Project-related marine vessel traffic and the expansion of the Westridge Marine Terminal.

The Project team received feedback from public open houses, workshops, one-on-one meetings, public presentations, online discussion and comment forms that have helped shape aspects of the Project. Key topics and issues are relayed to the appropriate Project team representative to be considered and incorporated in the application where applicable. For more information on feedback from all engagement refer to Volume 3A. Overall, engagement activities have provided feedback on the following:

- determining the scope and nature of the ESA;
- identifying potential mitigation measures to reduce environmental and socio-economic effects; and
- identifying potential local or regional benefits associated with the Project.

The stakeholder engagement program is designed to foster input from the public who have an interest in the marine aspects of the Project. The program also sought meaningful consultation with stakeholders regarding the Project; environmental effects; and socio-economic effects and benefits. The stakeholder engagement program also shared timely information with stakeholders to keep them informed throughout the process. Through a preliminary evaluation, stakeholder groups that were identified to have a potential interest in the marine aspects of the Project have been identified in the Table 3.1.1.

TABLE 3.1.1

INDENTIFIED STAKEHOLDER GROUPS FOR VICINITY OF MARINE SHIPPING LANES

Stakeholder Type	Stakeholder Type Sub-Categories
Government Authorities	• Government of Canada (federal agencies) • Government of BC • municipal governments • regional governments • Transit Authority
Environmental Non-Governmental Organizations (ENGOs)	• local stewardship groups in Burrard Inlet and coastal communities • provincial and Canadian (nationwide) groups with particular interests in marine-related biodiversity, marine protected areas and / or groups with interests in the environmental effects of shipping

TABLE 3.1.1

INDENTIFIED STAKEHOLDER GROUPS FOR VICINITY OF MARINE SHIPPING LANES (continued)

Stakeholder Type	Stakeholder Type Sub-Categories
Interest Groups	• chambers of commerce • economic development associations • recreation groups • labour groups • local interest groups • local and regional associations and organizations
Industry	• terminal operators in Burrard Inlet (including other petroleum product terminals) • oil and gas industry (*e.g.,* Canadian Association of Petroleum Producers [CAPP]) • maritime industry • Trans Mountain shippers potential suppliers and contractors
Public	• public living or working in marine shipping lanes communities • public living outside marine communities

3.1.1.1 Public

The stakeholder engagement program focused on building awareness and understanding of the Project, manage information flow, identify concerns and issues as well as gather public input into Project plans and design. Trans Mountain's target audience included all interested and potentially affected parties in the vicinity of the marine shipping lanes.

3.1.1.2 Focus Participants

The stakeholder engagement program involved focused discussions with small groups of interested stakeholders. Stakeholders had the opportunity to provide feedback on the marine studies as well as the approach to the ESA for the marine transportation component. These participants included representatives from local governments, community organizations, economic development organizations, and ENGOs. Through building relationships with the focus participants, Trans Mountain gathered informed input, identified issues or concerns and, where appropriate, developed early mitigation measures.

3.1.2 Geographic Reach of the Marine Public Consultation Program

Trans Mountain recognizes that the extensive scope and scale of the Project will result in interest by members of the broader public as well as stakeholders directly affected by the Project. In order to ensure that communications and engagement opportunities are appropriately tailored to the needs and interests of local communities, engagement activities were divided into proposed pipeline corridor communities (those potentially affected directly by the proposed pipeline and related facilities) and marine communities (those potentially affected by the increase in Project-related marine vessel traffic). In addition, pipeline and marine communities were further divided into the following five regions.

- AB;
- BC Interior;

- Lower Mainland/Fraser Valley;
- Mainland Coastal; and
- Island Coastal.

As Trans Mountain proceeds through the life of the Project, the stakeholder engagement program allows for the identification of new information and additional stakeholders. The initial grouping of communities was completed following preliminary conversations with stakeholders and municipal governments to identify local interests and needs. Table 3.1.2 provides the regional break-down as well as the core communities associated with the proposed pipeline corridor and marine areas.

TABLE 3.1.2

STAKEHOLDER ENGAGEMENT – PIPELINE CORRIDOR AND MARINE COMMUNITIES

Pipeline Corridor			Marine Corridor	
Alberta	**BC Interior**	**Lower Mainland/ Fraser Valley**	**Mainland Coastal**	**Island Coastal**
• Strathcona County • Community of Sherwood Park • City of Edmonton • Parkland County • City of Spruce Grove • Town of Stony Plain • Village of Wabamun • Yellowhead County • Town of Edson • Town of Hinton • Municipality (Town) of Jasper	• Village of Valemount • Community of Blue River • Community of Avola • Community of Vavenby • District of Clearwater • Community of Little Fort • District of Barriere • City of Kamloops • City of Merritt • District of Hope[1] • Fraser Fort George Regional District • Thompson-Nicola Regional District	• District of Hope[1] • Fraser Valley Regional District (FVRD) • City of Chilliwack • City of Abbotsford • Township of Langley • City of Coquitlam • City of Port Coquitlam • City of Burnaby[2] • City of Surrey • City of Vancouver • Metro Vancouver Regional District[2]	• City of Burnaby[2] • Village of Anmore • Village of Belcarra • City of North Vancouver • City of Port Moody • City of Richmond • City of Vancouver • City of White Rock • Corporation of Delta • District of North Vancouver • District of West Vancouver • Bowen Island Municipality • University Endowment Lands / Metro Vancouver Electoral Area "A" • Metro Vancouver Regional District[2] • Squamish Lillooet Regional District, • Village of Lions Bay • District of Squamish	• Corporation of the City of Duncan • City of Nanaimo • Nanaimo Regional District • Alberni – Clayoquot Regional District • Corporation of the City of Victoria • Cowichan Valley Regional District • Corporation of the District of Central Saanich • District of Metchosin • District of North, Saanich • Corporation of the District of Oak Bay • The Corporation of the District of District of Saanich • District of Sooke • Islands Trust Areas • Capital Regional District • Sunshine Coast Regional District • Town of Sidney • Corporation of the Township of Esquimalt

Notes:

1 The District of Hope, while a member of FVRD, is reported for the purposes of this application under the BC Interior Region and the FVRD is reported under the Lower Mainland/Fraser Valley Region.

2 For the purposes of this application on matters relating to the pipeline and associated facilities, the City of Burnaby and the Metro Vancouver Regional District will be reported under the pipeline communities in the Lower Mainland/Fraser Valley Region. There are also marine aspects of TMEP engagement with the City of Burnaby and the Metro Vancouver Regional District. Therefore, TMEP engagement with the City of Burnaby and the Metro Vancouver Regional District are also reported under the Mainland Coastal Region.

3.1.3 Phased Activities

The stakeholder engagement program adopted a phased approach to public and stakeholder engagement. Each phase was developed in response to information gathered from the previous phase as well as identified interests and needs. The current stakeholder engagement program consists of six phases which include:

- **Phase 1 Engagement** - Stakeholder and Issue Identification, May to September 2012;
- **Phase 2 Engagement** - Public Information and Input Gathering, October 2012 to January 2013;
- **Phase 3 Engagement** - Community Conversations, February to July 2013;
- **Phase 4 Engagement** - Feedback to Stakeholders and Application Filing, August to December 2013;
- **Phase 5 Engagement** - Regulatory Process to In-Service, January 2014 to in-service; and
- **Phase 6 Engagement** - Operational Consultation.

The stakeholder engagement program has been designed to foster positive relationships with the stakeholders as well as provide opportunities for stakeholders to be involved in the engagement process. The following section provides information on communications and engagement activities that took place during the first three phases of engagement activities conducted between the time of the Project announcement in May 2012 and the end of Phase 3 on July 31, 2013.

3.1.3.1 Communications Activities

The communications initiatives supported engagement activities by providing notification about the various engagement opportunities including public open houses, ESA technical workshops, and online discussion activities.

From producing printed newsletters to talking about Project details on social media channels to answering public and media inquiries, the communications program used a variety of methods to reach various audiences. The communications initiatives included:

- a comprehensive website with information about various components of the Project and the industry;
- proactively distributing Project updates via email to people who signed up through the Project website, at open houses or through other means;
- Twitter and YouTube posts to reach people who used social media channels;
- providing various forums for people to ask questions: toll-free phone line, email, a website question and answer forum, and direct letters;
- a full media relations service including a dedicated media toll-free phone line; and

- a modest advertising campaign aimed at notifying people about ways they could engage with members of the Project team – in person or online.

The Trans Mountain communications program provided those interested in the Project with a range of sources of information and platforms to encourage discussion and education, rather than engage in activities that merely help boost the profile of the Project.

3.1.3.1.1 Phase 1 Engagement: Stakeholder and Issue Identification, May to September 2012

The first phase of engagement focused on Project introduction, identifying interested stakeholders in government, municipalities and local communities, and identifying locally-appropriate means for engagement. Trans Mountain provided information through mail, email, and website posts as well as hand delivering information to stakeholders at Project introduction meetings.

3.1.3.1.2 Phase 2 Engagement: Public Information and Input Gathering, October 2012 to January 2013

Phase 2 of the stakeholder engagement program continued the outreach and discussions with municipalities and other stakeholders. In addition, Trans Mountain focused on engaging stakeholders through open house style information sessions and seeking input through conversation, feedback forms, online discussion, and Project-specific social media accounts. Content and format varied by the needs and interests of the communities, and where applicable. Trans Mountain provided stakeholders with information on the following:

- a Project overview and introductory information;
- the scope of the land and marine environmental assessments;
- the scope of the socio-economic assessment;
- introduction of the routing process; and
- an overview the regulatory process.

3.1.3.1.3 Public Open House Format

Public open houses in the Marine communities started in November 2012 and continued to mid-January 2013. The two to three hour sessions were structured as drop-in events where members of the public were invited to attend, gain information and ask questions about the Project. Project information was displayed on large poster boards positioned throughout the venue. Corporate leadership and technical experts including representatives from marine biological science, maritime navigation and industry, environment, routing, geotechnical, regulatory, operations, stakeholder engagement, and media relations were on hand to answer questions and receive comments and concerns from attendees.

In addition to these experts, representatives from the Port of PMV, the WCMRC, PPA, and Seaspan and/or SMIT Harbour Towage Inc (SMIT) were invited to provide to the public information on their role in maintaining or regulating marine safety along the shipping corridors. These outside representatives set up their own displays along with their own hand out materials. Their participation in the open houses was not meant to indicate any support or approval for

Trans Mountain, rather their involvement was to provide information to attendees about maritime matters in the context of increased tanker traffic.

3.1.3.1.4 Phase 3 Engagement: Community Conversations, February to July 2013

Phase 3 Engagement continued the discussion through a series of ESA Workshops, Community Workshops, and Routing Open Houses. Trans Mountain continued to reach out to previously unidentified stakeholder groups, and held focused discussions with local government and previously identified stakeholder groups. Project updates meetings and presentations for stakeholders continued.

3.1.3.2 Marine ESA Workshops

The Marine ESA Workshops in Phase 3 provided information on the proposed approach to the completion of the ESA for the marine transportation and Westridge Marine Terminal expansion components. Regional Marine ESA Workshops, held in Langford, on May 22, 2013, and North Vancouver on May 23, 2013, targeted local and regional subject matter experts. These workshops were consistent with the format of the pipeline community ESA Workshops (Volume 3A); however, the Marine ESA Workshops provided attendees with a proposed overview of the Marine ESA approach for the Project and sought feedback on particular modules of the ESA including biological, physical, and human impacts under normal operations and ecological and human impacts under an accident or malfunction circumstance. Input was solicited online for two weeks after each workshop. Trans Mountain conducted these workshops in response to feedback received during the early stages of engagement regarding community interests and needs.

3.1.3.2.1 Phase 4 Engagement: Feedback to Stakeholders and Application Filing, August to December 2013

The goals of the Phase 4 stakeholder engagement and communications program will include community and economic benefit presentations in conjunction with chambers of commerce, attending events, one on one meetings, emergency response workshops, and presentations/speaking opportunities. In addition, meetings with local government and interested parties will be ongoing. Trans Mountain will continue digital engagement efforts and seek out more public opportunities to share information and gather feedback.

3.1.3.2.2 Phase 5 Engagement: Regulatory Process to In-Service, January 2014 to In-Service

Additional engagement and communications phases will be developed to support the regulatory process and, if successful, the construction phases of the Project. The goals of this engagement and communication phase will include sharing results of any new studies or work being completed on the Project, to communicate any changes and or updates to Project plans, to share information with stakeholders on the regulatory process, and to engage on construction effects and mitigation measures. Additional objectives include communicating about the benefits of the Project to local stakeholders and engaging on environment offsets.

Engagement and communications activities will be undertaken through a number of initiatives, including but not limited to, open houses, workshops, one on one meetings, presentations, website, online discussion forums, printed materials, and digital media including social media.

Engagement continues with coastal stakeholders related to environmental aspects of the Project. Direct outreach to large and small conservation groups (including local ENGOs) on the

coast remains a focus during this phase to identify their interests and concerns and possible opportunities in mitigation or partnerships in conservation offset projects. Trans Mountain is also encouraging new relationships between local environmental groups and certified spill responders so that more information can be shared about areas of high ecological value on BC's southwest coast.

Engagement and communication initiatives will be documented and provided as updates to the NEB at logical intervals.

3.1.3.2.3 Phase 6 Engagement: Ongoing Operational Consultation, Post-Construction Throughout Operational Life

Kinger Morgan Canada Inc.'s (as the operator of TMPL) neighbours, governments and Aboriginal communities play an important role in how business is conducted. Kinder Morgan Canada Inc.'s success depends on earning the trust, respect, and cooperation of all community members.

Trans Mountain, as the Project applicant, and Kinder Morgan Canada Inc., as the operator of TMPL, are committed to respectful, transparent and collaborative interactions with communities to develop long term effective relationships. Once the pipeline becomes operational, engagement opportunities will continue through hosting facility open houses, providing newsletters and Project updates, making safety and public awareness presentations, participating in community events, regulatory processes, and ongoing informal meetings with stakeholders.

Initiatives to be activated during this phase will be developed in the lead up to construction. Kinder Morgan Canada Inc., as the operator of TMPL, is committed to ongoing consultation in the communities in which it operates.

3.1.4 Summary of Outcomes of the Public Consultation Program

Trans Mountain designed the stakeholder engagement program to involve people who may be affected or have interest in the Project. Through the first three phases of engagement, Trans Mountain has had the opportunity to provide Project information through various methods and receive general comments as well as specific information for route and Project planning. Trans Mountain has engaged stakeholders in dialogue to discover the social and environmental issues or concerns that matter most to those stakeholders. Trans Mountain has tracked these conversations and relayed the key topics to the appropriate Project representative to be considered and incorporated in the application where applicable. Appendix C (Summary of Outcomes of the Public Consultation Program) provides a summary of key stakeholder interests and concerns relating to the marine transportation component of the Project and where these topics are addressed in the application. Specific disciplines consulted with federal, provincial, regional and municipal authorities regarding the marine environmental and socio-economic effects assessment. For each environmental or socio-economic element, a summary table in Appendix C provides detailed information on the agency contacted, name and title of contact, method of contact, date of engagement, reason for engagement, key interests and concerns as well as any commitments or follow-up actions required.

3.2 Aboriginal Engagement

Since April 2012, Trans Mountain has engaged with Aboriginal communities who might have an interest in the Project or have Aboriginal interests potentially affected by the increase in Project-related marine vessel traffic based on their assertion of traditional and cultural use of marine resources to maintain a traditional lifestyle. Trans Mountain respects the Aboriginal and treaty rights, unique culture, diversity, languages, and traditions of Aboriginal peoples. Trans Mountain acknowledges the importance of teaching, the significance of culture and language, and the considerable traditional knowledge that has been passed on for generations and as such is committed to continued listening, learning and working with Aboriginal people to ensure that knowledge and advice is considered and incorporated in the Project. In order to build relationships for the long-term, the program is based on the principles of accountability, communication, local focus, mutual benefit, relationship building, respect, responsiveness, shared process, sustainability, timeliness, and transparency.

This subsection provides information on the Aboriginal Engagement Program for the Project and describes how the results of Project engagement activities relating to marine transportation were gathered as well as how these results have been incorporated into the application. The Aboriginal Engagement Program was developed in accordance with the KMC Aboriginal Policy. Volume 3B provides detailed information on the Trans Mountain approach to the Aboriginal Engagement Program as well as detailed information on the Trans Mountain vision and the principles and goals of the program.

For purposes of this application, the engagement activities conducted to date are reported up to November 30, 2013. The results of ongoing engagement efforts will be reported in supplemental filings.

3.2.1 Design of the Marine Aboriginal Engagement Program

3.2.1.1 Identification of Aboriginal Communities

Using an inclusive approach beginning in 2011, Trans Mountain worked in collaboration with the federal government and provincial ministries to identify marine Aboriginal communities in BC for engagement.

For purposes of identifying marine Aboriginal communities that might have an interest in the Project or have Aboriginal interests potentially affected by the Project, the Aboriginal Affairs and Northern Development Canada (AANDC) asserted territory maps for Aboriginal communities who are negotiating treaties within the BC Treaty Commission process were used. The Transport Canada shipping lanes provided guidelines and all territories were included where potential effects and cumulative effects could extend in the marine environment, thereby potentially effecting traditional use of the marine environment.

For communities not currently engaged in the BC treaty process, Trans Mountain reviewed territory maps for each community (or maps of associations or tribal councils with which the community is affiliated) using the same guidelines to identify Aboriginal communities for engagement.

Upon further discussion with AANDC, Trans Mountain contacted the BC Ministry of Aboriginal Relations and Reconciliation and received guidance on the development of engagement lists for the Project. In addition to engagement with the federal and provincial ministries regarding

communities and groups to include in the Marine Aboriginal Engagement Program, further engagement took place in early 2012 with representatives from:

- the Major Projects Management Office (MPMO);
- the NEB;
- Transport Canada; and
- the BC Oil and Gas Commission (OGC).

The final list was a compilation guided by both levels of government as well as an existing list of Aboriginal communities held by KMC, where existing relationships were in place as a result of the operating TMPL system. The result was a comprehensive list of 20 marine Aboriginal communities and 7 inlet Aboriginal communities with traditional territories located within the marine transportation corridor identified by the Project.

As the Project develops, Trans Mountain continues to consult with these departments and agencies in addition to the Aboriginal communities, to ensure all that might have an interest in the Project or have Aboriginal interests potentially affected by the Project are included in the Aboriginal Engagement Program.

3.2.1.2 Marine Aboriginal Communities Engaged

Trans Mountain is engaging with 27 Aboriginal communities in proximity to the marine transportation corridor that might have an interest in the Project or have Aboriginal interests potentially affected by the Project (Tables 3.2.1 and 3.2.2).

TABLE 3.2.1

ABORIGINAL COMMUNITIES LOCATED IN THE BURRARD INLET REGION

Katzie First Nation
Kwikwetlem First Nation
Musqueam Indian Band
Semiahmoo First Nation
Squamish Nation
Tsawwassen First Nation
Tsleil-Waututh Nation

TABLE 3.2.2

ABORIGINAL COMMUNITIES LOCATED IN THE MARINE CORRIDOR

Cowichan Tribes
Esquimalt Nation
Halalt First Nation
Hwlitsum First Nation
Lake Cowichan First Nation
Lyackson First Nation
Malahat First Nation
Pacheedaht First Nation
Pauquachin First Nation
Penelakut First Nation
Scia'new Indian Band (Beecher Bay)
Sechelt Indian Band
Snaw-Naw-As (Nanoose)
Snuneymuxw First Nation
Songhees Nation
Stz'uminus First Nation (Chemainus)
T'Sou-ke First Nation
Tsartlip First Nation
Twawout First Nation
Tseycum First Nation

3.2.1.3 Engagement Method

The Marine Aboriginal Engagement Program uses a comprehensive Aboriginal engagement process led by experienced engagement advisors in BC. The process for engagement with Trans Mountain about the Project is flexible, allowing each community and group to engage in meaningful dialogue in the manner they choose and in a way that meets their objectives and values.

In May 2012, the Trans Mountain Aboriginal engagement team was created and Aboriginal engagement team field advisors were assigned to each of the groups based on their knowledge and experience. Each advisor is a professional experienced in engagement. In addition to the field advisors, the Aboriginal engagement team is made up of professionals working in the areas of Aboriginal relations, law, economic development, education, training, employment and procurement.

The Marine Aboriginal Engagement Program focuses on:

- establishing trusting and respectful relationships;
- sharing Project information – Project scope, routing options, safety and emergency response, scheduling, environmental field study components;
- negotiating group and community-specific protocols, capacity agreements, Letters of Understanding (LOUs) and Mutual Benefit Agreements (MBAs), as appropriate;

- facilitating traditional marine resource use (TMRU) studies;
- identifying potential impacts and addressing concerns;
- discussing the adequacy of planned impact mitigation and opportunities; and,
- identifying education, training, employment and procurement opportunities.

3.2.1.4 Comprehensive Aboriginal Engagement Process

Acting as a framework for the engagement process, the following activities provide guidance to ensure a comprehensive and consistent process in working with each of the communities identified by Trans Mountain.

As outlined in Volume 3B, each community has the opportunity to engage with Trans Mountain in the manner they choose, depending on Project interests and potential effects.

- project announcement;
- initial contact with Aboriginal community or Aboriginal group;
- meetings with Chief and Council and meetings with staff;
- negotiate and execute confidential letter of understanding/capacity agreement;
- host community information session(s);
- conduct TMRU studies;
- identify interests and concerns;
- review key mitigation options;
- provide additional capacity funding, if required; and,
- negotiate and execute confidential mutual benefits agreement.

In December 2013, at the time of filing, Trans Mountain continues to actively engage with all marine Aboriginal communities that have been identified as having an interest in the Project or have Aboriginal interests potentially affected by the Project.

Engagement with communities is at varying stages in the engagement process. Specific detail about the engagement activities and the status of engagement with each group can be found in Section 1.5 of Volume 3B and within Appendix A of Volume 3B. In addition, details related to the TMRU studies completed with participating Aboriginal communities can be found in Section 4.0. Details related to studies completed with participating Aboriginal communities for the proposed pipeline corridor and Westridge Marine Terminal can be found in Volumes 5A and 5B.

3.2.1.5 Incorporating Aboriginal Traditional Marine Resource Use Studies

TERA Environmental Consultants (TERA) was commissioned to assist in the collection of traditional marine resource use information with potentially affected Aboriginal communities that focused on the current use of traditional marine resources potentially affected by the increases in Project-related vessel traffic.

TERA acknowledges the unique relationship that has evolved between the Aboriginal people and their surrounding physical environment. This physical environment includes the lands, waters, resources and events that have shaped and sustained the local Aboriginal people, their culture, and their communities.

The aim of the TMRU studies is to identify and mitigate effects of the increase in Project-related marine vessel traffic on current use of traditional marine resources. This is achieved by meeting the following objectives:

- determine the extent and general nature of each community's current use of marine resources for traditional activities relative to shipping lanes;
- identify existing concerns and potential effects of the Project on traditional marine resource use for baseline scoping and selection of social or environmental indicators for the effects assessment;
- provide traditional knowledge, where appropriate, for the assessment of potential effects of Project-related marine vessel traffic on traditional marine resource use; and
- recommend appropriate mitigation measures to address concerns raised relative to the Project-related marine vessel traffic regarding traditional marine resource use.

Following Project initiation, Trans Mountain began facilitation of the TMRU studies conducted by interested Aboriginal communities for the Project (see the Traditional Marine Resource Use – Marine Transportation Technical Report of [Volume 8B, TR 8B-5]). The Project scope, timetable and location were discussed. Project information packages, which included a description of the Project, facts on the nature, timing, scope and location of the Project, and relevant contact information for communication with Trans Mountain and TERA, were sent to each community and meetings were subsequently scheduled. Communities were also provided with copies of the proposed TMRU study methods and a draft outline of TERA's TMRU study work plan. The initiation of TMRU studies, either as TERA-facilitated or community-directed using a third-party consultant, was discussed with Aboriginal communities based on an indicated interest in participating in these studies.

Trans Mountain provided funding to assist Aboriginal communities that elected to conduct their own community-directed TMRU studies. These communities often engaged other consultants to provide technical support and assistance with their TMRU studies for the Project. During these studies, community representatives are asked to contribute to the discussion of potential Project-related effects on TMRU and to participate in the discussion of potential mitigation measures to reduce potential Project-related effects.

TERA has prepared a separate Traditional Marine Resource Use – Marine Transportation Technical Report that outlines Trans Mountain's information collection efforts for the assessment of potential adverse effects of the Project on current use of marine resources for traditional purposes (Volume 8B, TR 8B-5). The technical report also provides a description of how TMRU studies were developed for each interested Aboriginal community. The traditional marine resource use information collected has been incorporated into the Traditional Marine Resource Use – Marine Transportation Technical Report (Volume 8B, TR 8B-5) and used to assist in the assessment of the potential effects of the increase in Project-related marine vessel traffic.

Appendix A of Volume 3B provides a summary of the meetings and interviews that took place for the traditional marine resource use component of the ESA. The issues that were raised and where they are considered in the traditional marine resource use assessment are also summarized in Table 3.2.1.

3.2.2 Implementation

3.2.2.1 Engagement Activity

The Trans Mountain Marine Aboriginal Engagement Program was designed to provide meaningful engagement with marine Aboriginal communities using multiple forms of engagement detailed in Volume 3B, including Project letters, meetings, phone conversations, email dialogue, newsletters, public information sessions and the Project website.

Utilized specifically for engagement with marine Aboriginal communities, an expanded version of the presentation titled “Aboriginal Engagement Program: Trans Mountain Expansion Project” is used during meetings to share Project details with attendees (Appendix D). The presentation deck is similar to the presentation included in Volume 3B however includes additional details about the marine environment such as tankers, safety and the West Coast Marine Response Corporation.

A number of methods have been used to inform Aboriginal communities, obtain feedback and identify issues about the Project including: including Project letters, meetings, phone conversations, email dialogue, newsletters, public information sessions and the Project website and over 4,000 engagement activities have been carried out to date. The results of these engagement efforts, in conjunction with the collection of traditional marine resource use (Section 3.2.1.4) have contributed to the development of the marine transportation assessment, including mitigation and enhancement measures. A detailed summary of engagement with each Aboriginal community is available in Volume 3B.

3.2.2.2 Procurement, Employment, Education and Training

Trans Mountain is committed to supporting the sustainability of Aboriginal communities through procurement opporutnities, the creation of employment opportunities over the life of the proposed Project and is committed to the development of an Aboriginal workforce through effective and accessible training programs to maximize participation in available employment opportunities.

As detailed in Volume 3B, Trans Mountain is working in partnership with communities to achieve the objectives of the Aboriginal Procurement Policy and the Training Policy for Aboriginal Peoples to enhance employment opportunities with all interested communities, including marine communities.

3.2.2.3 TERMPOL Review Process

Transport Canada’s Aboriginal engagement process for the TERMPOL Review Process evolved during 2013, while TMEP Aboriginal engagement was already taking place. As recommended by Transport Canada in a letter addressed to Trans Mountain on August 30, 2013 (Appendix F) Trans Mountain is engaging with marine Aboriginal communities on this process in the following ways:

- provide sufficient information about the Project to enable participants understanding of the project;

- listen to concerns raised by Aboriginal groups and, where possible, address these concerns;
- provide Aboriginal groups an opportunity to review and comment on the draft surveys and studies of interest, and consider Aboriginal groups' comments;
- document efforts to engage Aboriginal groups' comments;
- document efforts to engage Aboriginal groups, including a written communication log, a summary of issues raised, how the proponent has addressed concerns (as applicable), and a description of outstanding issues; and
- provide Aboriginal groups an opportunity to review and validate the summary of issues raised.

In November/December 2013, Trans Mountain invited Aboriginal marine communities to review the TERMPOL studies. Trans Mountain continues to actively engage with Transport Canada and marine Aboriginal communities in the TERMPOL Review Process.

3.2.3 Summary of Outcomes of the Marine Aboriginal Engagement Program

The results of engagement have helped refine the ESA for the Project. With this information, Trans Mountain identified issues, responded to questions and addressed concerns. Engagement has also provided Aboriginal communities with an understanding of the Project.

Although a wide range of issues were raised by community members and representatives throughout the Aboriginal engagement process, recurring themes have emerged, including the following:

- potential environmental effects of spills on the marine environment and the related effects to traditional activities;
- increases of Project-related vessel traffic on traditional hunting and fishing areas, travelways and sacred areas;
- rehabilitation and protection of the Salish Sea;
- effect of increased vessel traffic through Burrard Inlet;
- additional economic incentives including preferred procurement opportunities, revenue sharing, community enhancement opportunities and equity participation; and
- ongoing respectful and meaningful engagement including capacity funding and TMRU study funding.

Results of the engagement have been considered and incorporated throughout the marine transportation assessment where relevant, including the mitigation measures and effects assessment. The issues identified by participating Aboriginal communities through engagement activities for the Project and references to where they are considered in this application are presented in Appendix E (Interests or Concerns Identified Through Engagement Activities with Aboriginal Communities for the Project). Detailed information on engagement activities

conducted and opportunities provided for Project input to date with each Aboriginal community can be found in Appendix A of Volume 3B.

3.2.4 Future Aboriginal Engagement Activities

Following submission of the application to the NEB, including Volume 8A, Trans Mountain will continue its engagement with Aboriginal communities to provide updates on the status of the Project and discuss key mitigation measures in place and additional recommendations for the Project. Information updates will continue to be sent to marine Aboriginal communities. From information sharing to ongoing TMRU studies to address interests and concerns, Trans Mountain is committed to the continuation of an effective engagement program that satisfies all parties.

The outcomes of meetings and remaining TMRU study engagement efforts will be documented and filed with the NEB (see Section 4.5). As described in Volume 3B, Trans Mountain will continue engagement through the regulatory process and into Project development and operations. Trans Mountain will also continue its liaison with the Crown and provide updates regarding Trans Mountain's engagement activities with Aboriginal communities who have an interest in the Project or interests potentially affected by the Project.

4.0 ENVIRONMENTAL AND SOCIO-ECONOMIC ASSESSMENT

4.1 Introduction

4.1.1 Overview of Marine Transportation and Shipping Activities

There are a variety of vessel types that currently transit the West Coast, including general cargo vessels, dry-bulk cargo vessels, container cargo vessels, tankers, tugs, passenger vessels, pleasure crafts, government vessels and warships, commercial passenger ferries, float planes, and commercial fishing vessels.

There are about 475,000 vessel movements per year on the West Coast and tankers accounting for about 1,500 movements (0.3 per cent) in 2009 to 2010 (Transport Canada 2013h). Oil tankers have been moving safely and regularly along Canada's West Coast since the 1930s (Transport Canada 2013h). Oil is moved mostly via the ports of Vancouver, Prince Rupert and Kitimat. Transport Canada records show that in 2009, about 8.4 million tonnes of oil were shipped out of Vancouver (Transport Canada 2013h). Much of this oil is transported in barges to and from communities along the BC coast. Varying quantities of oil are also carried on-board container ships, domestic and international ferries, and other types of commercial and private vessels, primarily as fuel (Transport Canada 2013h).

Existing traffic and Project-related marine vessel traffic calling at the Westridge Marine Terminal in this marine network will encounter other vessels and navigational features, such as pilot boarding stations, narrow channels, channel bends and marine traffic crossings.

Legislation exists in Canadian and American waters to be transited by Project-related vessels to ensure safety and environmental protection. MCTS communicate with vessels operating in Canadian waters and provide VTS to ensure navigational safety. The following requirements apply for mandatory participation in VTS:

- ships 20 m or more in length;
- ships engaged in towing or pushing any vessel;
- combined length of the ship and any vessel or object towed or pushed by the ship is 45 m or more in length; and/or
- the length of the vessel or object being towed or pushed by the ship is 20 m or more.

In addition, ships are subject to compulsory pilotage if the vessel is over 350 gross tons for non-pleasure craft vessels and over 500 gross tons for pleasure craft vessels. Compulsory pilotage does not apply to government vessels, ferries, or US government ships under 10,000 gross tons (Government of Canada 2009). The PPA is responsible for providing competent, licensed pilots to ensure safe, reliable and efficient marine pilotage. Project-related marine vessel traffic will be subject to PPA legislation.

As a result of the Project, marine traffic volume calling at the Westridge Marine Terminal will increase. The types of vessels calling at the Westridge Marine Terminal (*i.e.*, barges and Panamax and Aframax sized tankers) will not change as a result of the Project. In addition, the vessels calling at the Westridge Marine Terminal (after the Project is in operation) will continue to use the existing marine shipping lanes. The existing and future marine traffic volumes calling

at the Westridge Marine Terminal are described in Table 4.1.1.1, which shows the Project-related change.

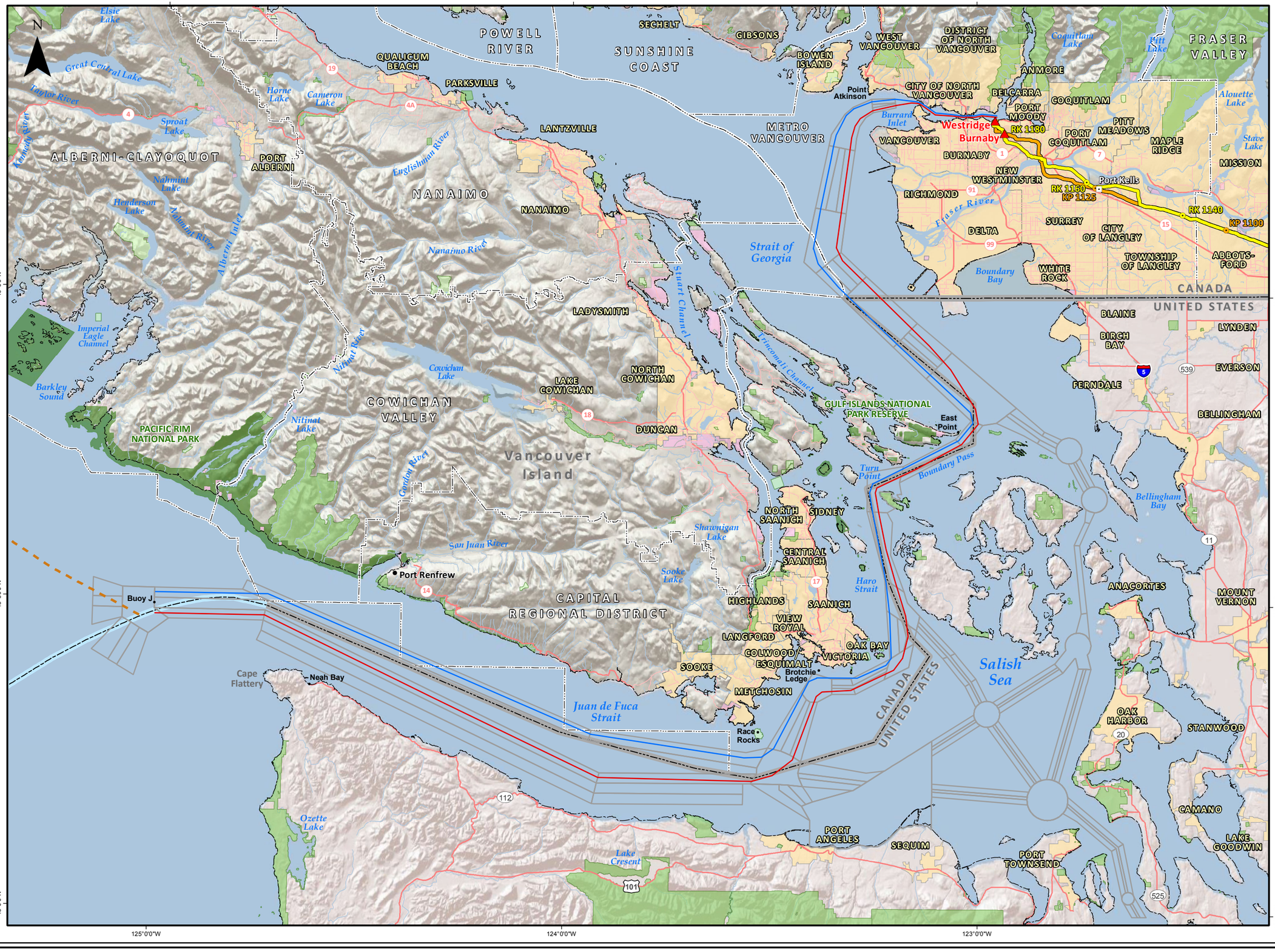
TABLE 4.1.1.1

EXISTING AND FUTURE MARINE TRAFFIC AT THE WESTRIDGE MARINE TERMINAL

Vessel type	Existing (monthly average)	Predicted 2018 (monthly average)*	Predicted Increase
Tanker loading	5	34	+29
Barge (crude oil) loading	2 to 3	2 to 3	0
Barge (jet fuel) discharge	1 to 2	1 to 2	0

Note: * Based on Aframax tankers

The regional location of the proposed increased Project-related marine vessel traffic is shown on Figure 4.1.1.



TRANS MOUNTAIN

FIGURE 4.1.1

REGIONAL LOCATION OF THE MARINE SHIPPING LANES

TRANS MOUNTAIN EXPANSION PROJECT

- Reference Kilometre Post (RK)
- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Terminal
- Existing Pump Station
- Highway
- Road
- 12 Nautical Mile Limit (Territorial Sea)
- Limit of Exclusive Economic Zone (EEZ)
- International Boundary
- Marine Vessel Outbound Shipping Lane
- Marine Vessel Inbound Shipping Lane
- Traffic Separation Scheme
- City / Town / District Municipality
- Indian Reserve / Métis Settlement
- National Park
- Provincial / State Park
- Protected Area/Natural Area/ Provincial Recreation Area/Wilderness Provincial Park/Conservancy Area
- Regional District Boundary

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Projection: UTM Zone 10N.
Routing: Baseline TMPL & Facilities: provided by KMC, 2012; Proposed Pipeline Corridor V6: provided by UPI, Aug. 23, 2013; Transportation: BC Forests, Lands and Natural Resource Operations, 2012 & ESRI, 2005; Geopolitical Boundaries: IHS Inc., 2011, BC FLNRO, 2007 & ESRI, 2005, Natural Resources Canada, 2012; First Nation Lands: Government of Canada, 2013 & IHS Inc., 2011; Hydrology: IHS Inc., 2004, United States National Imagery and Mapping Agency, 2000, Natural Resouces Canada, 2010; Parks and Protected Areas: Natural Resources Canada, 2013, BC FLNRO, 2008; CHS: provided by KMC, 2013; Marine Shipping Lanes: Moffat and Nichol, 2013; Hillshade: TERA, derived from Geobase; US Hillshade: Copyright:© 2013 Esri.

tera ENVIRONMENTAL CONSULTANTS

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

MAP NUMBER: 201308_MAP_TERA_MR_00378_REV0		PAGE: SHEET 1 OF 1
DATE: December 2013	TERA REF: 7894	REVISION: 0
SCALE: 1:650,000	PAGE SIZE: 11x17	DISCIPLINE: MR
DRAWN: AJS	CHECKED: TGG	DESIGN: TGG

SCALE: 1:650,000

0 5 10 15 20 25 km

ALL LOCATIONS APPROXIMATE

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4.1.2 Purpose of the Environmental Assessment

Early in the Project planning process, Trans Mountain recognized that the increased Project-related marine transportation was an important issue to many stakeholders. Trans Mountain initiated an ESA, which included public consultation and Aboriginal engagement activities to assist in identifying potential adverse environmental and socio-economic effects and mitigation measures resulting from the increased Project-related marine transportation. The purpose of the ESA is to describe:

- the potential environmental and socio-economic effects and cumulative effects of the increased Project-related marine vessel traffic;
- the mitigation and enhancement measures that will be in place to anticipate, prevent, reduce and manage potentially adverse environmental and socio-economic effects over the life of the Project;
- consultation undertaken to notify those potentially affected, identify their concerns, and the measures to be taken to address those concerns; and
- an assessment of the significance of potential effects, after applying proposed mitigation measures.

With respect to regulatory requirements, Trans Mountain is required to prepare an ESA as the Project is considered a designated project under the *CEA Act, 2012*.

Although marine transportation is not regulated by the NEB, the NEB has included the potential effects of increased marine transportation on the Project List of Issues for review (NEB 2013a). The NEB provided further clarification of its requirements to consider the environmental and socio-economic effects of the increase in marine tanker traffic in its Filing Requirements Related to the Potential Environmental and Socio-Economic Effects of Increased Marine Shipping Activities, Trans Mountain Expansion Project (September 10, 2013) (NEB 2013b), effectively determining the scope of the ESA and the factors to be assessed.

Although the NEB Filing Manual (2013c) does not provide guidance directed towards marine transportation effects, the general outline of this volume and methodology of effects assessment follow guidance set out in the NEB Filing Manual (2013c) to maintain consistency with Volumes 5A and 5B.

This ESA for the increased Project-related marine vessel traffic has been prepared following the guidance in the NEB Filing Manual (NEB 2013c) and direction provided in guidance documents issued by the CEA Agency. Trans Mountain directed TERA to conduct an assessment to meet the requirements of both the NEB Filing Manual (2013c) and Section 19(1) of the *CEA Act, 2012*.

Additional federal and other regulatory authorities may have environmental regulatory interests associated with the Project, although regulatory responsibilities are evolving and actual interests will be confirmed through ongoing consultation with the regulatory authorities. Authorities with interests may include:

- Environment Canada pursuant to the *CEPA*, the *Species at Risk Act* and the *Migratory Birds Convention Act*;
- DFO pursuant to the *Fisheries Act*;

- PMV pursuant to Section 56 of the *Canada Marine Act*; and
- Transport Canada engaged through the voluntary TERMPOL and the authority responsible for marine emergency response.

The roles and responsibilities of these regulatory authorities, as they relate to the Project and marine transportation, were previously described in Section 1.4.

4.1.3 Overview of Marine Transportation Environmental and Socio-Economic Assessment

Section 4.0 (ESA for the increased Project-related marine vessel traffic) has been prepared as a detailed report of the potential effects of increased Project-related marine vessel traffic on environmental and socio-economic conditions. Marine transportation spill scenarios are presented in Section 5.7. Mitigation measures and additional supporting information are detailed in Volume 8B, Technical Reports. Section 4.0 is divided into the following sections.

4.1 Introduction: Provides background information pertaining to the Project, the scope of the assessment and the outline of Section 4.0.

4.2 Environmental and Socio-Economic Setting: Provides a description of the current environmental and socio-economic conditions in the vicinity of the marine shipping lanes.

4.3 Environmental and Socio-Economic Effects Assessment: Describes the effects assessment and identifies the potential environmental and socio-economic effects, mitigation measures and predicted residual effects as well as an assessment of their significance for the increased Project-related marine vessel traffic.

4.4 Cumulative Effects Assessment: Provides a description of the contribution of increased Project-related marine vessel traffic to potential adverse cumulative effects as well as an assessment of its significance.

4.5 Supplemental Studies: Provides information regarding additional information that may be required to supplement the application.

4.6 Conclusion: Provides conclusions related to the significance of potential adverse residual effects and cumulative effects associated with the increased Project-related marine vessel traffic.

4.1.4 Scope of the Assessment

Scoping is the process of identifying the physical works and activities to include within the ESA, and which biophysical and socio-economic elements are likely to be affected. Proper scoping reduces the risk of including unimportant or irrelevant information in the assessment or excluding factors that should be assessed (NEB 2013c). This ESA relies, in part, on information developed in support of the Transport Canada TERMPOL process.

In addition to the environmental assessment report completed by the NEB under the *CEA Act, 2012*, the proponent is required to submit an ESA to the NEB. The environmental assessment report and ESA will meet the requirements of the complete federal ESA process including the *CEA Act, 2012* and NEB requirements. The environmental assessment considers the mandatory factors listed in Section 19(1) of the *CEA Act, 2012*, as well as the factors listed in

the NEB Filing Manual (NEB 2013c), and pertinent issues and concerns identified through Aboriginal engagement and regulatory authority, stakeholder, and public consultation.

The assessment considers the potential effects of the increased Project-related marine vessel traffic on the environment and socio-economic conditions in the context of defined spatial and temporal boundaries. These boundaries vary with the issues and environmental elements or interactions to be considered, and reflect:

- the proposed physical activities associated with the increased Project-related marine vessel traffic;
- the natural variation of a population, or environmental or socio-economic component;
- the time required for an effect to become evident;
- the time required for a population or environmental or socio-economic component to recover from an effect and return to a pre-effect condition;
- the area directly affected by proposed physical activities; and
- the area in which a population or environmental or socio-economic component functions and within which a Project effect may be felt.

The spatial boundaries consider one or more of the following areas, as summarized below.

- A **Local Study Area (LSA)** consisting of the zone of influence or area where the element and associated indicators are most likely to be affected by the increased Project-related marine vessel traffic. This generally represents a buffer from the centre of the marine shipping lanes. Detailed descriptions of the element-specific LSAs are provided in Section 4.2 and associated rationales are provided in Section 4.3.
- A **Regional Study Area (RSA)** consisting of the area extending beyond the LSA boundary where the direct and indirect influence of other activities could overlap with project-specific effects and cause cumulative effects on the indicator. For each element considered, a separate spatial RSA boundary was established in consideration of the regional effects of the increased Project-related marine vessel traffic on the individual element. Detailed descriptions of the element-specific RSAs are provided in Section 4.2 and associated rationales are provided in Section 4.3.

Individually established environmental or socio-economic boundaries are described within the discussions in Section 4.2 for each applicable element. Spatial environmental and socio-economic boundaries were determined by the distribution, movement patterns and potential zones of interaction between an element and the Project.

Desktop studies considered the width of the shipping lanes at a minimum.

The environmental assessment also considers cumulative effects that are likely to result from the Project in combination with existing activities and reasonably foreseeable developments that have been or will be carried out.

4.1.5 Project Team

Table 4.1.5.1 provides the companies that assisted with the preparation of Section 4.0.

TABLE 4.1.5.1

PROJECT TEAM

Application Component	Team
Overview of Marine Transportation and Shipping Activities	Trans Mountain
Air Emissions and Greenhouse Gas Emissions Assessment Noise Impact Assessment	Rowan Williams Davies and Irwin Inc.
Marine Resources Assessment (Marine Fish and Marine Mammals) Marine Bird Assessment Marine Sediment and Water Quality Assessment Species At Risk Assessment Accidents and Malfunctions Assessment	Stantec Consulting Ltd. (Stantec)
Traditional Marine Resource Use Assessment	TERA
Human Health Risk Assessment for Normal Operations	Intrinsik Environmental Sciences Inc. (Intrinsik)
Marine Commercial, Recreational and Tourism Use Assessment	Vista Strategy Corp. (Vista Strategy) TERA

Supporting technical reports are provided in Volume 8B. The technical reports provide discipline-specific background information as well as the research conducted in support of this ESA. These technical reports and previous surveys and studies provide an information base for the marine transportation component of the Project. The authors of the supporting technical reports also participated in the identification of potential effects, the development of mitigation measures and the evaluation of significance of residual effects within their respective disciplines.

4.2 Environmental and Socio-Economic Setting

The following subsections present a summary of the environmental and socio-economic setting of the marine transportation component of the Project. The setting was compiled based on the following sources:

- desktop reviews of physical oceanography, marine sediment and water quality, air emissions, greenhouse gas (GHG) emissions, acoustic environment, marine fish and fish habitat, marine mammals, marine birds, marine species at risk, traditional marine resource use, marine commercial, recreational and tourism use (MCRTU), and human health;
- published literature including topographic maps, aerial photography, scientific papers and reference books, as well as municipal, provincial and federal government maps, reports, interactive websites, guides, information letters, fact sheets and databases; and
- consultation and engagement with Aboriginal communities, government agencies, stakeholders, and the general public.

Aboriginal traditional knowledge relevant to each element is summarized in each subsection. Methods of obtaining resource material included library and internet searches, and sourcing and receiving documents directly from government agencies. References used in the preparation of the setting are cited in Section 4.6.

Detailed methodology for the collection of information on existing conditions is provided in the applicable supporting studies of Volume 8B.

The potential Project-related effects of increased marine vessel traffic and mitigation are presented in Section 4.3. The spatial boundaries of elements discussed in the socio-economic setting are also described in detail in Section 4.3. An element is defined as a technical discipline or discrete component of the biophysical or human environment identified in the NEB Filing Manual (NEB 2013c).

This section provides information regarding overall environmental and biophysical conditions as well as specific information regarding indicators. An indicator is a biophysical, social, or economic property or variable that society considers important and is assessed to predict Project-related changes and focus the impact assessment on key issues. Indicators are selected (one or more) and used as surrogates to describe the present and predicted future condition of an element. Societal views reflect published information such as management plans and engagement with regulatory authorities, the public, Aboriginal, and other interested groups.

4.2.1 Regional Overview

The designated marine shipping lanes run through the Strait of Georgia, Boundary Pass, and the Haro and Juan de Fuca straits. These waterways are all located within the Salish Sea (Figure 4.2.1), an inland sea that extends from Olympia, Washington State in the US northward to Campbell River, BC. The Salish Sea has an areal extent of approximately 17,000 km^2 and 7,500 km of coastline (Gaydos and Pearson 2011). Major bodies of water within the Salish Sea include the Strait of Georgia, Juan de Fuca Strait and Puget Sound. The inland waterways are partially separated from the open Pacific Ocean by Vancouver Island and the Olympic Peninsula and are, therefore, partially shielded from Pacific Ocean storms. Marine vessels can also find shelter from storms among inlets and bays of smaller islands in this area. These waters encompass a bi-national ecosystem that is home to the first inhabitants of the region, the Coast Salish. Oceanographic processes, influenced by freshwater inflows and wind-driven surface currents, exchange biota, sediments and nutrients throughout the larger ecosystem.

For the purposes of this assessment, the marine shipping lanes are defined to include the normal tanker transit patterns from the Westridge Marine Terminal to the 12 nautical mile limit, including transit within Burrard Inlet and transit in the internationally designated marine shipping lanes.

Stantec

SCALE: 1:2,000,000

0 10 20 30 40 km

ALL LOCATIONS APPROXIMATE

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MAP NUMBER		PAGE
10494_EA_TRANS_MAR_04_02_01		SHEET 1 OF 1
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- Westridge Marine Terminal
- Town / City
- Marine Vessel Inbound Shipping Lane
- Marine Vessel Outbound Shipping Lane
- International Border
- Canadian 12 Nautical Mile Territorial Boundary
- Bathymetry
- Watercourse
- Existing Trans Mountain Pipeline
- Trans Mountain Expansion Proposed Pipeline Corridor
- Waterbody
- Provincial Park
- Traffic Separation Scheme
- Land of British Columbia
- Land of Washington State
- Boundaries of the Salish Sea
- Marine RSA (Transportation)

Projection: UTM Zone 10N; Marine Vessel Inbound Shipping Lane: Moffatt & Nichol, 2013a; Marine Vessel Outbound Shipping Lane: Moffatt & Nichol, 2013b; International Border: British Columbia Ministry of Energy and Mines, 2013; Canadian 12 Nautical Mile Territorial Boundary and Traffic Separation Scheme: Canadian Hydrographic Service, 2013; Bathymetry: Canadian Hydrographic Service, 2011; Watercourse: National Hydro Network, 2007; Existing Pipeline: Kinder Morgan Canada, 2012; Trans Mountain Expansion Proposed Pipeline Corridor: Universal Pegasus International, 2013; Provincial Park: BC MFLNRO, 2008a; Land of British Columbia: National Topographic Data Base, 2007; Land of Washington State: Washington State Department of Ecology, 1994; Salish Sea Boundary: Bartnik et al., 2002.

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TRANS MOUNTAIN

FIGURE: 4.2-1

BOUNDARIES OF THE SALISH SEA

TRANS MOUNTAIN EXPANSION PROJECT

To the east, shipping lanes are bounded by the mainland coasts of BC and Washington, and the Fraser River Delta which drains into the Strait of Georgia. The Olympic Peninsula in Washington is to the southwest. The shipping lanes transit among the numerous islands and islets belonging to either the Gulf Islands or San Juan Islands, forming an archipelago of diverse marine habitats.

The shipping lanes extend across the Strait of Georgia and the Juan de Fuca Marine Ecodistricts within the Georgia Basin Marine Ecoregion. The physiographic, oceanographic and biological characteristics of these classifications described in Harding (1997) are summarized in Table 4.2.1.1.

TABLE 4.2.1.1

CHARACTERISTICS OF MARINE ECOREGION AND ECODISTRICTS

Marine Ecoregion/Ecodistrict	Physiographic Characteristics	Oceanographic Characteristics	Biological Characteristics
Georgia Basin Marine Ecoregion	Large strait characterized by numerous channels, fjords, islands and adjacent coastal lowlands.	Enclosed basin with large freshwater input (including Fraser River); high turbidity; generally well stratified with estuarine-like circulation patterns.	Neritic, estuarine plankton species. Productive and protected habitats for juvenile fish and invertebrates, some productive benthic invertebrate areas. Marine mammals such as seals are abundant. Feeding area for marine birds (shorebirds, waterfowl and seabirds).
Strait of Georgia Ecodistrict	Broad shallow basin surrounded by coastal lowlands (Georgia Depression).	Warm, protected coastal waters with substantial freshwater input, high turbidity; seasonally stratified.	Neritic plankton community. Nursery area for Pacific salmon and herring. Abundant shellfish habitat.
Juan de Fuca Marine Ecodistrict	Deep trough, a major structural feature accentuated by glacial scour.	Semi-protected coastal waters with strong estuarine circulation (coast-hugging, buoyancy-driven current to north) and major water exchange conduit with inland sea.	Mixture of neritic and oceanic plankton species; migratory corridor for anadromous fish (Pacific salmon); moderately productive.

The existing conditions for each element are described with respect to a LSA, RSA, or both (Table 4.2.1.2). Separate spatial boundaries have been established for Marine Air Quality (Section 4.2.3), Marine Birds (Section 4.2.8), and Human Health Risk Assessment (HHRA) (Section 4.2.12). These element-specific spatial boundaries are described in their respective subsections.

- **Marine LSA -** includes the inbound and outbound marine shipping lanes, the area between the shipping lanes, where it exists, and a 2 km buffer extending from the outermost edge of each shipping lane. The shipping lanes extend from the Westridge Marine Terminal in Burnaby, through Burrard Inlet, south through the southern part of the Strait of Georgia, the Gulf Islands and Haro Strait, then westward past Victoria and through Juan de Fuca Strait out to the 12 nautical

mile limit of Canada's territorial sea, corresponding to the line of longitude of Buoy J.

- **Marine RSA -** comprised of a large portion of the Salish Sea, including the inland marine waters of the southern Strait of Georgia and Juan de Fuca Strait and their connecting channels, passes and straits. The RSA is generally centred on the marine shipping lanes, which extend from the Westridge Marine Terminal through Burrard Inlet, south through the southern part of the Strait of Georgia, the Gulf Islands and Haro Strait, westward past Victoria and through Juan de Fuca Strait out to the 12 nautical mile limit of Canada's territorial sea. The western boundary of the Marine RSA extends further out to sea than the western boundary of the Salish Sea and the northern boundary of the Marine RSA is limited to the southern portion of the Strait of Georgia. Puget Sound is excluded from the Marine RSA.

Puget Sound is excluded from the Marine RSA due to its distance from the shipping lanes and because it is partially separated from the Juan de Fuca Strait by the archipelago of islands that lie at its northern end.

The study areas also follow guidance indicated by the NEB in the letter titled Filing Requirements Related to the Potential Environmental and Socio-Economic Effects of Increased Marine Shipping Activities (NEB 2013b), received by Trans Mountain on September 10, 2013. The letter indicates that the marine transportation assessment should take place out to the 12 nautical mile limit of Canada's territorial seas.

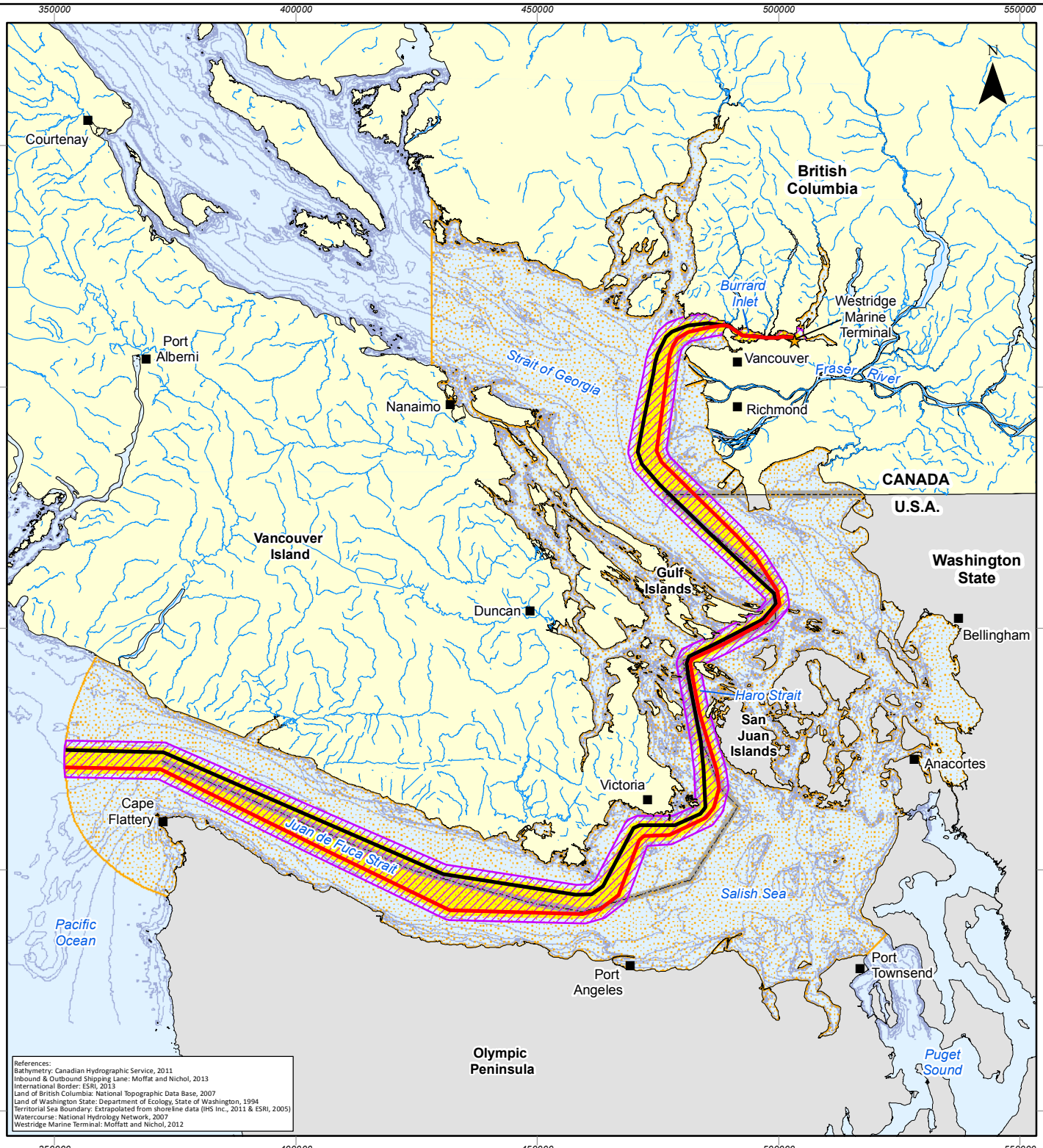
TABLE 4.2.1.2

MARINE LOCAL STUDY AREA AND MARINE REGIONAL STUDY AREA ELEMENTS

Spatial Boundary	
Marine LSA[1]	**Marine RSA**
Marine Acoustic Environment, Marine Fish and Fish Habitat, Traditional Marine Resource Use, and MCRTU	Marine Acoustic Environment, Marine Fish and Fish Habitat, Marine Mammals, Marine Birds, Traditional Marine Resource Use, and MCRTU

Note: [1] The LSA for traditional marine resource use includes the area that encompasses the Marine LSA (for Marine Fish and Fish Habitat) as well as the Marine Birds LSA since traditional marine resource use is dependent on these resources.

Spatial boundaries (excluding the Marine Air Quality and HHRA spatial boundaries) are shown on Figure 4.2.2.



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SCALE: 1:1,150,000

0 10 20 30 40 km

ALL LOCATIONS APPROXIMATE

- Westridge Marine Terminal
- Town / City
- Inbound Shipping Lane
- Outbound Shipping Lane
- International Border
- Bathymetry
- Watercourse
- Land of British Columbia
- Land of Washington State
- Waterbody
- Marine RSA
- LSA (1 km Buffer) for Marine Birds
- LSA (2 km Buffer) for
  - Marine Noise
  - Marine Fish and Fish Habitat
  - Traditional Marine Resource Use
  - Marine Commercial, Recreational, and Tourism Use

MAP NUMBER: 10494_EA_TRANS_MAR_04_02_02		PAGE: SHEET 1 OF 1
DATE: Aug 2013	REF.: 7894	REVISION: A
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DRAWN: SS	CHECKED: DP	DESIGN: SD

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TRANS MOUNTAIN

FIGURE: 4.2-2

MARINE LOCAL AND REGIONAL STUDY AREAS

TRANS MOUNTAIN EXPANSION PROJECT

4.2.1.1 Existing Habitat Disturbances

Like many other coastal zones around the world, the inland sea ecosystem that is to be used by the Project-related marine vessel traffic is currently affected by a growing human population and conversion of shoreline habitat to urban/industrial development. Consequences have included contamination of sediments and species and an overharvesting of resources. In recent history, marine shorelines in Burrard Inlet have been dramatically altered for industrial or residential use, with the exception of some federally and provincially designated conservation areas. The increased Project-related marine vessel traffic will use the existing anchorages and shipping lanes for 100 per cent of their route. The potential disturbances to marine species and habitats from the Project should be considered within the context of a large volume of existing small and large vessel traffic.

4.2.1.2 Conservation Areas

The provincial component of the region includes provincial Marine Protected Areas (MPAs), Important Bird Areas (IBAs), Ecological Reserves, Provincial Parks and Wildlife Management Areas (WMAs). Federal protection designations include Migratory Bird Sanctuaries (Canadian Wildlife Service [CWS]), Fisheries and Oceans Canada (DFO) MPAs, Rockfish Conservation Areas (RCAs), National Marine Conservation Areas (Parks Canada), National Parks of Canada (Parks Canada), National Wildlife Areas (NWAs), and Critical Habitat (*Species at Risk Act* [*SARA*]). Figure 4.2.3 shows the conservation areas described. The Gulf Islands National Park Reserve in the Strait of Georgia supports approximately 36 km^2 of terrestrial and marine habitat on 15 islands and various islets and reefs (Parks Canada 2013a). As part of the Pacific Flyway, both pelagic and coastal waters are used seasonally by a wide variety of breeding, foraging and over-wintering marine birds especially in extensive tidal mudflats, eelgrass beds, rocky offshore islets and old-growth forests (Parks Canada 2009a).

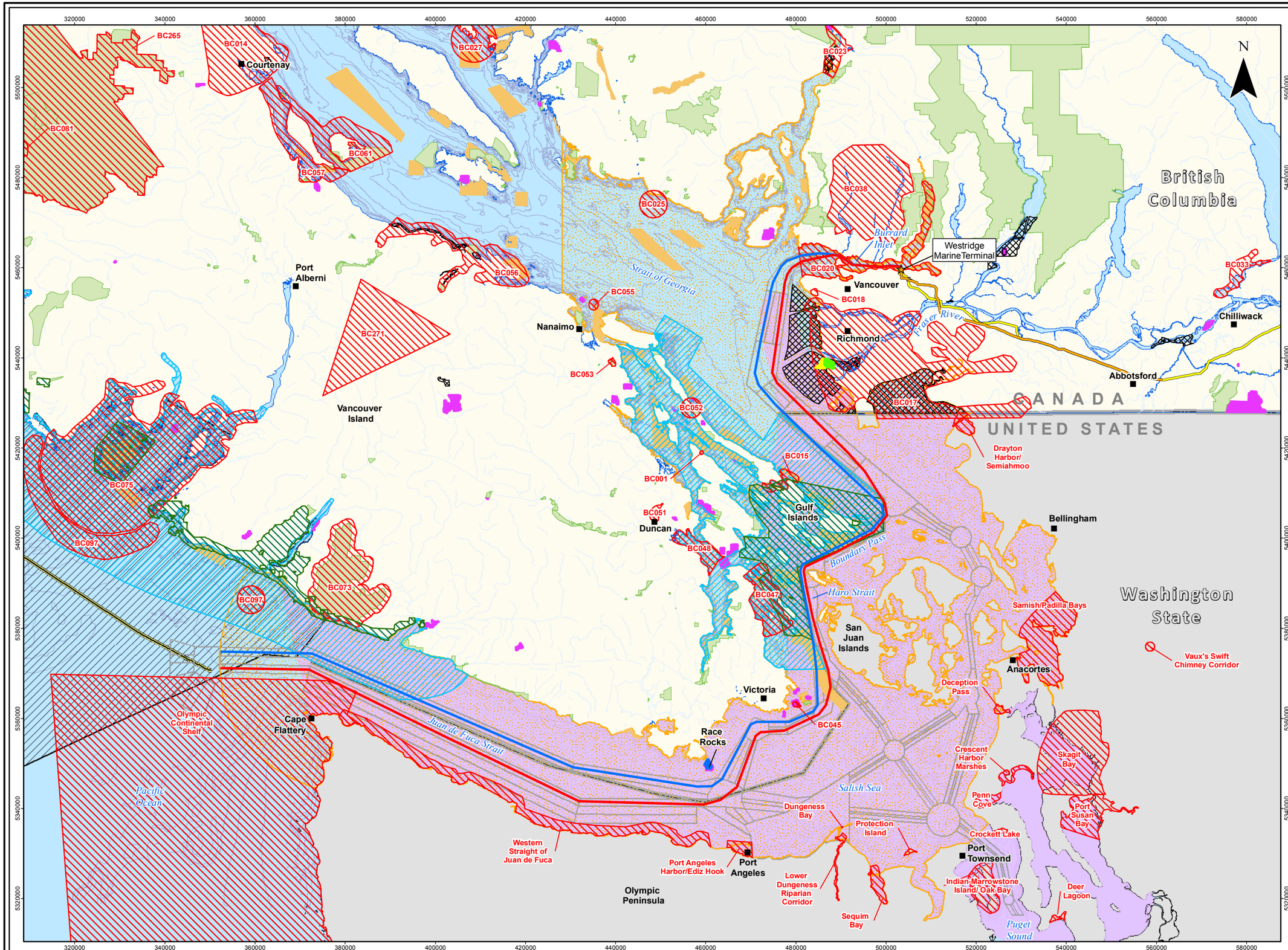
While there is the potential for additional conservation areas (*e.g.*, MPAs) to be designated in the vicinity of the established shipping lanes, these areas are not likely to impede the passage of ships.

TRANS MOUNTAIN

FIGURE: 4.2-3

CONSERVATION AREAS IN AND NEAR THE MARINE RSA

TRANS MOUNTAIN EXPANSION PROJECT



- Westridge Marine Terminal
- Town / City
- Marine Vessel Inbound Shipping Lane
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- International Border
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- Watercourse
- Existing Trans Mountain Pipeline
- Trans Mountain Expansion Proposed Pipeline Corridor
- Waterbody
- Land of British Columbia
- Land of Washington State
- Traffic Separation Scheme
- Marine RSA (Transportation)
- National Marine Conservation Area
- Marine Protected Area
- National Park
- Provincial Park
- Ecological Reserve
- Rockfish Conservation Area
- Important Bird Area
- Wildlife Management Area
- Migratory Bird Sanctuary
- National Wildlife Area
- Southern Resident Killer Whale Critical Habitat
- Humpback Whale Critical Habitat

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SCALE: 1:800,000

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ALL LOCATIONS APPROXIMATE

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4.2.1.3 Species of Conservation Concern Designations

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) uses the best available biological information to assess species that are in danger of becoming extinct. This information is compiled by COSEWIC into Status Reports and recommendations to the federal government for species designations as Extinct, Extirpated, Endangered, Threatened, Special Concern, Not at Risk, or Data Deficient. Marine species of conservation concern receive federal legal protection under *SARA*, which is a commitment to prevent at risk wildlife species from becoming extinct and to secure the necessary actions for their recovery. *SARA* also provides for the conservation of biological diversity. Under Schedule 1 of *SARA* S.C. 2002, c. 29, Section 32 (1) "No person shall kill, harm, harass, capture or take an individual of a wildlife species that is listed as an Extirpated, Endangered or Threatened species as that species has legal protection related to species' residence and critical habitats".

The BC List Status is assigned by the British Columbia Conservation Data Centre (BC CDC) and depends upon the provincial (S) ranking or conservation status of that species. S rankings are: (1) critically imperiled, (2) imperiled, (3) special concern, (4) apparently secure, and (5) secure.

The federal and provincial conservation designations that apply to species discussed in this ESA are defined as follows:

Federal (*SARA* and COSEWIC Status) (Government of Canada 2013a, b):

- **Endangered** - a species facing imminent extirpation or extinction;
- **Threatened** - a species that is likely to become Endangered if limiting factors are not reversed;
- **Special Concern** - a species with characteristics that make it sensitive to human activities or natural events;
- **Not at Risk** – a species that has been evaluated and found to be not at risk; and
- **Data Deficient** – a species for which there is insufficient scientific information to support status designations.

Provincial (BC List Status) (BC CDC 2013):

- **Red** – an indigenous species or subspecies that is a candidate to become Extirpated, Endangered or Threatened in BC;
- **Blue** – an indigenous species or subspecies of Special Concern in BC and that is sensitive to human activity or natural events;
- **Yellow** – a species that has secure populations;
- **Accidental** – a species occurring infrequently or unpredictably outside of its usual range;
- **Unknown** – provincial status is unknown due to extreme uncertainty (*i.e.*, more inventory or data gathering is needed); and

- **Exotic** – not native to BC.

4.2.1.4 Physical Environment

A summary of the general physical oceanographic characteristics of the Strait of Georgia and Juan de Fuca Strait Marine Ecodistricts described in Thomson (1981) is provided in the following descriptions.

4.2.1.4.1 Physical Oceanography

Strait of Georgia

The Strait of Georgia is a portion of the Georgia Basin that lies between the Coast Mountain range and Vancouver Island. Eastern portions of the Strait are characterized by fjords and a complex of islands, sounds and passages. Western portions are characterized by few inlets and a more regular coastline. The Strait is approximately 222 km long, an average of 28 km wide and an average of 155 m deep. Only 5 per cent of the total of area of the Strait has depths that exceed 360 m and the maximum recorded depth is 420 m immediately south of Texada Island.

The main sources of freshwater that discharge into the Strait of Georgia are the Fraser River, which empties directly into the basin near Vancouver and the Squamish River that enters the Strait via Howe Sound. Other sources of freshwater input into the Strait include the Cowichan, Chemainus, Nanaimo, and Courtenay rivers on Vancouver Island and the numerous rivers that empty into the inlets on the eastern side of the Strait.

The water column in the Strait of Georgia has a two-layer structure based on temperature and salinity; the upper layer occurs at depth of less than 50 m and the lower layer extends from 50 to 420 m depth. Water temperatures in the upper layer vary by season and location and range from 5 to 20°C. Temperatures are coldest between February and March when they average 5 to 6°C and warmest in July and August when they can exceed 20°C in middle portions of the Strait and sheltered areas. Water temperatures in the lower layer are nearly uniform throughout the year, ranging from 8 to 10°C.

Salinity also varies in the upper layer depending on season and distance from the mouth of the Fraser River estuary where salinity levels are comparatively low due to the large freshwater input. From December to April, the salinity level in areas under direct influence of the Fraser River can be as low as 2.5 per cent in the upper layer, while salinities in other areas range from 2.7 to 2.9 per cent during this period. From May to July, runoff from the Fraser River can result in a salinity level of only 1.5 per cent in the upper layer of most central and southern areas of the Strait. Northern areas of the Strait have an average salinity of 2.5 per cent or greater during this period. Salinity at the top of the lower layer averages 2.9 per cent, while near-bottom values of salinity average 3.0 per cent in summer and 3.1 per cent in winter.

Wind patterns in the Strait of Georgia are influenced by seasonal weather patterns and by the funnelling effects of Juan de Fuca Strait, Puget Sound and the Fraser Valley. The prevailing winds are from the northwest in summer and southeast in winter in exposed areas of the Strait.

The tidal range along the BC coast is usually 3 to 5 m, with greater ranges during June and December and smaller ranges during March and September. Tides in BC, including the Strait of Georgia, are predominantly mixed diurnal and semidiurnal, with only a few days each month having purely diurnal or semidiurnal tides. Mixed tides on the West Coast have a diurnal inequity, meaning there is a difference in tidal heights between successive high tides and

successive low tides. There is also a cyclic 14 day variation in the diurnal inequity during which high tide becomes continually higher and low tide continually lower for about 7 days and then high tides become lower and low tides become higher for the next 7 days.

Currents in the Strait of Georgia are highly complex and are influenced by tides, winds, river discharge, channel bathymetry, the Coriolis force and centrifugal forces. The relative importance of these factors varies along the length of the Strait, resulting in a diversity of circulation patterns. In general, there is a counterclockwise circulation pattern in the Strait and a smaller counterclockwise gyre to the south of Sand Heads and Active Pass. Central and southern portions of the Strait are characterized by strong tidal streams and by the influence of the Fraser River runoff, which directs waters southwesterly toward the Gulf Islands and enhances wind-generated currents. In summer, outflow speeds near the mouth of the Fraser River can reach 2.5 m/s near low water during large tides and speeds of 1.0 to 1.5 m/s during less extreme low tides, decreasing to around 0.5 m/s within 5 km of the river mouth. Outflow speeds are typically below 0.5 m/s at high tide. Current speeds of 0.5 to 1.0 m/s are common in other areas of the central Strait, driven by winds, tides and poorly understood residual currents. Tidal currents in the southern Strait can attain speeds of 0.5 m/s during normal tides. The northern portion of the Strait is characterized by weak and variable tidal currents which attain speeds of about 0.1 m/s in most areas.

Juan de Fuca Strait

Juan de Fuca Strait is a submarine valley between Vancouver Island and the Olympic Mountains. The Strait has a gently sloping U-shaped profile east of the line between Jordan River and Pillar Point and a V-shaped profile to the west of this line to the Pacific Ocean entrance off Cape Flattery. Further seaward of the Pacific entrance, the channel turns to the southwest and becomes irregular with deep incisions such as the Juan de Fuca Canyon. A cross-channel sill cuts across the Strait south of Victoria, BC.

Juan de Fuca Strait has a total length of approximately 160 km and averages 22 to 28 km wide from its entrance to about 100 km eastward. It narrows to about 18 km in width between Race Rocks and Port Angeles before widening again to about 40 km width to the eastern boundary at Whidbey Island. Overall, Juan de Fuca Strait is shallower than the Strait of Georgia. The maximum depth of Juan de Fuca Strait is about 250 m at mid-channel near the Pacific entrance. The depth decreases gradually inland to approximately 180 m east of Cape Flattery. Shallower depths of about 55 m are found over the sill south of Victoria. There are several shallow banks east of the sill with deeper channels that lead into Haro Strait, Rosario Strait, Admiralty Inlet, and Deception Pass.

Water temperatures in Juan de Fuca Strait are cold year-round, ranging from 8 to 14°C at the surface due to its direct exposure to the Pacific Ocean, upwelling and mixing by strong tidal streams. Temperatures may also decrease a few degrees with increasing depth. In summer, surface waters can reach a maximum of 12 to 14°C with localized solar heating and input of warmer waters from the Strait of Georgia. In winter, surface temperatures range from 8 to 10°C, with the coldest waters occurring in the eastern portions of the Strait. Bottom temperatures remain cold year-round. In general, salinity in Juan de Fuca Strait increases from top to bottom and from east to west. In winter, salinity averages 3 to 3.1 per cent in the surface waters and 3.3 per cent in bottom waters near the Strait entrance. In spring and summer, average salinity of the surface waters decreases to 2.6 to 2.8 per cent in Haro Strait and to 2.8 to 3 per cent in the eastern portions of Juan de Fuca Strait due to freshwater runoff from the Fraser River.

Wind patterns in Juan de Fuca Strait are influenced by seasonal weather patterns and by the adjacent mountain terrain of the Olympic Mountains. Prevailing winds in Juan de Fuca Strait are from the east in winter and from the west in summer. Winds greater than 15 m/s occur an average of 10 to 15 days per month in winter and only 1 to 2 days per month in summer. Wind speeds tend to increase from east to west along the Strait, with weak and variable winds prevailing over easterly portions of the Strait.

As with the Strait of Georgia, tides in Juan de Fuca Strait are characterized by mixed diurnal and semidiurnal tides, with a diurnal inequality. From the Pacific entrance of the Strait east to Race Rocks, the tides are mainly semidiurnal, and from Race Rocks east to the southern Strait of Georgia, the tides are mainly diurnal. Tidal range varies along the Strait, with the average tidal range decreasing from 2.4 m off Cape Flattery to a minimum of 1.8 m near Victoria, before increasing again to 2.4 m around Haro Strait. Tidal range also varies between the Canadian and US sides of the Strait, with the US side having a larger tidal range.

Currents in Juan de Fuca Strait are influenced by tides, freshwater runoff, winds and atmospheric pressure differences, channel curvature and bathymetry and the Coriolis force. Flood currents during incoming tides move northward along the Washington coast, turn into Juan de Fuca Strait north of Cape Flattery and are then directed down-channel parallel to the axis of the Strait before moving northwest into the Strait of Georgia. At maximum flood, tidal currents in the Strait reach speeds of 0.7 to 1.3 m/s on large spring tides. In the eastern portion of the Strait, speeds of 1.8 m/s can occur on large tides in the eastern portion of the Strait. Currents in narrow channels in the vicinity of Race Rocks and Victoria can reach speeds of 2.5 m/s at times. Ebb currents generally flow in the opposite direction of flood currents. Ebb currents are noticeably stronger and of longer duration than flood currents in the upper 100 m due to river runoff into the Strait of Georgia and Puget Sound; however, flood currents are stronger and of longer duration below this depth as oceanic water moves inward to replace the water carried to the Pacific in the surface layer. Estuarine processes produce residual currents in Juan de Fuca Strait that are poorly understood and can lead to unpredictable current patterns.

4.2.1.4.2 Wave Conditions

The general wave conditions in the Strait of Georgia and Juan de Fuca Strait are described in Thomson (1981) and summarized in the following text.

Strait of Georgia

Wave heights in the Strait of Georgia are primarily limited by the distance over open water that wind has blown (fetch) and to a lesser extent, wind strength and duration. The Strait has a length of about 222 km; however, the total fetch is further limited by obstructions such as Texada and Lasqueti islands.

Wave conditions were studied at three buoy locations in the Strait of Georgia between 1973 and 1976, including West Vancouver in Burrard Inlet, Sturgeon Bank and Roberts Bank (Thompson 1981). The significant wave heights (average wave height of the highest third of waves) recorded during the observation period did not exceed 2.7 m at Sturgeon Bank and 2.1 m at Roberts Bank with corresponding maximum wave heights less than 4.0 m and 3.3 m, respectively. Significant wave heights off West Vancouver were always less than 1.0 m. Average wave heights at Sturgeon Bank and Roberts Bank exceeded 0.8 m ten per cent of the time. Maximum wave heights at these locations exceeded 1.2 m 10 per cent of the time, and

0.3 m 60 per cent of the time. At the West Vancouver buoy, maximum wave heights were greater than 0.6 m 10 per cent of the time and greater than 0.3 m 30 per cent of the time.

Juan de Fuca Strait

Studies of wave conditions in Juan de Fuca Strait are limited, and empirical wind-wave relationships are often used to estimate wave heights. As with the Strait of Georgia, wave heights are limited by the total fetch of 160 km and the strength and duration of the wind. Waves generated by winds in Juan de Fuca Strait are expected to generate wave conditions similar to the Strait of Georgia. However, the western portion of Juan de Fuca Strait is exposed to the Pacific Ocean, so long-period swells with larger wave heights propagate inland along the entire length of the Strait from open waters, regardless of winds. Wave heights from these swells gradually decrease as they travel east along the Strait. Wave records from the West Coast of Vancouver Island indicate that maximum probable wave heights near the Strait entrance exceed 6 m at least ten per cent of the time in winter and exceed 3 m about ten per cent of the time in summer, with an average period of 9 to 10 seconds.

The federal government maintains 16 offshore buoys in Canadian Pacific waters. There are three of these buoys located in the vicinity of the marine shipping lanes including Halibut Bank and Patricia Bay in the Strait of Georgia and La Pérouse Bank off Vancouver Island, northeast of the entrance to Juan de Fuca Strait (DFO 2009a). Table 4.2.1.3 shows the maximum, minimum and average significant wave heights from historical buoy data from DFO (2013a). Significant wave height is defined as the average wave height of the highest third of waves observed during a defined observation period. Heights are measured as the vertical distance between successive crests and troughs.

TABLE 4.2.1.3

WAVE OBSERVATIONS AT SELECTED BUOY LOCATIONS NEAR THE MARINE SHIPPING LANES

Parameter	C46146 (Halibut Bank)	C46134 (Patricia Bay)	C46206 (La Pérouse Bank)
Latitude	49° 20.4' N	48° 39.4' N	48° 50.1' N
Longitude	123° 43.6' W	123° 29.0 W	125° 59.9' W
Depth (m)	43	65	73
Start Date	Mar. 13, 1992	Feb. 19, 2001	Nov. 22, 1988
End Date	May 27, 2013	May 27, 2013	May 27, 2013
Maximum significant wave height (m) during observation period	4.93	4.33	19.51
Minimum significant wave height (m) during observation period	0.00	0.00	0.00
Average significant wave height (m) during observation period	0.33	0.06	2.23

Note: Significant wave height is defined as the average wave height of the highest third of waves observed. Heights are measured as the vertical distance between successive crests and troughs.

4.2.1.5 United States of America Waters

Physical oceanography and wave conditions are generally similar across US and Canadian waters in Juan de Fuca Strait. In addition, existing habitat disturbances are similar in type as well as frequency. The Washington State Department of Fish and Wildlife (WDFW) has set aside certain areas of Puget Sound marine waters for the protection and preservation of marine species and/or habitats. These are generally known as MPAs and include 9 Conservation Areas, 16 Marine Preserves and 2 Sea Cucumber and Sea Urchin Commercial Harvest Exclusion Zones. The greater San Juan Island archipelago holds the most MPAs. The north coast of the state has the largest MPA, the Olympic Coast National Marine Sanctuary. Several state parks, IBAs, federal historical parks, and federal marine sanctuaries are also present in Puget Sound (Van Cleve *et al.* 2009, WDFW 2013a) as well as MPAs administered by other agencies, such as the Department of Natural Resources.

4.2.2 Marine Water and Sediment Quality

This subsection provides a general description of marine water and sediment quality along the marine shipping lanes, from the Westridge Marine Terminal to the 12 nautical mile limit of Canada's territorial sea (shown in Figure 4.2.1). Information about Burrard Inlet east of First Narrows is provided in the Marine Sediment and Water Quality – Westridge Marine Terminal Technical Report of Volume 5C.

Information pertaining to marine sediment and water quality in US waters can be found in Section 4.2.2.2. A discussion of the potential effects of the increased Project-related marine vessel traffic on marine sediment and water quality is located in Section 4.3.2.

4.2.2.1 General Information

Marine water and sediment quality is influenced by general oceanographic processes and, in some areas, strongly influenced by freshwater inputs (Section 4.2.1.4). In the Strait of Georgia, the Fraser River contributes a large sediment load annually within its delta, and the freshwater plume (surface lens) extends well into the Strait, particularly during spring freshet. There are similar but more localized influences around the numerous smaller rivers that enter the Salish Sea.

There is some baseline water and sediment quality information available in the vicinity of the marine shipping lanes and in the broader Georgia Basin Marine Ecoregion. Marine monitoring studies are typically developed for specific purposes, for example, to document the effects of specific contaminant sources, where the approach, parameters of interest and results differ, depending on the study purpose. There are no available studies documenting ambient contaminant levels over the marine shipping lanes. Results from the following long-term monitoring programs indicate good water quality, particularly in well-mixed areas.

- University of British Columbia Oceanography Department, Stratogem Project three-year study (2001-2004) of oceanography (currents, salinity, temperature, and oxygen) and productivity (phytoplankton chlorophyll a and zooplankton) of the Strait of Georgia. The study investigated the role of natural physical variability and changing human influences (climate change and nutrient regimes) in regulating biological production and factors influencing salmon populations (University of British Columbia 2004).

- Washington State Department of Ecology (2013a) long-term marine water quality dataset (several stations sampled monthly since 1977 in Puget Sound and eastern Juan de Fuca Strait for temperature, salinity, dissolved oxygen, chlorophyll, and pH).

- Coast Salish Tribal Journey Water Quality Project (2013), the Coast Salish Nation and Swinomish Indian Tribal Community in partnership with US Geological Survey have collected temperature, salinity, dissolved oxygen, pH and turbidity data since 2008 on summer canoe journeys along the coast of the Salish Sea (US Geological Survey 2013).

- Puget Sound Georgia Basin Ecosystem Initiative (undated), a partnership of Environment Canada and the US Environmental Protection Agency, which included seasonal surveys of water stratification (temperature and salinity) at numerous locations from 1999 to 2004, to identify areas with potential sensitivity to human activities.

Within the Georgia Basin Marine Ecoregion, there are major population centers (Vancouver and Victoria, BC and Seattle, Washington) and smaller communities where human activities can contribute contaminants to marine water. Within the well-mixed waters of the shipping lanes; however, any contaminants are likely to be diluted. The shipping lanes through the Strait of Georgia out through Juan de Fuca Strait are not adjacent to human activities. The exception is Burrard Inlet. Industrial activities within Burrard Inlet include railways, wood treatment, concrete and cement manufacture, marinas, port terminals and operations, lumber mills, cruise ships, fishing and boat maintenance, shipyards, metal and auto recycling, fish processing, animal by-product rendering, and aquaculture. These activities can be sources of pesticides, fertilizers, nutrients, bacteria, metals, hydrocarbons, and chlorinated organic compounds. Point (*e.g.*, treated and untreated sewage) and non-point (*e.g.*, recreational vessels, road runoff) source discharges also contribute contaminants. The ambient monitoring program for Burrard Inlet (Nautilus Environmental 2006) has included bi-annual surveys of water, sediment and biota at seven locations since 2006 (water parameters include pH, nutrients, metals, oil and grease, bacteria, salinity). There are ongoing water and sediment monitoring programs associated with wastewater treatment plant discharges (*e.g.,* Metro Vancouver programs for Lions Gate and Iona Wastewater Treatment Plants [Metro Vancouver 2013]; Capital Regional District [CRD] programs for Macauly and Clover Point outfalls [CRD 2011] and stormwater discharges (*e.g.,* CRD 2010, 2012). Baseline water quality data were collected on Roberts Bank for the Deltaport Third Berth Project environmental assessment (Hemmera Envirochem 2005). The Fraser River Action Plan included numerous studies of contaminant levels and effects of human activities on conditions in the Fraser River watershed that provide historical context (to the mid-1990s) for sediment conditions in the river and the delta (Fraser River Action Plan. Undated). Sediment surveys have been conducted in the southern Strait of Georgia and Juan de Fuca Strait for the Washington State Department of Ecology since 1989 (Dutch *et al.* 2008, Partridge *et al.* 2013). This includes monitoring at ten locations at a five-year interval for particle size, total organic carbon, metals, butyl tins, organic compounds including polycyclic aromatic hydrocarbons, chlorinated pesticides, polychlorinated bi-phenyls and polybrominated dichloroethylene in sediment, with results presented in Washington State Department of Ecology (2013b).

Shipping activities have the potential to affect water quality through release of ballast or bilge water. However, these activities are regulated through the *Canada Shipping Act* (2001), apply to Canadian vessels operating in all waters and to all vessels operating in Canadian waters and are not expected to be sources of contaminants in the marine shipping lanes. Ballast water is

required to be exchanged mid-Pacific to avoid introduction of invasive alien species at a terminal (as discussed in Section 7.6 of Volume 5A). However, subject to Port guidance, a vessel is allowed to release ballast water while taking on cargo. Bilge water must be treated to remove oils and grease prior to discharge. Therefore, any releases of oily water would be due to an accident or malfunction (Section 4.3.13) and not routine operations. Reports of marine oil spills and sheens are addressed through the Regional Marine Information Centre, which coordinates a response through various agencies, including the CCG. Given that spills and sheens can originate from land or sea (commercial or recreational marine vessels), it can be challenging to identify a source.

4.2.2.2 US Waters

Contaminant sources and concentrations are expected to be similar in US and Canadian waters, given the similar types of activities in Washington and BC. Three of the monitoring programs discussed in Section 4.2.2.1 include sampling stations in both US and Canadian waters.

4.2.3 Marine Air Emissions

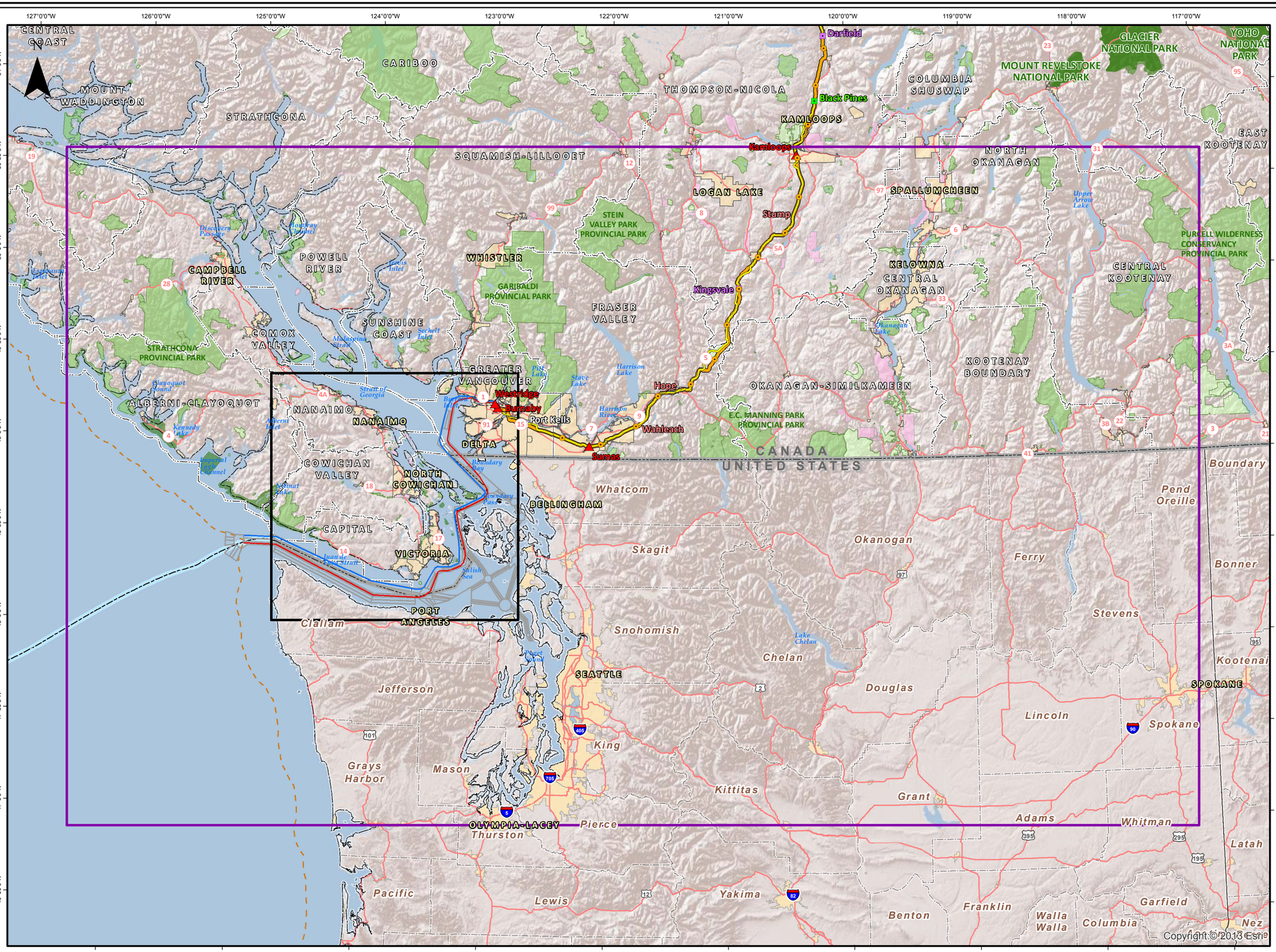
This subsection provides a general description of marine air emissions along the marine shipping lanes, from the Westridge Marine Terminal to the 12 nautical mile limit of Canada's territorial sea (shown in Figure 4.2.1). More detailed technical information pertaining to marine air emissions is presented in the Marine Air Quality and Greenhouse Gas – Marine Transportation Technical Report (Volume 8B, TR 8B-3).

Information pertaining to marine air emissions in US waters can be found in Section 4.2.3.9. A discussion of the potential effects of the increased Project-related marine vessel traffic and associated mitigation as well as a discussion of the spatial boundaries for marine air emissions are located in Section 4.3.3.

4.2.3.1 Spatial Boundaries

The existing air quality conditions are described within the Marine Air Quality RSA and Lower Fraser Valley Photochemical Model Domain (LFV), as illustrated on Figure 4.2.4.

- **Marine Air Quality RSA** - a 150 km × 150 km area. The Marine Air Quality RSA is generally centered on the marine shipping lanes, which extend from the Westridge Marine Terminal through Burrard Inlet, south through the southern part of the Strait of Georgia, the Gulf Islands and Haro Strait, westward past Victoria and Juan de Fuca Strait out to the 12 nautical mile limit of Canada's territorial sea.
- **LFV** - a 412 km × 688 km area at 4 km resolution centred on the Lower Fraser Valley and covering southern BC and northern Washington State, including Vancouver Island, Juan de Fuca Strait, and the Salish Sea. This inner domain is embedded in a larger 1,068 km × 840 km intermediate domain at 12 km resolution covering the southern half of BC plus Washington and Oregon states in the US. The intermediate domain is embedded in a 3,420 km × 3,348 km parent domain at 36 km resolution covering much of western North America including BC and Alberta and the US Pacific states. Emissions scenarios for the Project will be implemented over the inner 4 km resolution domain, with the boundary condition determined from baseline 36 km and 12 km model results.



TRANS MOUNTAIN

FIGURE 4.2-4

AIR QUALITY SPATIAL BOUNDARIES

TRANS MOUNTAIN EXPANSION PROJECT

- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Terminal
- Pump Station (Pump Additions, Station Modifications and/or Scraper Facilities)
- New Pump Station (Proposed)
- Pump Station (Reactivated)
- Existing Pump Station
- Highway
- Road
- Lower Fraser Valley Study Area
- Marine Air Quality RSA
- 12 Nautical Mile Limit (Territorial Sea)
- Limit of Exclusive Economic Zone (EEZ)
- International Boundary
- Marine Vessel Outbound Shipping Lane
- Marine Vessel Inbound Shipping Lane
- Traffic Separation Scheme
- City / Town / District Municipality
- Indian Reserve / Métis Settlement
- National Park
- Provincial / State Park
- Protected Area/Natural Area/ Provincial Recreation Area/Wilderness Provincial Park/Conservancy Area
- Regional District Boundary

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Projection: Modified Lambert Conformal Conic (LCC).
Routing: Baseline TMPL Route Revision 0, provided by KMC, May 2012. Proposed Corridor V6 provided by UPI, August 23, 2013.; Transportation: BC Forests, Lands and Natural Resource Operations, 2012 & ESRI, 2005; Geopolitical Boundaries: IHS Inc., 2011, BC FLNRO, 2007, ESRI, 2005, & ESRI, 2013, Natural Resources Canada, 2012; First Nation Lands: Government of Canada, 2013 & IHS Inc., 2011; Hydrology: IHS Inc., 2004, United States National Imagery and Mapping Agency, 2000, Natural Resouces Canada, 2010; Parks and Protected Areas: Natural Resources Canada, 2013, BC FLNRO, 2008 & ESRI, 2005; CHS Marine Features: Government of Canada, 2013; Marine Vessel Inbound/Outbound Shipping Lanes: Moffatt and Nichol, 2013; Hillshade: ESRI, 2009.

RWDI

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

MAP NUMBER		PAGE
1202006_TMEP_RWDI_AQ_FIG4.2-4		SHEET 1 OF 1
DATE	TERA REF.	REVISION
December 2013	7894	0
SCALE	PAGE SIZE	DISCIPLINE
1:2,200,000	11x17	AIR
DRAWN	CHECKED	DESIGN
NBN	AKH	TGG

0 15 30 45 60 75 km

ALL LOCATIONS APPROXIMATE

1202006_TMEP_RWDI_AQ_FIG4.2-4.mxd

4.2.3.2 Indicators

Four indicators were selected to represent potential effects from Project-related marine vessel traffic on marine air emissions:

- primary emissions of criteria air contaminants (CACs) such as sulphur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), particulate matter (PM);
- primary emissions of volatile organic compounds, such as BTEX (defined as the sum of benzene, toluene, ethyl benzene, and xylene);
- formation of secondary PM and ozone; and
- visibility.

The marine air emissions indicators represent common sources of air quality contaminants and their effects in the atmosphere. See Section 4.3 for more information regarding indicators.

4.2.3.3 Legislation

The North American Emission Control Area, under MARPOL, came into effect on August 1, 2012, bringing in stricter controls on air emissions from ships trading off the coasts of Canada, the US and the French overseas collectivity of Saint-Pierre and Miquelon. Under the legislation, emissions of NOx and SOx are expected to decrease within the Emissions Control Area, which extends approximately 200 nautical miles off the Pacific Coast.

New energy efficiency standards were also adopted by the IMO in July 2011. These standards require all vessels to carry a Ship Energy Efficiency Management Plan. In addition, these standards set requirements for new vessels built after June 30, 2013 to have calculated their Energy Efficiency Design Index (EEDI) and to meet its required efficiency target. The EEDI provides a standardized indicator of a new vessel's energy efficiency. These EEDI requirements are expected to improve air emissions from new vessels in the future.

This legislation is detailed in the Marine Air Quality and Greenhouse Gas - Marine Transportation Technical Report (Volume 8B, TR 8B-3).

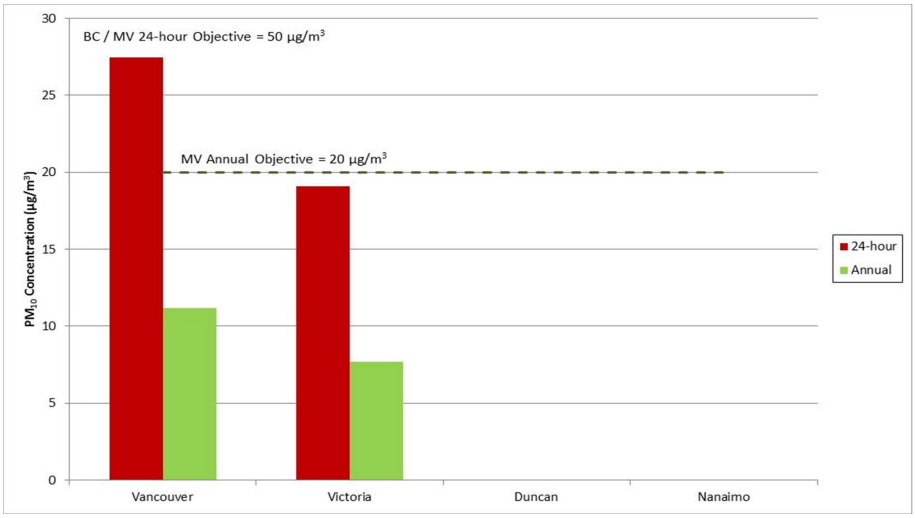
4.2.3.4 Existing Air Quality – Criteria Air Contaminants

Existing air quality conditions can be defined by ambient measurements from several stations that have been operating for a number of years. Ambient monitoring data of CACs are available from a number of stations operated by Metro Vancouver and the BC Ministry of Environment (MOE). CACs include PM, CO, NO_2 and SO_2. These stations are centered in urban areas and, therefore, it was deemed impractical to use these data to determine a single background concentration for the entire Marine Air Quality RSA which encompasses a wide range of land uses including water, urban and agricultural areas. The stations selected to represent the air quality setting at urban areas within the Marine Air Quality RSA were Vancouver-Kitsilano, Victoria-Topaz, Duncan-Cairnsmore, and Nanaimo-Labieux.

Overall, ambient concentrations of CACs have decreased over the last decade in the Marine Air Quality RSA. Both BC and Metro Vancouver have air quality objectives, which are shown on the figures in this subsection (more information can be found in the Marine Air Quality and Greenhouse Gas – Marine Transportation Technical Report (Volume 8B, TR 8B-3). A summary of existing ambient concentrations based on 2011, or the most recent year if 2011 was not

available, is shown in Figures 4.2.5 to 4.2.9. Overall, existing ambient concentrations of CACs are low, with a few exceedances of the relevant ambient air quality objectives only for $PM_{2.5}$.

Ambient concentrations of CACs in urban areas tend to be influenced by vehicle traffic and residential heating and tend to be higher in more populated areas, such as Vancouver and Victoria. $PM_{2.5}$ concentrations; however, were highest in Duncan on Vancouver Island and are likely a result of the industrial contribution to air quality in that area. Notable industrial facilities near the Duncan-Cairnsmore monitoring station include aggregate facilities, steel recycling and forestry.



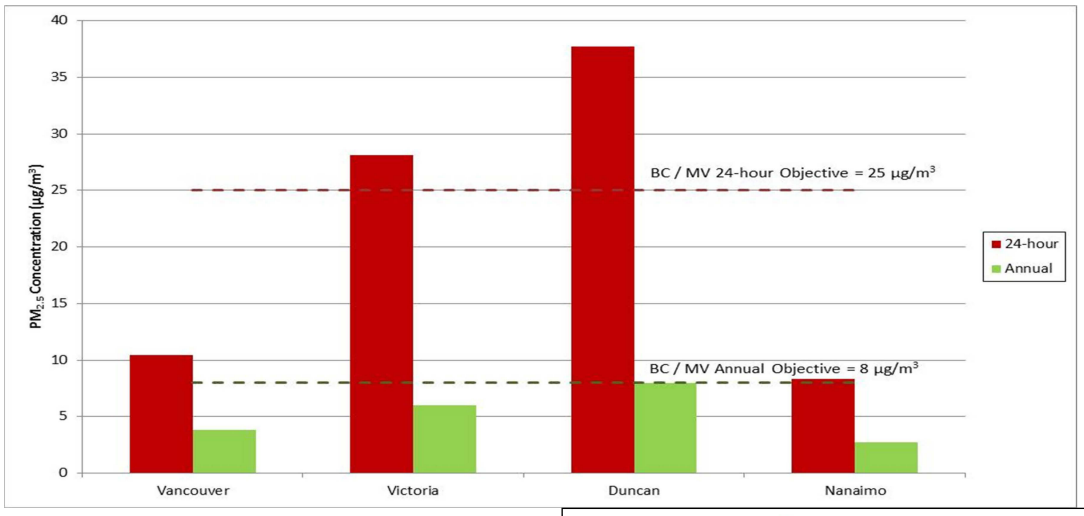
Notes: There were no PM_{10} observations from the Duncan-Cairnsmore and Nanaimo Labieux stations.

MV = Metro Vancouver

TRANS MOUNTAIN
KINDER MORGAN CANADA

FIGURE 4.2.5
OBSERVED PM_{10} CONCENTRATIONS IN 2011 FOR MARINE AIR QUALITY REGIONAL STUDY AREA (in µg/m³)

Figure 4.2.5 Observed PM_{10} Concentrations in 2011 for Marine Air Quality Regional Study Area (in µg/m³)

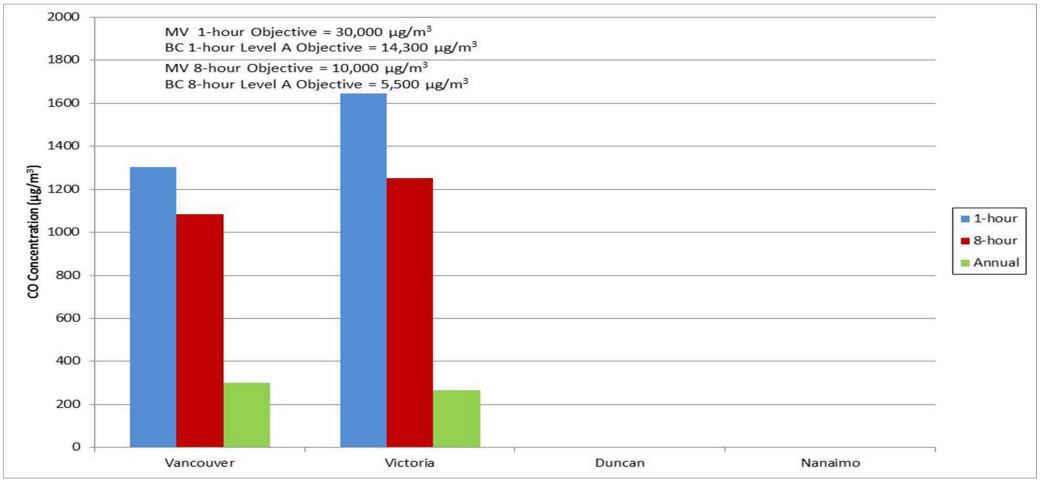


Notes: There was no $PM_{2.5}$ data from the Vancouver-Kitsilano station in 2011. Data from 2008 are presented.

TRANS MOUNTAIN
KINDER MORGAN CANADA

FIGURE 4.2.6
OBSERVED $PM_{2.5}$ CONCENTRATIONS IN 2011 FOR THE MARINE AIR QUALITY REGIONAL STUDY AREA (in µg/m^3)

Figure 4.2.6 Observed $PM_{2.5}$ Concentrations in 2011 for the Marine Air Quality Regional Study Area (in µg/m^3)



Notes: There were no CO observations from the Duncan-Cairnsmore and Nanaimo Labieux stations.

TRANS MOUNTAIN
KINDER MORGAN CANADA

FIGURE 4.2.7
OBSERVED CO CONCENTRATIONS IN 2011 FOR THE MARINE AIR QUALITY REGIONAL STUDY AREA (in µg/m^3)

Figure 4.2.7 Observed CO Concentrations in 2011 for the Marine Air Quality Regional Study Area (in µg/m^3)

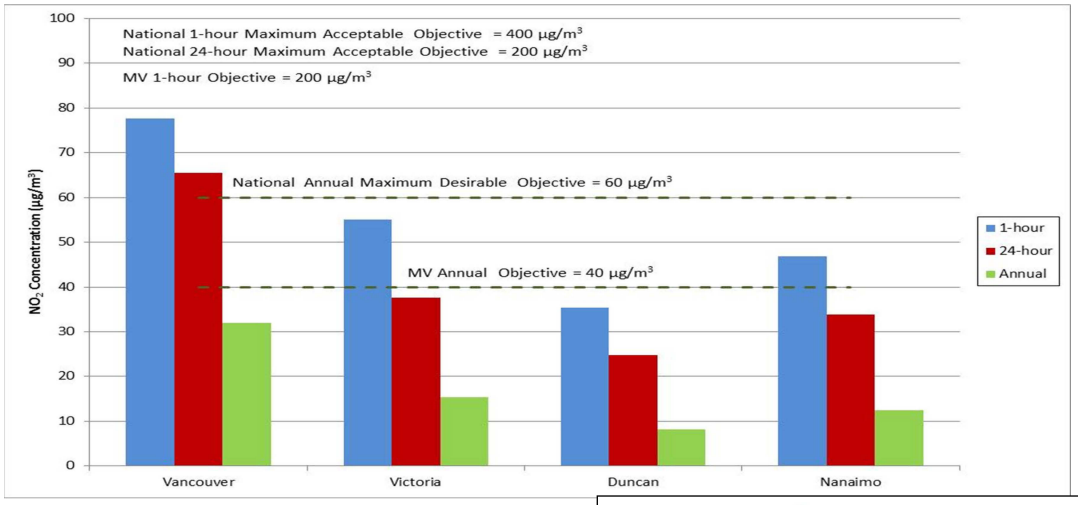
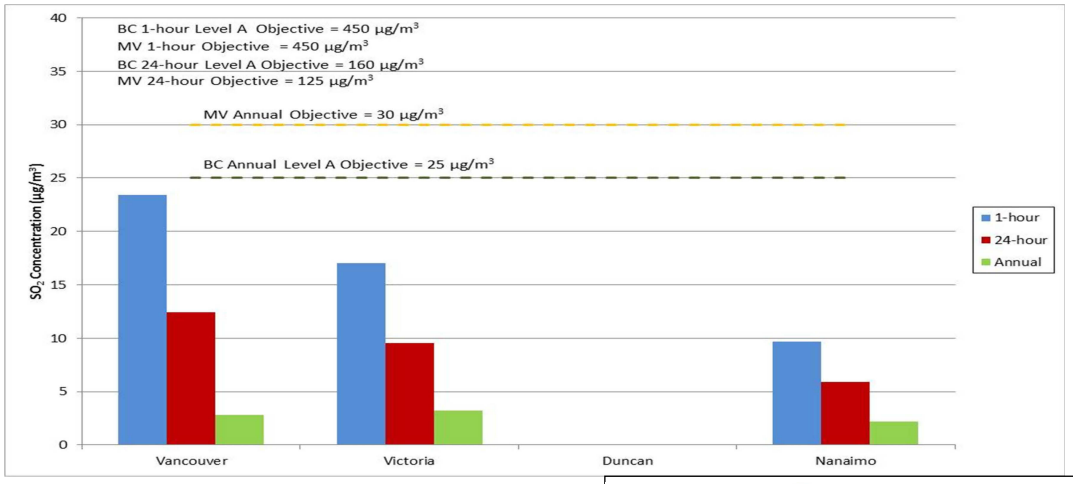


Figure 4.2.8 Observed NO_2 Concentrations in 2011 for the Marine Air Quality Regional Study Area (in µg/m^3)



Notes: There were no SO_2 observations from the Duncan-Cairnsmore station.

Figure 4.2.9 Observed SO_2 Concentrations in 2011 for the Marine Air Quality Regional Study Area (in µg/m^3)

4.2.3.5 Existing Air Quality – BTEX

Monitoring records of BTEX are available from Environment Canada's National Air Pollution Surveillance Program (Environment Canada 2013a). Stations at Robson Square (in Vancouver) and Saturna Island were selected to represent existing BTEX concentrations in the Marine Air Quality RSA. BTEX concentrations for the 10-year period from 2002 to 2011 are illustrated in Figures 4.2.10 and 4.2.11. BTEX concentrations in the Marine Air Quality RSA have decreased since 2002 and are considerably higher in Robson Square than in Saturna Island due to a greater amount of surrounding human activity and related emission sources such as vehicular traffic. BC MOE and Metro Vancouver do not produce air quality objectives for BTEX.

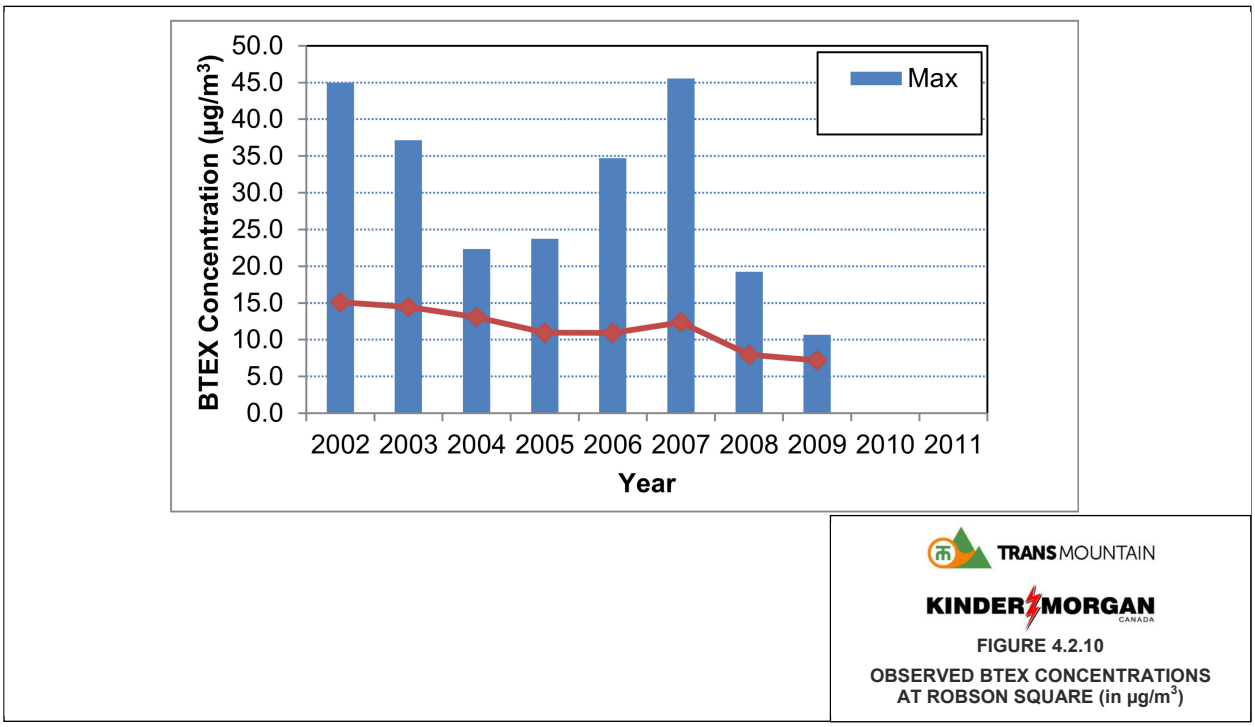


Figure 4.2.10 Observed BTEX Concentrations at Robson Square (in µg/m^3)

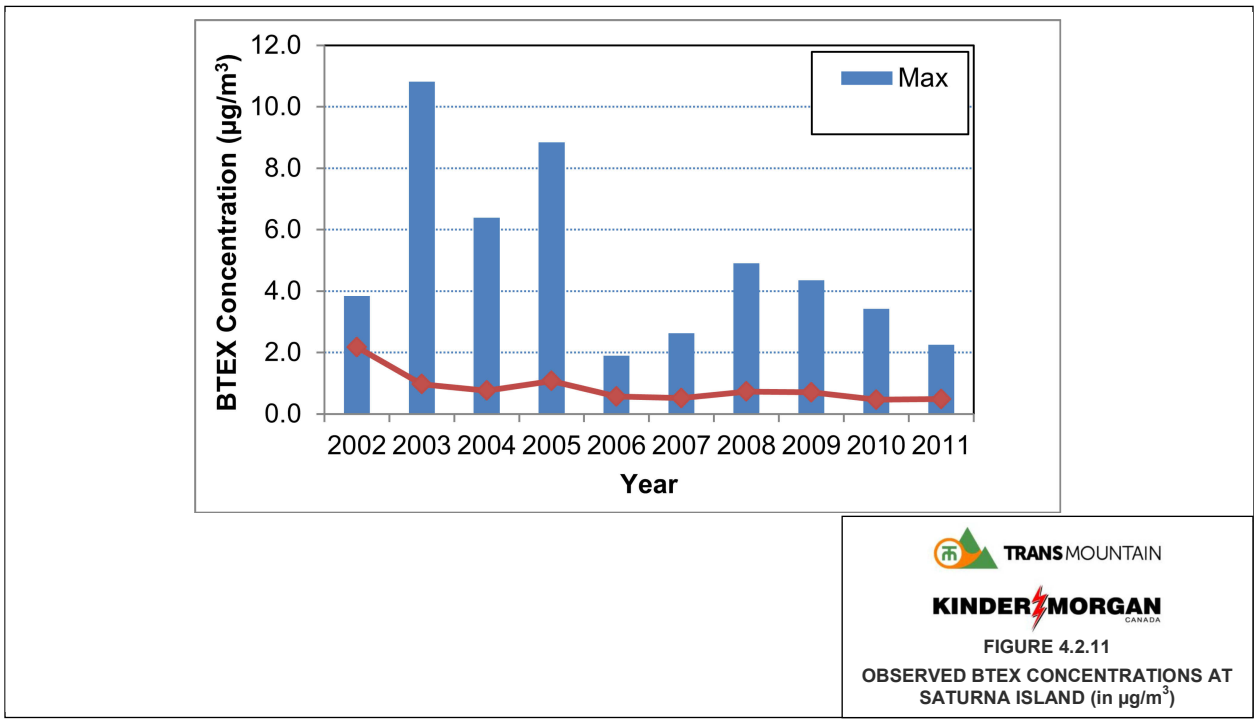


Figure 4.2.11 Observed BTEX Concentrations at Saturna Island (in µg/m^3)

4.2.3.6 Existing Air Quality – Ozone

Ozone monitoring data from Vancouver-Kitsilano, Victoria-Topaz, Duncan-Cairnsmore and Nanaimo-Labieux stations (same as those for CACs, see Section 4.2.3.3) were selected to represent existing ozone concentrations in the Marine Air Quality RSA. Ozone concentrations have increased over the last decade except in Victoria, where ozone concentrations have remained relatively constant. Existing ozone concentrations based on 2011 are illustrated in Figure 4.2.12.

Ozone concentrations are highest in Vancouver and may be attributable to large quantities of precursor NO_x and volatile organic compound emissions from urban and industrial sources in the region. Ozone concentrations at the Vancouver-Kitsilano monitoring station in 2011 exceeded the 1-hour Metro Vancouver objective of 82 parts per billion (ppb) 3.4 per cent of the time, and the 8-hour Metro Vancouver objective of 65 ppb approximately 33 per cent of the time. Ozone concentrations in Victoria, Duncan and Nanaimo also exceeded the national ambient air quality objectives up to 3.9 per cent of the time, but there were no exceedances of the numerical value of the 2015 Canadian Ambient Air Quality Standard of 63 ppb.

Ozone concentrations at all four locations tend to be highest in the spring and in the afternoon. This reflects the influence of solar radiation and temperature on ozone formation. Sunlight directly affects the photolysis reactions involved in ozone formation. High temperatures are typically associated with greater solar radiation, low wind speeds and stagnant atmospheric circulation, which suppress mixing and promote build-up of precursor concentrations.

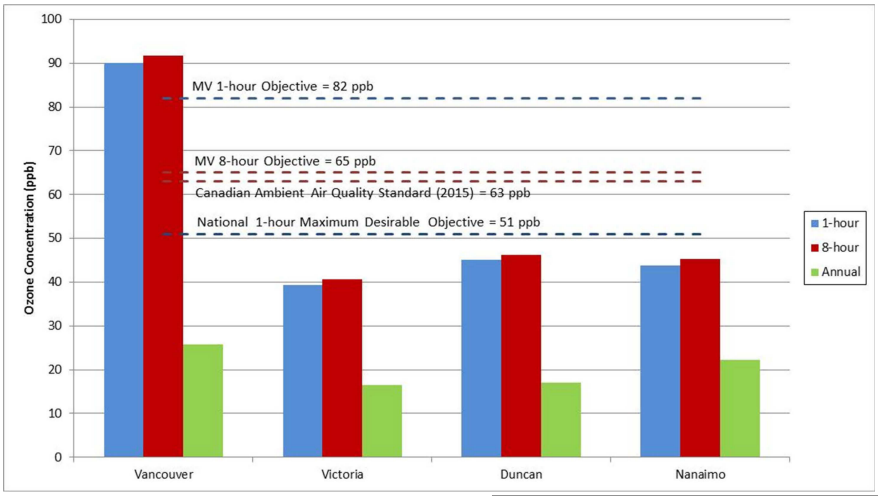


Figure 4.2.12 Observed Ozone Concentrations in 2011 for the Marine Air Quality Regional Study Area (in ppb)

4.2.3.7 Existing Emissions

Table 4.2.3.1 shows the existing annual emissions due to marine traffic in the Marine Air Quality RSA, based on the 2005 Corbett inventory (Wang *et al.* 2008). These emissions provide context for increased emissions from the increased Project-related marine vessel traffic.

TABLE 4.2.3.1

EXISTING 2005 EMISSIONS FROM MARINE VESSEL TRAFFIC IN THE MARINE AIR QUALITY REGIONAL STUDY AREA

Contaminant	Annual Emissions (t/y)
Total suspended particulate (TSP)	66.2
CO	60.1
NO_x	913.5
SO_2	524.6
Total hydrocarbon (HC)	31.9

4.2.3.8 Existing Visibility Conditions

Visibility, in addition to being an aesthetic value, is often used as a gauge for air quality. Light can be scattered by particulate matter in the atmosphere and absorbed by gases such as NO_x, which results in a degradation of visibility. Monthly visibility observations from Vancouver

International Airport and Victoria International Airport, based on Environment Canada climate normal data (Environment Canada 2013b), are presented in Tables 4.2.3.2 and 4.2.3.3, respectively. Overall, existing visibility conditions in the Marine Air Quality RSA are good, with visibility greater than 9 km over 90 per cent of the time. The fewest hours with low visibility and the most hours with high visibility tend to be observed in the spring and summer months (March to August). Victoria tends to have more hours with high visibility and fewer hours with low visibility than Vancouver, which may be reflective of the lower PM_{10} and NO_x concentrations and/or the lesser amount of precipitation in the area. Vancouver's air quality is also influenced by being located in the Fraser Valley air shed geography.

TABLE 4.2.3.2

MONTHLY VISIBILITY OBSERVATIONS FROM VANCOUVER INTERNATIONAL AIRPORT FOR THE PERIOD OF 1971 TO 2000

Parameter	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Visibility (hours with < 1 km)	30.8	11.5	2.8	0.3	0.1	0.2	0.2	0.4	4.7	27	14.1	25	117.1
Visibility (hours with 1 to 9 km)	134.4	81.0	46.4	26.7	18.0	19.1	13.2	23.4	50.7	111.4	94.5	122.7	741.6
Visibility (hours with > 9 km)	578.8	584.6	694.8	693.0	725.9	700.7	730.6	720.2	664.6	605.7	611.5	596.3	7,906.5

Source: Environment Canada 2013b

TABLE 4.2.3.3

MONTHLY VISIBILITY OBSERVATIONS FROM VICTORIA INTERNATIONAL AIRPORT FOR THE PERIOD OF 1971 TO 2000

Parameter	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Visibility (hours with < 1 km)	16.6	8.9	3.6	0.6	1.0	0.7	0.8	2.2	5.5	18.8	10.8	14.5	83.9
Visibility (hours with 1 to 9 km)	127.2	91.8	47.3	19.7	14.8	14.2	10.9	20.9	38.3	101.5	99.9	131.6	718.0
Visibility (hours with > 9 km)	600.2	577.3	693.1	699.6	718.3	705.1	732.3	721.0	676.2	623.8	609.4	597.8	7,964.1

Source: Environment Canada 2013b

4.2.3.9 US Waters

Two stations were selected to represent air quality over US waters of the Marine Air Quality RSA, namely Cheeka Peak and Port Townsend, both located in the Olympic Peninsula. Cheeka Peak is part of the US Environmental Protection Agency National Core multi-pollutant monitoring network and is located in a rural setting, while Port Townsend is located in a suburban setting and measures $PM_{2.5}$.

A summary of 2011 concentrations of CACs and ozone observed at Cheeka Peak and Port Townsend stations are illustrated in Figures 4.2.13 to 4.2.16. There were no exceedances of the US Environmental Protection Agency National Ambient Air Quality Standards (NAAQS). The maximum 24-hour $PM_{2.5}$ concentrations were less than half the standard and the maximum CO and SO_2 concentrations were less than 10 per cent of the standards.

There were no exceedances of the eight-hour ozone NAAQS at Cheeka Peak in 2011. However, observed concentrations are relatively high for a rural location and is expected to be a result of episodic trans-Pacific ozone transport (McKendry 2006).

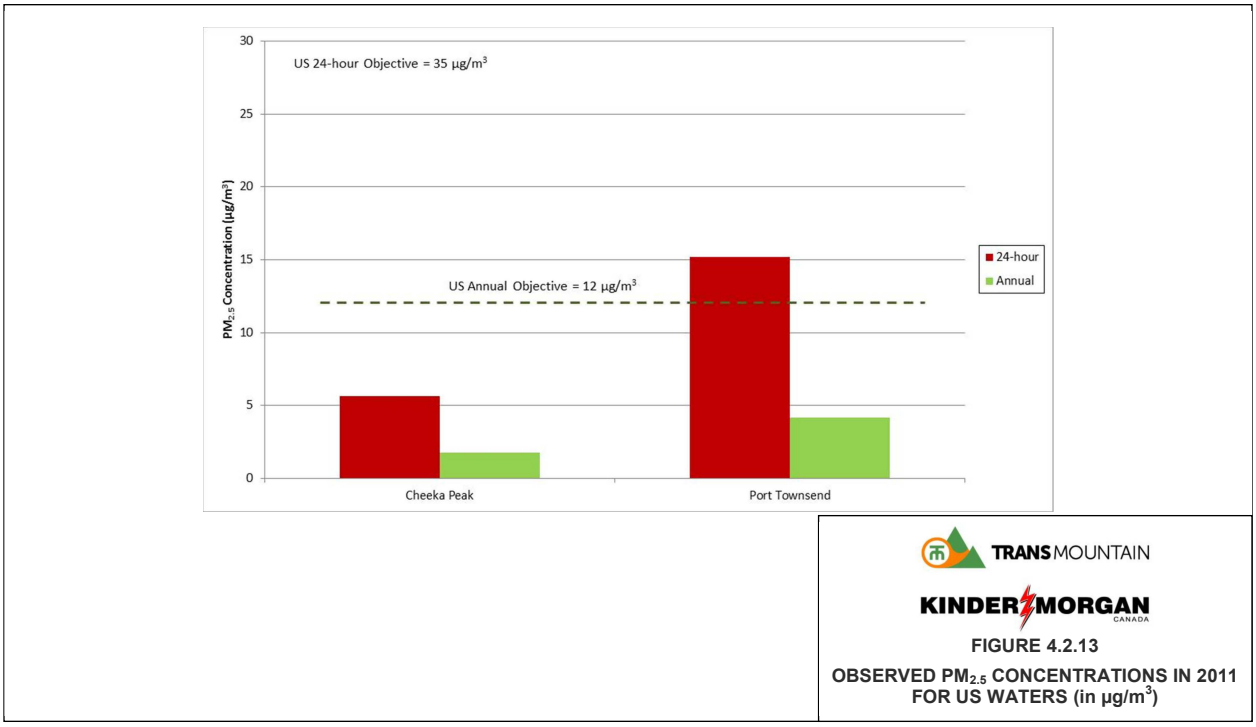
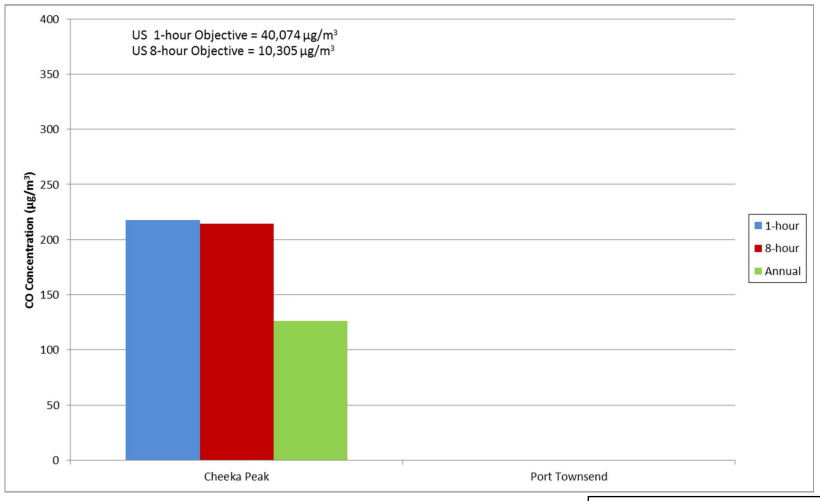


Figure 4.2.13 Observed $PM_{2.5}$ Concentrations in 2011 for US Waters (in µg/m^3)



Notes: There were no CO observations from the Port Townsend station.

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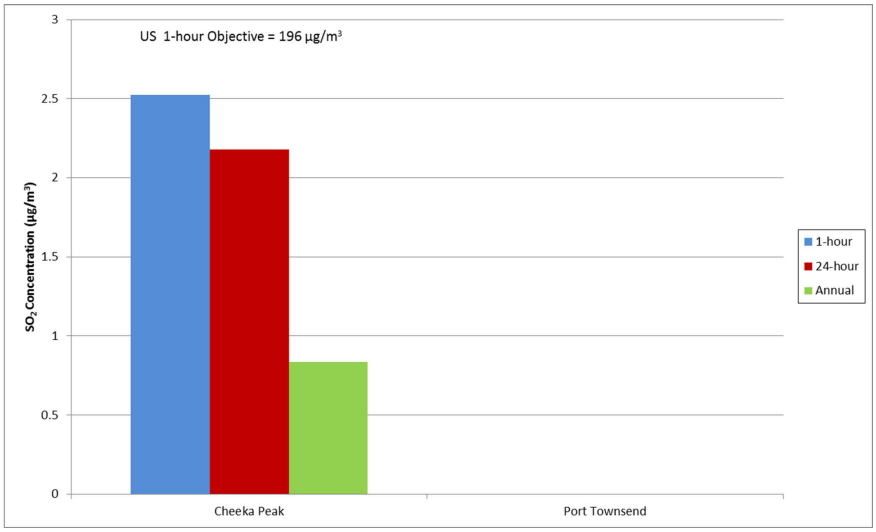
FIGURE 4.2.14
OBSERVED CO CONCENTRATIONS IN 2011 FOR US WATERS (in µg/m³)

Figure 4.2.14 Observed CO Concentrations in 2011 for US Waters (in µg/m³)



Notes: here were no SO_2 observations from the Port Townsend station.

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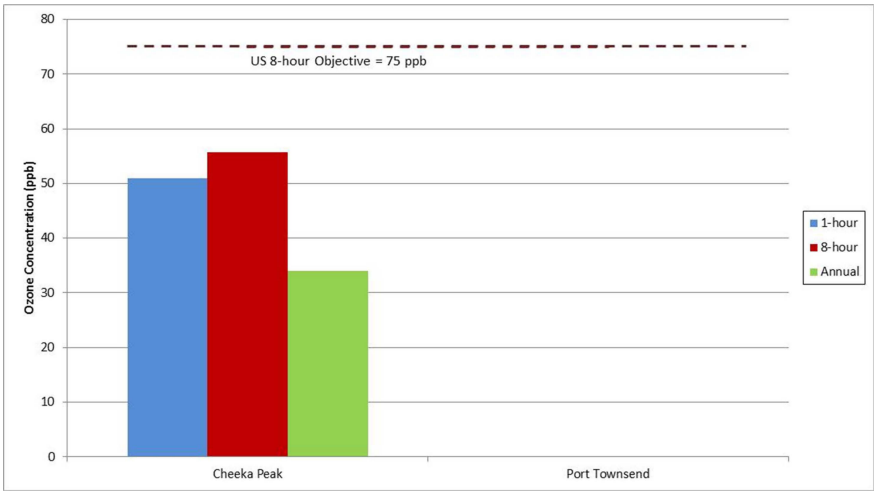
FIGURE 4.2.15
OBSERVED SO_2 CONCENTRATIONS IN 2011 FOR US WATERS (in µg/m³)

Figure 4.2.15 Observed SO_2 Concentrations in 2011 for US Waters (in µg/m³)



Notes: There were no ozone observations from the Port Townsend station.

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FIGURE 4.2.16
OBSERVED OZONE CONCENTRATIONS IN 2011 FOR US WATERS (in ppb)

Figure 4.2.16 Observed Ozone Concentrations in 2011 for US Waters (in ppb)

The 2005 Corbett inventory, summarized in Section 4.2.3.6, includes emissions from both Canadian and US waters. A separation of emissions by jurisdiction is not available.

Visibility measurements at Cheeka Peak and Port Townsend vary from 13 km to 349 km, with higher visibility observed at Cheeka Peak than at Port Townsend. Visibility measurements over US waters are considerably higher than those in Vancouver and Victoria, possibly due to the better air quality in less urban areas and/or different measurement techniques.

4.2.4 Greenhouse Gas Emissions

Environment Canada's National Inventory Report estimates total GHG emissions from Canada to be 692 megatonnes (Mt) in 2010, consisting of 545 Mt of carbon dioxide (CO_2), 4.3 Mt of methane (CH_4) and 0.15 Mt of nitrous oxide (N_2O). Of the 692 Mt, 6.7 Mt (6,350 kilotonnes [kt] CO_2, 0.5 kt CH_4, 1 kt N_2O) was estimated to be from domestic marine traffic. In BC alone, the total GHG emissions in 2010 were estimated to be 56.1 Mt (43,700 kt CO_2, 400 kt CH_4, 7.8 kt N_2O), with 2.7 Mt (2,590 kt CO_2, 0.2 kt CH_4, 0.4 kt N_2O) generated from domestic marine traffic (Environment Canada 2012).

The 2005 Corbett inventory (Wang *et al.* 2008) estimates a total of 35,872 tonnes (or 35.9 Mt) of CO_2 emissions from existing marine traffic in the Marine Air Quality RSA. Emissions of other GHGs, namely CH_4 and N_2O, are not available from the 2005 Corbett inventory.

4.2.4.1 US Waters

The 2008 National Emissions Inventory (US Environmental Protection Agency 2013) estimates total GHG emissions from Washington to be 39.8 Mt. These include emissions from burning, on-road vehicles and non-road equipment; emissions from marine traffic were not readily available. However, a first-order estimate of GHG emissions from commercial marine vessels can be determined by scaling from CO emissions and was estimated to contribute an additional 2.3 Mt.

4.2.5 Marine Acoustic Environment

This subsection provides a general description of marine acoustic environment along the marine shipping lanes, from the Westridge Marine Terminal to the 12 nautical mile limit of Canada's territorial sea (shown in Figure 4.2.1). More detailed technical information pertaining to the marine acoustic environment is presented in the Marine Noise (Atmospheric) – Marine Transportation Technical Report (Volume 8B, TR 8B-4).

Information pertaining to the marine acoustic environment in US waters can be found in Section 4.2.5.4. A discussion of the potential effects of the increased Project-related marine vessel traffic and associated mitigation as well as a discussion of the spatial boundaries for marine acoustic environment are located in Section 4.3.5.

Information pertaining to underwater noise is discussed in Section 4.2.7, Marine Mammals.

4.2.5.1 Indicators

Atmospheric sound levels are the indicator selected to represent potential effects from Project-related increased marine vessel traffic on the marine acoustic environment. See Section 4.3 for more information regarding indicators.

4.2.5.2 Existing Noise Levels

Existing atmospheric noise levels will vary along the length of the marine shipping lanes, due to variations in proximity to the shore and the presence of noise from wind, waves, and spray (surface agitation). The focus of this discussion is on shoreline areas nearest the shipping lanes. A combination of available measured baseline data and published data is used to establish the expected existing atmospheric noise levels within the Marine LSA.

Details on the baseline measurement program methods and results are summarized in the Marine Noise (Atmospheric) – Marine Transportation Technical Report (Volume 8B, TR 8B-4) and provided in full detail in the Terrestrial Noise and Vibration Technical Report of Volume 5C. Atmospheric noise levels are measured in A-Weighted decibels or dBA, a filtering system that matches the response of the human ear. The values reported are equivalent energy levels or Leq, which is a commonly used indicator for environmental sound since it accounts for the natural variation that occurs over time.

As the amount of shoreline exposure varies throughout the Marine LSA, the existing sound levels are described for the relevant segments as described in Figure 4.2.17. In Burrard Inlet (Segments 1 and 2), shoreline areas from the Westridge Marine Terminal to First Narrows lie within the Marine LSA. Land use in these segments is generally dense urban development with a mix of residential, commercial, industrial and urban park development. Ambient noise measurements made at the Westridge Marine Terminal are expected to be representative of sound levels in residential areas along Burrard Inlet. Results of the measurement program

indicate the existing daytime sound levels to be approximately 51 dBA and nighttime sound levels to be approximately 46 dBA and included a ship at the Westridge Marine Terminal as well as normal marine traffic in the inlet. This is similar to expected ambient sound levels estimated using the BC OGC methods of 56 dBA day and 46 dBA night (BC OGC 2009).

No shoreline areas or islands are located within the Marine LSA through English Bay and the Strait of Georgia (Segments 3 and 4) or Juan de Fuca Strait (Segment 7).

In the Haro Strait to Boundary Pass (Segment 5) and Victoria to Race Rocks (Segment 6), various islands are located within the Marine LSA. These locations are either not inhabited or sparsely developed. Ambient measurements have not been conducted for these locations. The measurements conducted for the Westridge Marine Terminal indicate that even though there is port activity near the location, the measured data are similar to expectations for existing conditions in the BC OGC Guidance. Therefore, the ambient sound levels of 45 dBA day and 35 dBA night as defined for rural and undeveloped areas in the BC OGC Guidance are used to represent existing conditions for these locations (BC OGC 2009).

4.2.5.3 Existing Sound Emissions from Ship Traffic

Current marine traffic levels in the Marine RSA are high, with a small contribution from marine vessels associated with existing Trans Mountain operations. The following focuses on atmospheric sound emissions from current marine vessel traffic associated with existing Trans Mountain operations.

The existing sound level attenuation curves from the Project tankers travelling along the shipping lanes were calculated using the sound emissions established through empirical formulae, and calculated through various distances in the outdoor environment based on International Standards Organization ISO9613 algorithms (ISO 1996). Details on the calculation methods and results are summarized in the Marine Noise (Atmospheric) – Marine Transportation Technical Report (Volume 8B, TR 8B-4).

The resulting attenuation curves are estimated in Figures 4.2.18a, 18b and 18c. The figures provide an estimate of “pass-by” sound levels or the amount of atmospheric sound generated by a single tanker by distance for each tanker/tug boat combination. Currently, there are a maximum of two tankers on the shipping lanes on any given day, with a total of five tankers per month that may generate sound.

The estimated sound emission levels from the tugs and tankers for use in calculation of sound levels at distance calculations are listed in Table 4.2.5.1. The table provides sound power level, in dBA, for each type of vessel considered.

TABLE 4.2.5.1

SOUND POWER LEVELS FOR EXISTING VESSELS ASSOCIATED WITH THE WESTRIDGE MARINE TERMINAL OPERATIONS

Source	Octave Spectrum (dB)									Overall Sound Power [1, 2]	
	31.5	63	125	250	500	1,000	2,000	4,000	8,000	dBA	dB
Hawk Stern-pull Harbour Tugboat	127.8	115.2	107.8	101.9	99.3	101.9	102.1	100.6	92.6	107.9	128.2
Kestrel Bow-pull Harbour Tugboat	129.9	117.5	110.6	104.3	101.2	103.5	103.4	101.8	93.8	109.4	130.3
Commodore Haro-Strait Tugboat	128.5	115.6	107.7	102.1	99.7	102.6	102.7	101.3	93.3	108.5	128.8
Panamax Tanker in Open Water	113.4	109.4	115.4	111.4	103.4	99.6	94.2	87.7	79.7	107.1	119.1
Panamax Tanker in Haro-Strait	110.4	106.4	112.4	108.4	100.4	96.5	91.2	84.7	76.7	104.1	116.1
Aframax Tanker in Open Water	118.6	114.6	120.6	116.6	108.6	104.7	99.1	91.6	83.6	112.3	124.3
Aframax Tanker in Haro-Strait	115.6	111.6	117.6	113.6	105.6	101.7	96.1	88.6	80.6	109.2	121.3

Notes: 1 Manufacturer's data were used for engine performance.

2 Sound power was calculated from engine specifications using empirical formulae (Crocker 2007).

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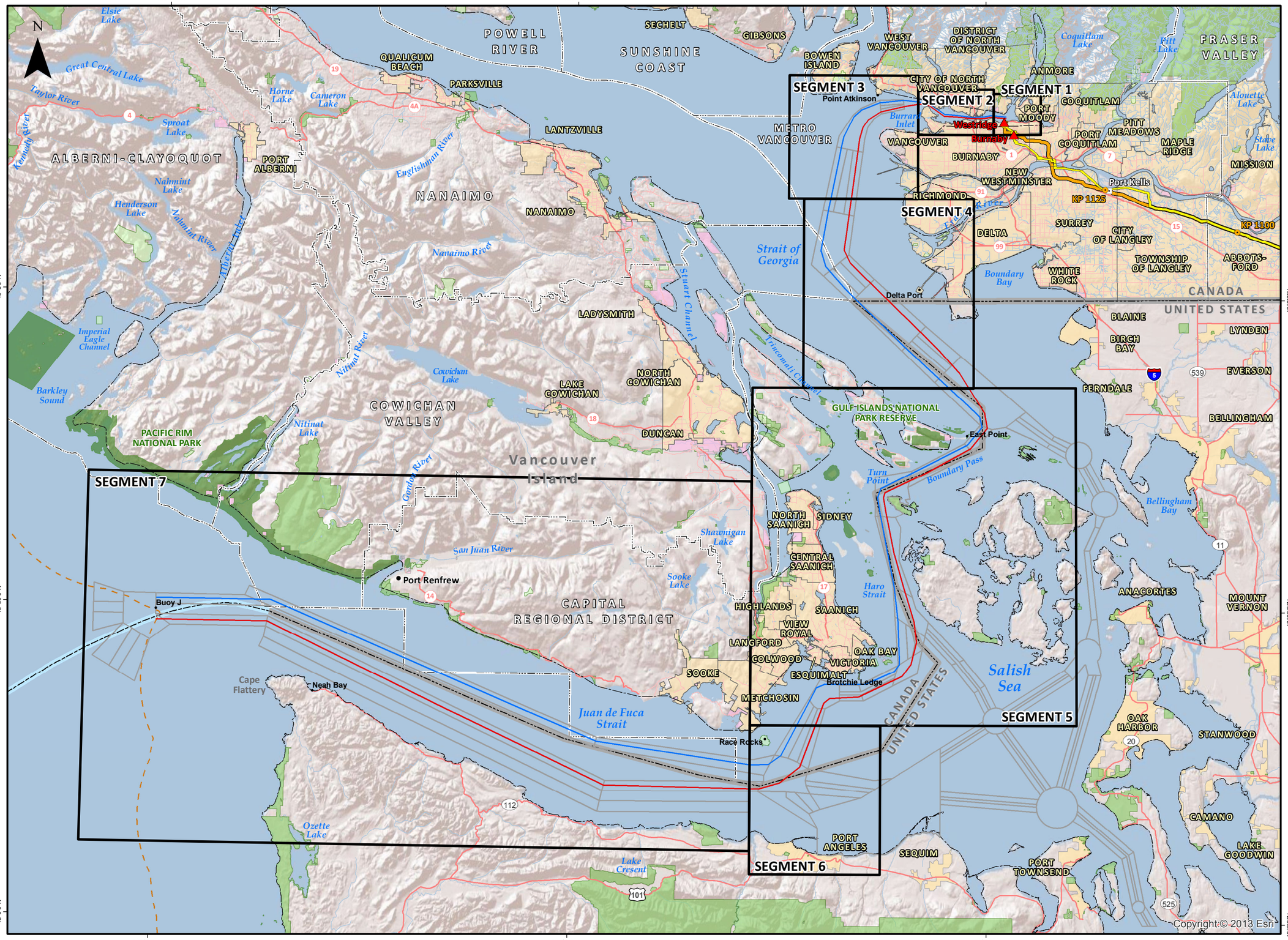
FIGURE 4.2-17

ATMOSPHERIC NOISE ROUTE SEGMENTS

TRANS MOUNTAIN EXPANSION PROJECT



- Kilometre Post (KP)
- Trans Mountain Pipeline (TMPL)
- Trans Mountain Expansion Project Proposed Pipeline Corridor
- Terminal
- Existing Pump Station
- Highway
- Road
- 12 Nautical Mile Limit (Territorial Sea)
- Limit of Exclusive Economic Zone (EEZ)
- International Boundary
- Marine Vessel Outbound Shipping Lane
- Marine Vessel Inbound Shipping Lane
- Traffic Separation Scheme
- Marine Traffic Segments
- City / Town / District Municipality
- Indian Reserve / Métis Settlement
- National Park
- Provincial / State Park
- Protected Area/Natural Area/ Provincial Recreation Area/Wilderness Provincial Park/Conservancy Area
- Regional District Boundary

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Projection: UTM Zone 10N.
Routing: Baseline TMPL Route Revision 0, provided by KMC, May 2012. Proposed Corridor V6 provided by UPI, August 23, 2013.; Transportation: BC Forests, Lands and Natural Resource Operations, 2012 & ESRI, 2005; Geopolitical Boundaries: IHS Inc., 2011, BC FLNRO, 2007 & ESRI, 2005, Natural Resources Canada, 2012; First Nation Lands: Government of Canada, 2013 & IHS Inc., 2011; Hydrology: IHS Inc., 2004, United States National Imagery and Mapping Agency, 2000, Natural Resouces Canada, 2010; Parks and Protected Areas: Natural Resources Canada, 2013, BC FLNRO, 2008 & ESRI, 2005; CHS Marine Features: Government of Canada, 2013; Marine Vessel Inbound/Outbound Shipping Lanes: Moffatt and Nichol, 2013; Hillshade: ESRI, 2009.

RWDI

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

MAP NUMBER		PAGE
1202006_TMEP_MR_NOISE_FIG4.2-17		SHEET 1 OF 1
DATE: December 2013	TERA REF.: 7894	REVISION: 0
SCALE: 1:650,000	PAGE SIZE: 11x17	DISCIPLINE: NOISE
DRAWN: NBN	CHECKED: AKH	DESIGN: TGG

0 5 10 15 20 25 km

ALL LOCATIONS APPROXIMATE

1202006_TMEP_MR_NOISE_FIG4.2-17.mxd

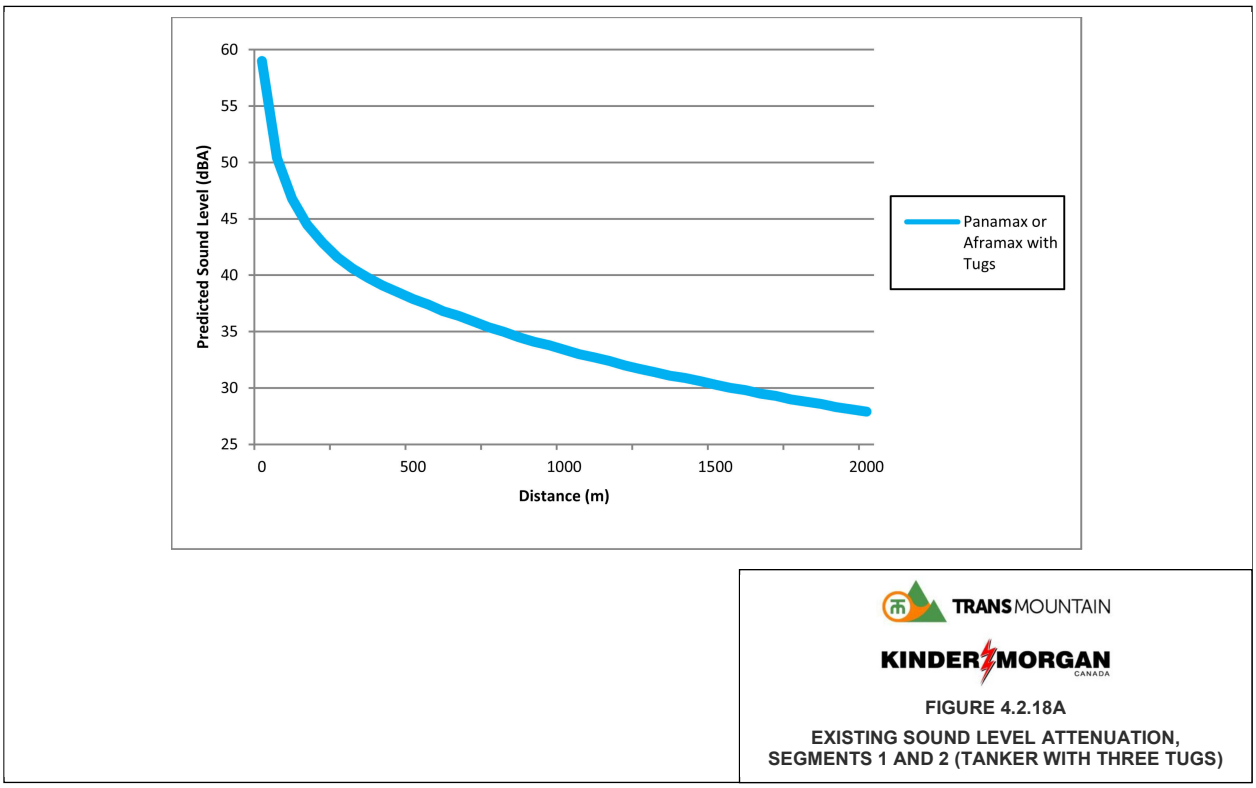


Figure 4.2.18a Existing Sound Level Attenuation, Segments 1 and 2 (Tanker with Three Tugs)

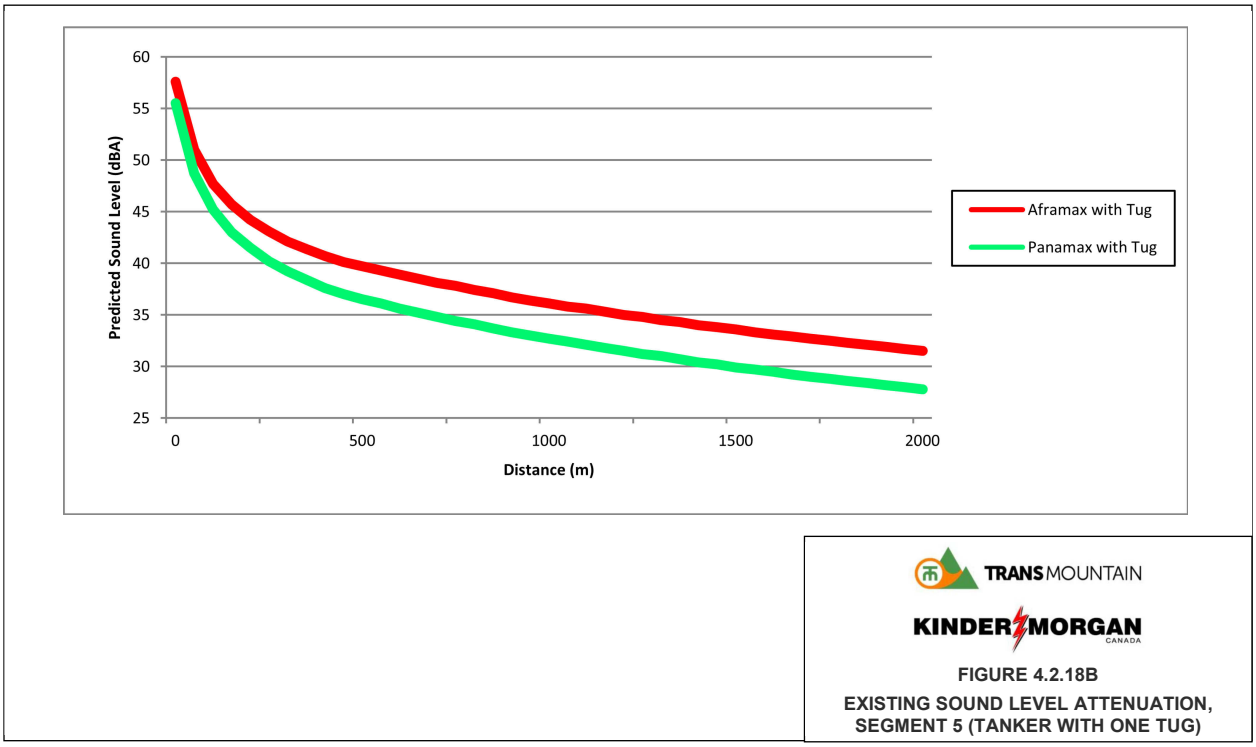


Figure 4.2.18b Existing Sound Level Attenuation, Segment 5 (Tanker with One Tug)

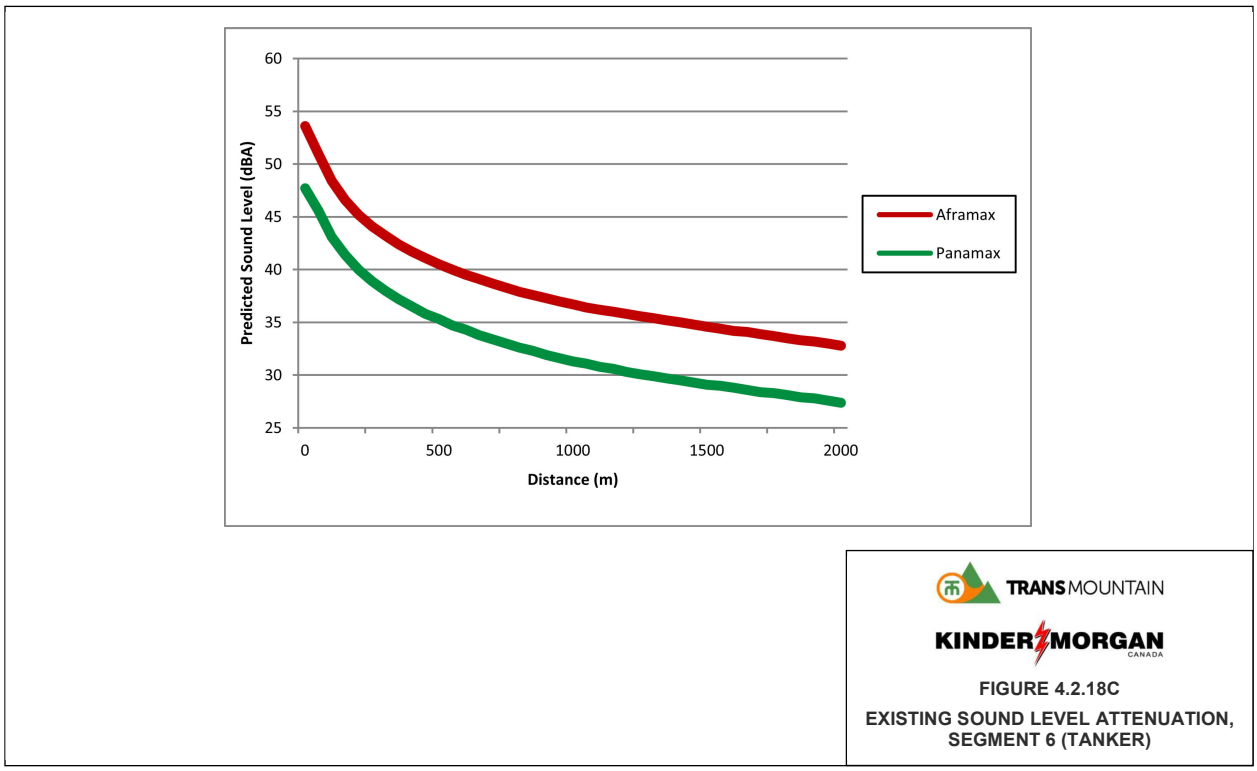


Figure 4.2.18c Existing Sound Level Attenuation, Segment 6 (Tanker)

4.2.5.4 US Waters

Existing sound levels in US waters, specifically the various shoreline areas in US waters, are expected to be similar to those in Canadian waters. Similar vessels will have similar sound emissions. Existing conditions in US waters are expected to mirror Canadian conditions.

4.2.6 Marine Fish and Fish Habitat

This subsection provides a broad description of the marine fish species (including marine invertebrates) and habitats along the marine shipping lanes, from the Westridge Marine Terminal to the 12 nautical mile limit of Canada's territorial sea (shown in Figure 4.2.1). More detailed technical information pertaining to marine fish and fish habitat is presented in the Marine Resources – Marine Transportation Technical Report (Volume 8B, TR 8B-1).

Aboriginal traditional knowledge pertaining to marine fish and fish habitat is summarized in Section 4.2.6.6. Information pertaining to marine fish and fish habitat in US waters can be found in Section 4.2.6.7. A discussion of the potential effects of the increased Project-related marine vessel traffic and associated mitigation as well as a discussion of the spatial boundaries for marine fish and fish habitat are located in Section 4.3.6.

4.2.6.1 General Information

A total of 409 species of marine fish have been reported in Canadian Pacific waters (Peden 2013). A number of these species are targeted or captured incidentally in commercial, recreational and Aboriginal fisheries, including salmon, groundfish (*e.g.*, flounder, lingcod,

rockfish), pelagics (*e.g.*, herring), and shellfish (*e.g.*, crab, prawn and shrimp) (DFO 2012a). Marine fish contribute to healthy marine ecosystems and food webs. For example, Pacific herring are an important forage fish for many species of fish, birds and marine mammals, including Pacific salmon and killer whales (Gustafson *et al.* 2006, Livingston 1993, Saulitis *et al.* 2000). Pacific salmon support marine, estuarine, freshwater, and terrestrial food webs by providing nutrients to the ecosystem during their migration from the ocean to rivers and streams to spawn (DFO 2013b, Hart 1973).

Fish habitat is defined under Section 34(1)(e) of the *Fisheries Act* as "spawning grounds and nursery, rearing, food supply, and migration areas on which fish depend directly or indirectly in order to carry out their life processes". The shipping lanes extend across the Strait of Georgia and the Juan de Fuca Marine Ecodistricts within the Georgia Basin Marine Ecoregion (Harding 1997). While these broad classifications provide a framework for categorizing marine habitats at a regional scale, marine habitats also vary at a smaller scale (*e.g.*, site-specific) based on localized differences in physical and biological characteristics (Burd *et al.* 2008, Howes *et al.* 1994, Levings *et al.* 1983, Williams 1993).

4.2.6.2 Field Data Collection

Information on marine resources within the Marine RSA is readily available in published literature and is deemed to be sufficient to assess potential effects of the increased Project-related marine vessel traffic on marine fish and fish habitat. Therefore, Project-specific field studies for this aspect of data gathering were not considered warranted.

4.2.6.3 Database and Information Gathering

The marine fish and fish habitat knowledge base is derived from a review of relevant scientific literature, government reports and documents, and electronic resources including:

- DFO Canadian Science Advisory Secretariat (CSAS) publications (DFO 2013c);
- DFO WAVES Online Catalogue (DFO 2013d);
- DFO Mapster v3 (DFO 2013e);
- COSEWIC assessments and status reports (COSEWIC 2013);
- Species at Risk Public Registry (Government of Canada 2013a);
- BC Coastal Resource Information Management System (2013);
- BC Species and Ecosystems Explorer (BC CDC 2013);
- BC Marine Conservation Analysis (BC MCA) (2013); and
- Washington State Coastal Atlas (Washington State Department of Ecology 2006).

4.2.6.4 Conservation Status

Based on a review of COSEWIC assessments and status reports, the federal *SARA* public registry list (Schedule 1), and the BC CDC Red and Blue Lists, a total of 19 marine fish and invertebrate species or populations of conservation concern have been identified as potentially

occurring within the Marine RSA (Table 4.2.6.1). Of these, eight are listed under Schedule 1 of *SARA* and two are listed under the BC *Wildlife Act* (BC CDC 2013, Government of Canada 2013a).

TABLE 4.2.6.1

CONSERVATION STATUS OF MARINE FISH SPECIES IN THE MARINE REGIONAL STUDY AREA

Species Name	Population(s)	Taxon	BC List Status[1]	COSEWIC Status[1]	*SARA* Status[1]
Basking shark *Cetorhinus maximus*	Pacific Ocean	Fish	No status	Endangered	Endangered – Schedule 1
Bluntnose sixgill *Shark Hexanchus griseus*	Pacific Ocean	Fish	No status	Special Concern	Special Concern – Schedule 1
Bocaccio *Sebastes paucispinis*	Pacific Ocean	Fish	No status	Threatened	No status
Canary rockfish *Sebastes pinniger*	Pacific Ocean	Fish	No status	Threatened	No status
Chinook salmon *Oncorhynchus tshawytscha*	Okanagan population	Fish	No status	Threatened	Yellow
Coho salmon *Oncorhynchus kisutch*	Interior Fraser population	Fish	No status	Endangered	No status
Darkblotched rockfish *Sebastes crameri*	Pacific Ocean	Fish	No status	Special Concern	No status
Eulachon *Thaleichthys pacificus*	Fraser River population	Fish	No status	Endangered	Blue
Longspine thornyhead *Sebastolobus altivelis*	Pacific Ocean	Fish	No status	Special Concern	Special Concern – Schedule 1
North Pacific spiny dogfish *Squalus suckleyi*	Pacific Ocean	Fish	No status	Special Concern	No status
Northern abalone *Haliotis kamtschatkana*	Pacific Ocean	Mollusc	Red	Endangered	Endangered – Schedule 1
Olympia oyster *Ostrea lurida*	Pacific Ocean	Mollusc	Blue	Special Concern	Special Concern – Schedule 1
Pacific sardine *Sardinops sagax*	Pacific Ocean	Fish	No status	Not at Risk	Special Concern – Schedule 3
Quillback rockfish *Sebastes maliger*	Pacific Ocean	Fish	No status	Threatened	No status
Rougheye rockfish type I *Sebastes sp. type I & II*	Pacific Ocean	Fish	No status	Special Concern	Special Concern – Schedule 1
Sockeye salmon *Oncorhynchus nerka*	Cultus population, Sakinaw population	Fish	No status	Endangered	No status
Tope *Galeorhinus galeus*	Pacific Ocean	Fish	No status	Special Concern	Special Concern – Schedule 1
Yelloweye rockfish *Sebastes ruberrimus*	Pacific Ocean outside waters population, inside waters population	Fish	No status	Special Concern	Special Concern – Schedule 1
Yellowmouth rockfish *Sebastes reedi*	Pacific Ocean	Fish	No status	Threatened	No status

Sources: BC CDC 2013, Government of Canada 2013a. Last updated on November 25, 2013.

Note: 1 See Section 4.2.1.3 for definitions of COSEWIC, *SARA* and BC List status.

4.2.6.5 Indicator Species and Habitat

Three indicators were selected to represent potential effects from Project-related increased marine vessel traffic on marine fish and fish habitat: intertidal habitat, Pacific herring, and Pacific salmon. Marine habitat can be divided into three broad zones based on physical and biological characteristics: the marine riparian (backshore) zone, the intertidal zone, and the subtidal zone (Howes *et al.* 1994, Williams 1993). Intertidal habitat is the area of habitat between the higher high water mark and the mean lower low water line for spring tides (Williams 1993) and is present along shorelines in the Marine RSA. The Marine RSA encompasses areas used by Pacific herring and Pacific salmon for spawning, rearing, foraging, and migration. See Section 4.3 for more information regarding indicators.

4.2.6.5.1 Intertidal Habitat

Intertidal habitat is strongly influenced by a range of physical and biological factors including substrate type, slope, wave exposure, shore width, tidal range, salinity, light, temperature, and vegetation (Burd *et al.* 2008, Howes *et al.* 1994, Levings *et al.* 1983, Williams 1993). Common intertidal species in BC include marsh plants, seagrasses, algae, invertebrates, and fish (Williams 1993).

BC's intertidal zone provides spawning, rearing, migration and foraging habitat for a diverse range of marine fish species. Pacific salmon are known to use the intertidal zone of estuaries as rearing and migration habitat (Healey 1980, Levings and Jamieson 2001, Levings and Thom 1994). Salmon also feed on organisms that originate in the intertidal zone (Levings and Jamieson 2001, Levings and Thom 1994). Marine vegetation in the intertidal zone provides spawning substrate for Pacific herring (Hart 1973, Humphreys and Hourston 1978, Levings and Thom 1994, Taylor 1964).

The Government of BC has developed a Biophysical Shore-Zone Mapping System for describing the biophysical character of the province's shore zone (Howes *et al.* 1994, Searing and Frith 1997). Physical and biological information about the shore zone is collected during spring low tides using high-quality aerial video imagery. Professional geoscientists use this information to divide the shore zone into discrete sections of coastline known as "shore units" that are continuous and homogenous in the alongshore direction in terms of morphology and sediment type (Howes *et al.* 1994).

The total length of shoreline in the Marine RSA is approximately 3,861 km, of which approximately 2,315 km is located within Canada. The distribution of shore types in the Marine RSA is shown in Figure 4.2.19, with further details shown in the inset maps on Figures 4.2.19a through 4.2.19d. The length and relative abundance of shore types in the Canadian portion of the Marine LSA and Marine RSA are shown in Table 4.2.6.2. A discussion of shore types in the US portion of the Marine RSA is provided in Section 4.2.6.7. A total of 15 different shore types have been identified within the Marine RSA. "Rock cliff" is the most common shore type in the Marine RSA, covering about 596 km or 25.8 per cent of the total shoreline (BC Ministry of Forest, Land and Natural Resource Operations [MFLNRO] 2005). "Rock, sand and gravel beach" and "rock with gravel beach" shore types are the second and third most common in the Marine RSA, covering 14.2 per cent and 12.9 per cent of the shoreline, respectively (BC MFLNRO 2005).

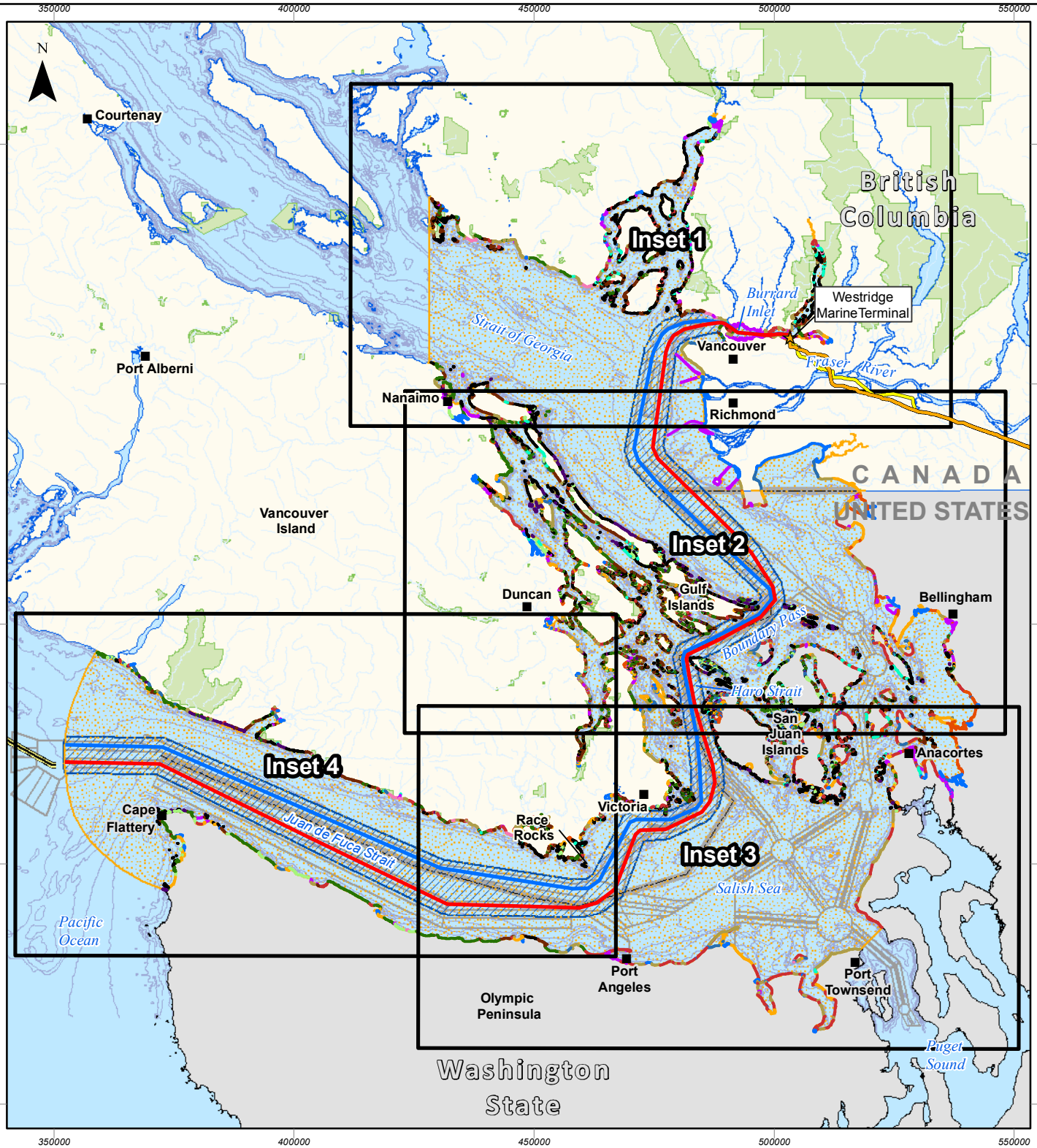
The total length of shoreline in the Canadian portion of the Marine LSA is approximately 109 km, along which a total of 13 different shore types have been identified (BC MFLNRO 2005). "Man-made" is the most common shore type in the Marine LSA, covering about 49 km or

44.7 per cent of the total shoreline (BC MFLNRO 2005). “Sand and gravel flat” and “rock cliff” shore types are the second and third most common in the Marine LSA, covering 11.2 per cent and 10.2 per cent of the shoreline, respectively (BC MFLNRO 2005).

TABLE 4.2.6.2

LENGTH AND RELATIVE ABUNDANCE OF SHORE TYPES IN THE CANADIAN PORTION OF THE MARINE LSA AND MARINE RSA

Shore Type	Marine LSA - Length (km)	Marine LSA - % Total Length	Marine RSA - Length (km)	Marine RSA - % Total Length
Channel	0.0	0.0	1.3	0.1
Estuary, marsh or lagoon	0.8	0.8	177.3	7.7
Gravel beach	1.6	1.5	54.1	2.3
Gravel flat	2.7	2.5	16.1	0.7
Man-made	48.7	44.7	222.8	9.6
Mud flat	1.8	1.6	30.5	1.3
Rock cliff	11.1	10.2	596.3	25.8
Rock platform	1.6	1.5	83.5	3.6
Rock with gravel beach	8.3	7.6	298.6	12.9
Rock, sand and gravel beach	8.5	7.8	328.3	14.2
Rock with sand beach	0.0	0.0	42.8	1.8
Sand and gravel beach	9.9	9.1	133.9	5.8
Sand and gravel flat	12.2	11.2	186.5	8.1
Sand beach	0.4	0.4	39.4	1.7
Sand flat	1.1	1.0	103.7	4.5
Total	108.9	100.0	2,315.0	100.0



Stantec

SCALE: 1:1,150,000

0 10 20 30 40 km

ALL LOCATIONS APPROXIMATE

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MAP NUMBER		PAGE
10494_EA_TRANS_MAR_04_02_19		SHEET 1 OF 1
DATE	REF.	REVISION
Nov 2013	7894	0
SCALE	PAGE SIZE	DISCIPLINE
1:1,150,000	8.5x11	SD
DRAWN	CHECKED	DESIGN
SS	DP	SD

- Westridge Marine Terminal
- Town / City
- Marine Vessel Inbound Shipping Lane
- Marine Vessel Outbound Shipping Lane
- International Border
- Canadian 12 Nautical Mile Territorial Boundary
- Bathymetry
- Watercourse
- Existing Trans Mountain Pipeline
- Trans Mountain Expansion Proposed Pipeline Corridor

- Waterbody
- Provincial Park
- Traffic Separation Scheme
- Land of British Columbia
- Land of Washington State
- Marine Fish and Fish Habitat LSA (Transportation)
- Marine RSA (Transportation)

Shore Type

- Channel
- Gravel Beach
- Gravel Flat
- Man-made
- Mud Flat
- Rock Cliff
- Rock Platform
- Rock with Gravel Beach
- Rock with Sand Beach
- Rock, Sand and Gravel Beach
- Sand Beach
- Sand Flat
- Sand and Gravel Beach
- Sand and Gravel Flat
- Estuary, Marsh or Lagoon

Projection: UTM Zone 10N; Marine Vessel Inbound Shipping Lane: Moffatt & Nichol, 2013a; Marine Vessel Outbound Shipping Lane: Moffatt & Nichol, 2013b; International Border: British Columbia Ministry of Energy and Mines, 2013; Canadian 12 Nautical Mile Territorial Boundary and Traffic Separation Scheme: Canadian Hydrographic Service, 2013; Bathymetry: Canadian Hydrographic Service, 2011; Watercourse: National Hydro Network, 2007; Existing Pipeline: Kinder Morgan Canada, 2012; Trans Mountain Expansion Proposed Pipeline Corridor: Universal Pegasus International, 2013; Provincial Park: BC MFLNRO, 2008a; Land of British Columbia: National Topographic Data Base, 2007; Land of Washington State: Washington State Department of Ecology, 1994; BC Shore Types: BC MFLNRO, 2005; Washington Shore Types: Washington State DNR, 2006.

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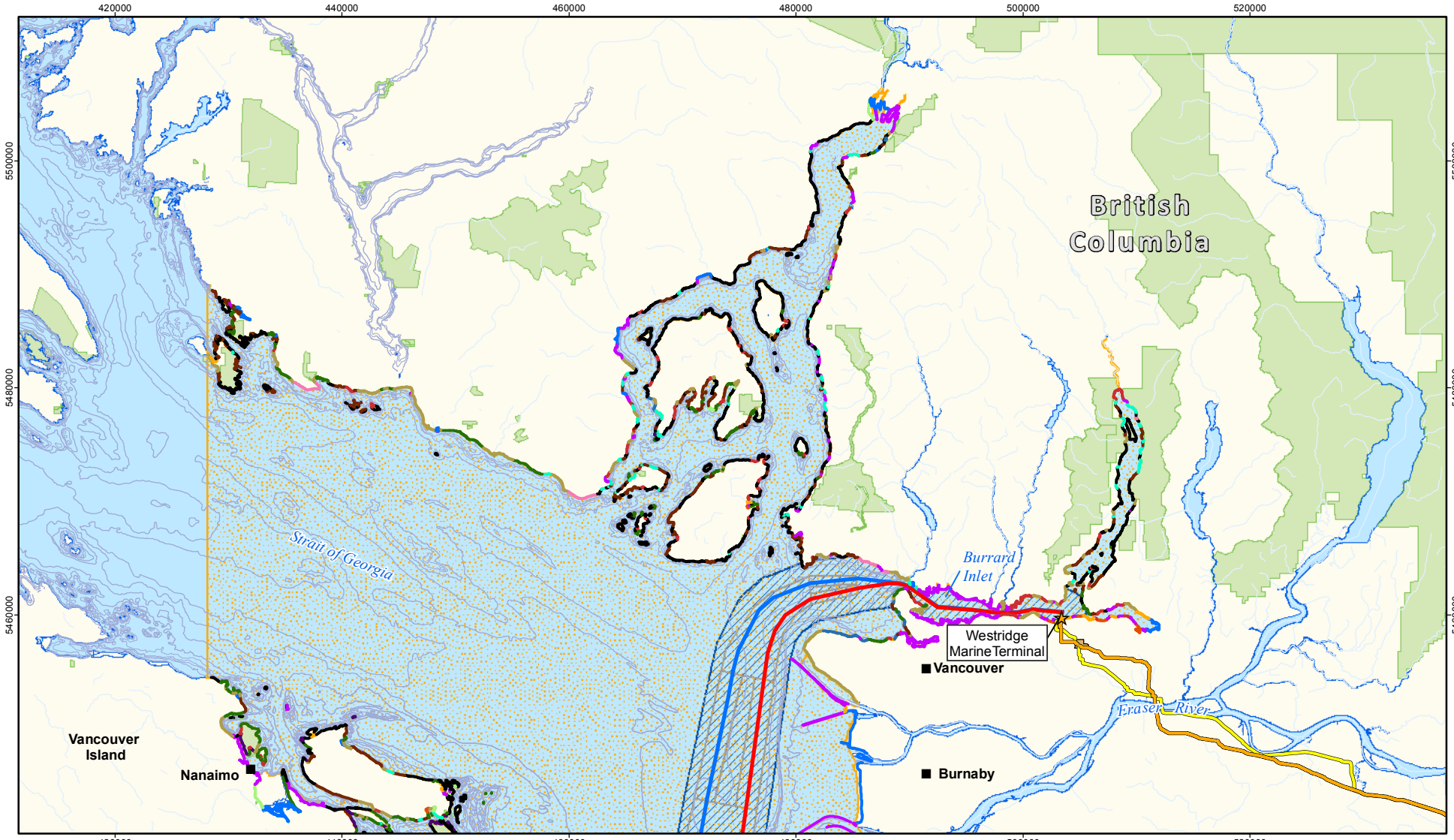
TRANS MOUNTAIN

FIGURE: 4.2-19

DISTRIBUTION OF SHORE TYPES IN THE MARINE RSA OVERVIEW

TRANS MOUNTAIN EXPANSION PROJECT



Stantec

SCALE: 1:500,000

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ALL LOCATIONS APPROXIMATE

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DATE: Nov 2013	TERA REF.: 7894	REVISION: 0
SCALE: 1:500,000	PAGE SIZE: 8.5 x 11	DISCIPLINE: SD
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- Westridge Marine Terminal
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- Marine Vessel Inbound Shipping Lane
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- Waterbody
- Provincial Park
- Traffic Separation Scheme
- Land of British Columbia
- Land of Washington State
- Marine RSA (Transportation)
- Marine Fish and Fish Habitat LSA (Transportation)

Shore Type

- Channel
- Gravel Beach
- Gravel Flat
- Man-made
- Mud Flat
- Rock Cliff
- Rock Platform
- Rock with Gravel Beach
- Rock with Sand Beach
- Rock, Sand and Gravel Beach
- Sand Beach
- Sand Flat
- Sand and Gravel Beach
- Sand and Gravel Flat
- Estuary, Marsh or Lagoon

Projection: UTM Zone 10N; Marine Vessel Inbound Shipping Lane: Moffatt & Nichol, 2013a; Marine Vessel Outbound Shipping Lane: Moffatt & Nichol, 2013b; International Border: British Columbia Ministry of Energy and Mines, 2013; Canadian 12 Nautical Mile Territorial Boundary and Traffic Separation Scheme: Canadian Hydrographic Service, 2013; Bathymetry: Canadian Hydrographic Service, 2011; Watercourse: National Hydro Network, 2007; Existing Pipeline: Kinder Morgan Canada, 2012; Trans Mountain Expansion Proposed Pipeline Corridor: Universal Pegasus International, 2013; Provincial Park: BC MFLNRO, 2008a; Land of British Columbia: National Topographic Data Base, 2007; Land of Washington State: Washington State Department of Ecology, 1994; BC Shore Types: BC MFLNRO, 2005; Washington Shore Types: Washington State DNR, 2006.

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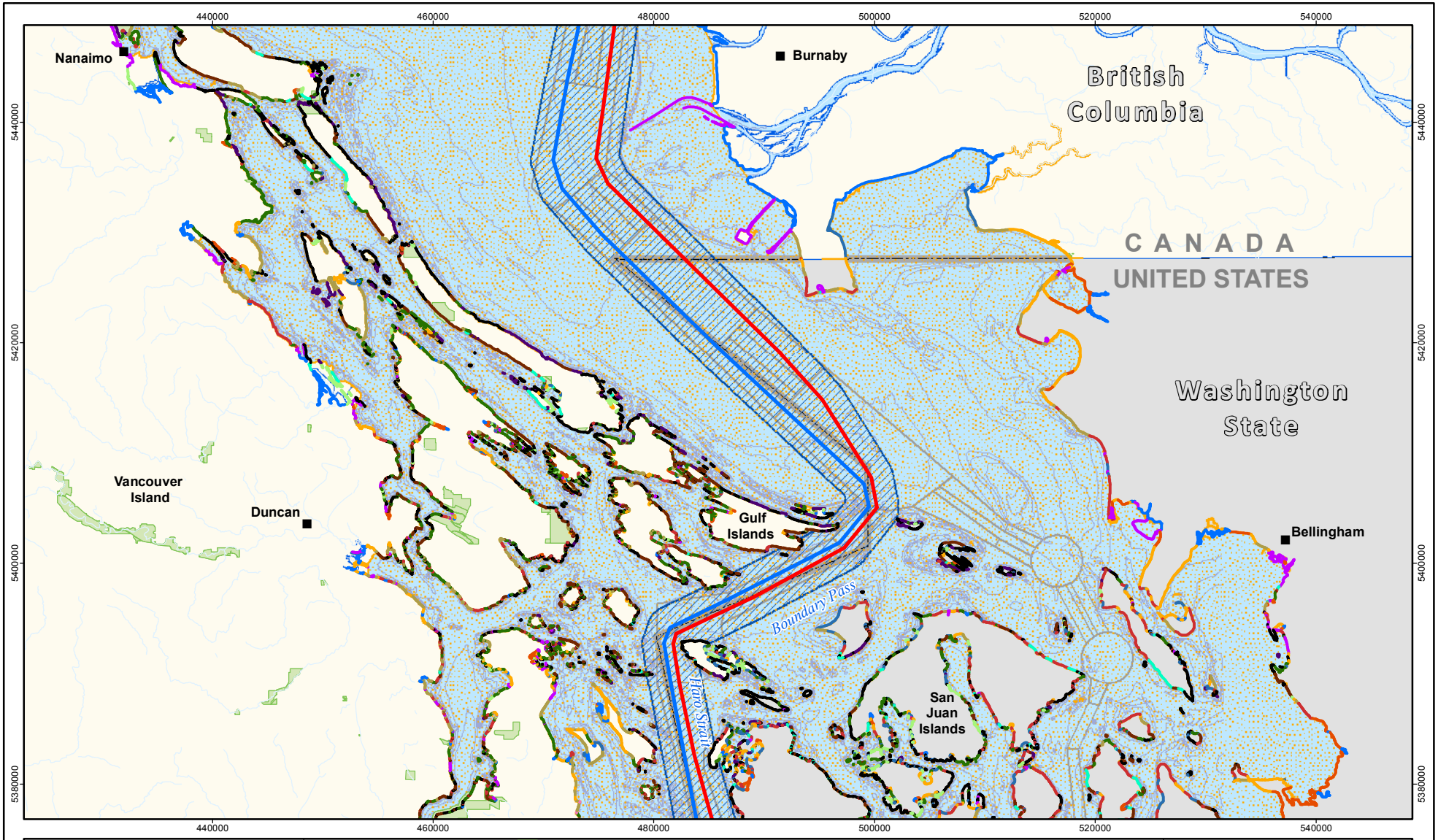
TRANS MOUNTAIN

FIGURE: 4.2-19a

DISTRIBUTION OF SHORE TYPES IN THE MARINE RSA INSET 1

TRANS MOUNTAIN EXPANSION PROJECT



Stantec

SCALE: 1:500,000

0 5 10 15 20 km

ALL LOCATIONS APPROXIMATE

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- Westridge Marine Terminal
- Town / City
- Marine Vessel Inbound Shipping Lane
- Marine Vessel Outbound Shipping Lane
- International Border
- Bathymetry
- Watercourse
- Waterbody
- Provincial Park
- Traffic Separation Scheme
- Land of British Columbia
- Land of Washington State
- Marine RSA (Transportation)
- Marine Fish and Fish Habitat LSA (Transportation)

Shore Type

- Channel
- Gravel Beach
- Gravel Flat
- Man-made
- Mud Flat
- Rock Cliff
- Rock Platform
- Rock with Gravel Beach
- Rock with Sand Beach
- Rock, Sand and Gravel Beach
- Sand Beach
- Sand Flat
- Sand and Gravel Beach
- Sand and Gravel Flat
- Estuary, Marsh or Lagoon

Projection: UTM Zone 10N; Marine Vessel Inbound Shipping Lane: Moffatt & Nichol, 2013a; Marine Vessel Outbound Shipping Lane: Moffatt & Nichol, 2013b; International Border: British Columbia Ministry of Energy and Mines, 2013; Canadian 12 Nautical Mile Territorial Boundary and Traffic Separation Scheme: Canadian Hydrographic Service, 2013; Bathymetry: Canadian Hydrographic Service, 2011; Watercourse: National Hydro Network, 2007; Existing Pipeline: Kinder Morgan Canada, 2012; Trans Mountain Expansion Proposed Pipeline Corridor: Universal Pegasus International, 2013; Provincial Park: BC MFLNRO, 2008a; Land of British Columbia: National Topographic Data Base, 2007; Land of Washington State: Washington State Department of Ecology, 1994; BC Shore Types: BC MFLNRO, 2005; Washington Shore Types: Washington State DNR, 2006.

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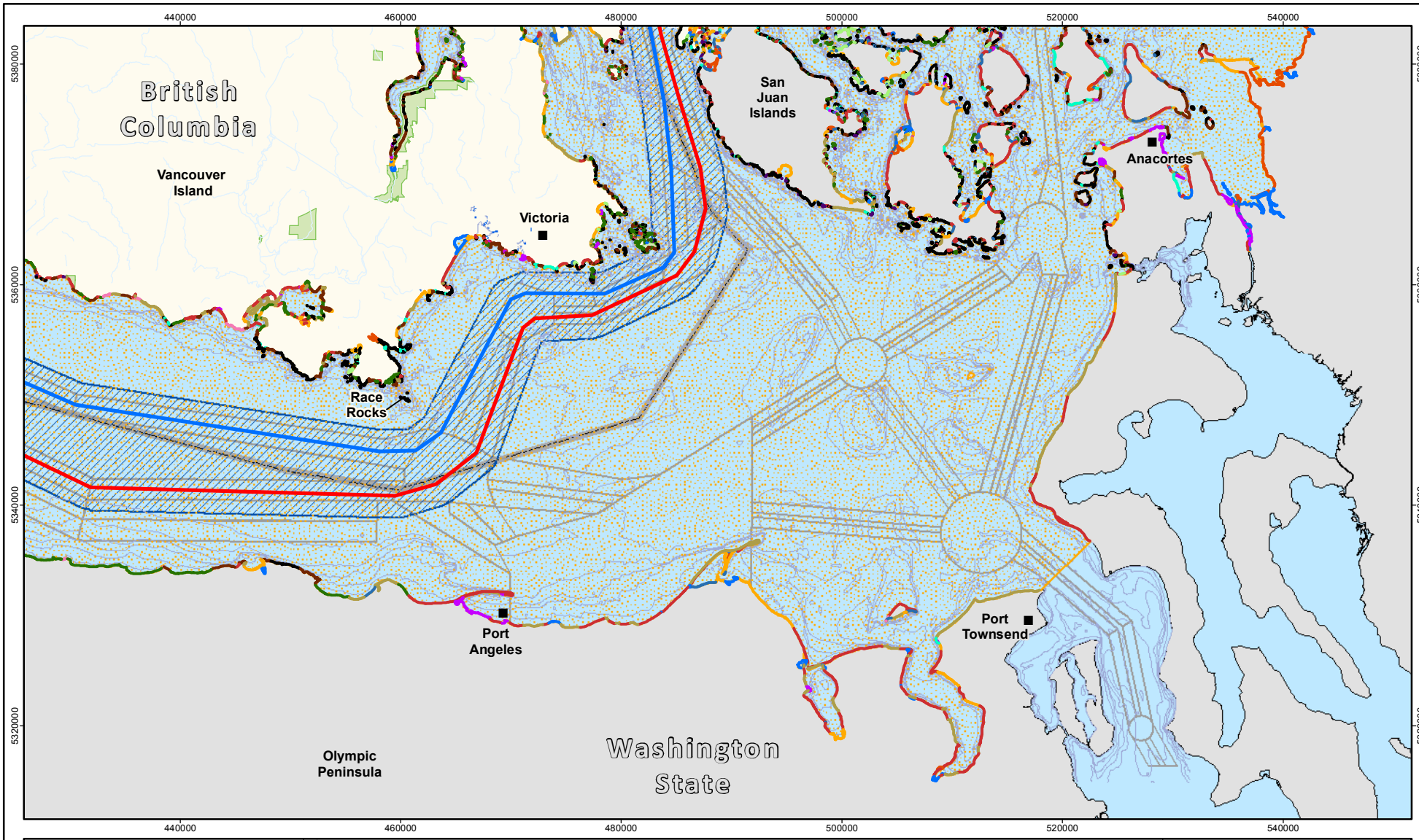
TRANS MOUNTAIN

FIGURE: 4.2-19b

DISTRIBUTION OF SHORE TYPES IN THE MARINE RSA INSET 2

TRANS MOUNTAIN EXPANSION PROJECT



Stantec

SCALE: 1:500,000

0 5 10 15 20 km

ALL LOCATIONS APPROXIMATE

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DATE: Nov 2013	TERA REF.: 7894	REVISION: 0
SCALE: 1:500,000	PAGE SIZE: 8.5 x 11	DISCIPLINE: SD
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- Westridge Marine Terminal
- Town / City
- Marine Vessel Inbound Shipping Lane
- Marine Vessel Outbound Shipping Lane
- International Border
- Bathymetry
- Watercourse
- Waterbody
- Provincial Park
- Traffic Separation Scheme
- Land of British Columbia
- Land of Washington State
- Marine RSA (Transportation)
- Marine Fish and Fish Habitat LSA (Transportation)

Shore Type

- Channel
- Gravel Beach
- Gravel Flat
- Man-made
- Mud Flat
- Rock Cliff
- Rock Platform
- Rock with Gravel Beach
- Rock with Sand Beach
- Rock, Sand and Gravel Beach
- Sand Beach
- Sand Flat
- Sand and Gravel Beach
- Sand and Gravel Flat
- Estuary, Marsh or Lagoon

Projection: UTM Zone 10N; Marine Vessel Inbound Shipping Lane: Moffatt & Nichol, 2013a; Marine Vessel Outbound Shipping Lane: Moffatt & Nichol, 2013b; International Border: British Columbia Ministry of Energy and Mines, 2013; Canadian 12 Nautical Mile Territorial Boundary and Traffic Separation Scheme: Canadian Hydrographic Service, 2013; Bathymetry: Canadian Hydrographic Service, 2011; Watercourse: National Hydro Network, 2007; Existing Pipeline: Kinder Morgan Canada, 2012; Trans Mountain Expansion Proposed Pipeline Corridor: Universal Pegasus International, 2013; Provincial Park: BC MFLNRO, 2008a; Land of British Columbia: National Topographic Data Base, 2007; Land of Washington State: Washington State Department of Ecology, 1994; BC Shore Types: BC MFLNRO, 2005; Washington Shore Types: Washington State DNR, 2006.

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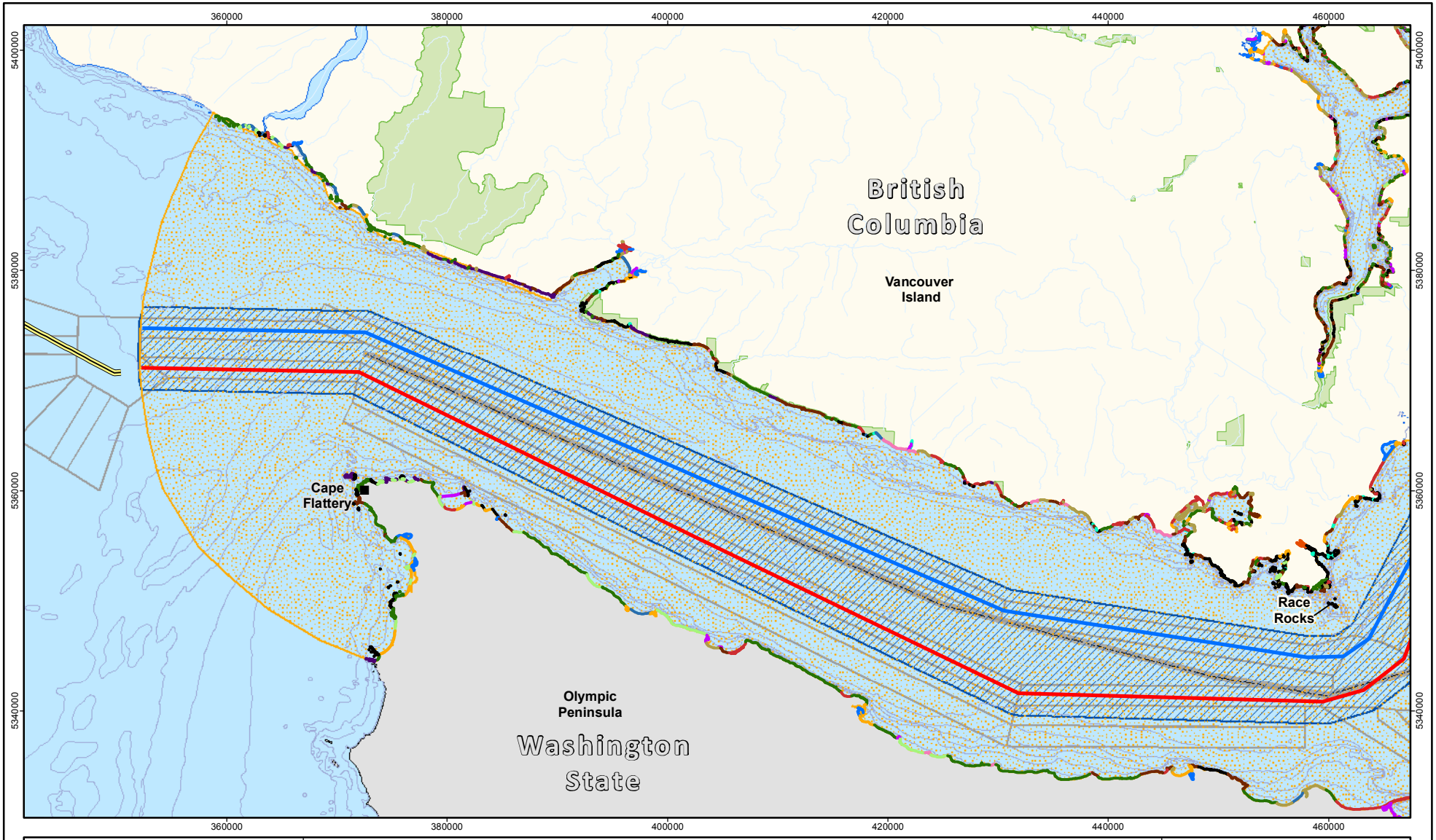
TRANS MOUNTAIN

FIGURE: 4.2-19c

DISTRIBUTION OF SHORE TYPES IN THE MARINE RSA INSET 3

TRANS MOUNTAIN EXPANSION PROJECT



Stantec

SCALE: 1:500,000

0 5 10 15 20 km

ALL LOCATIONS APPROXIMATE

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- Westridge Marine Terminal
- Town / City
- Marine Vessel Inbound Shipping Lane
- Marine Vessel Outbound Shipping Lane
- International Border
- Canadian 12 Nautical Mile Territorial Boundary
- Bathymetry
- Watercourse
- Waterbody
- Provincial Park
- Traffic Separation Scheme
- Land of British Columbia
- Land of Washington State
- Marine RSA (Transportation)
- Marine Fish and Fish Habitat LSA (Transportation)

Shore Type

- Channel
- Gravel Beach
- Gravel Flat
- Man-made
- Mud Flat
- Rock Cliff
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- Rock with Sand Beach
- Rock, Sand and Gravel Beach
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- Sand Flat
- Sand and Gravel Beach
- Sand and Gravel Flat
- Estuary, Marsh or Lagoon

Projection: UTM Zone 10N; Marine Vessel Inbound Shipping Lane: Moffatt & Nichol, 2013a; Marine Vessel Outbound Shipping Lane: Moffatt & Nichol, 2013b; International Border: British Columbia Ministry of Energy and Mines, 2013; Canadian 12 Nautical Mile Territorial Boundary and Traffic Separation Scheme: Canadian Hydrographic Service, 2013; Bathymetry: Canadian Hydrographic Service, 2011; Watercourse: National Hydro Network, 2007; Existing Pipeline: Kinder Morgan Canada, 2012; Trans Mountain Expansion Proposed Pipeline Corridor: Universal Pegasus International, 2013; Provincial Park: BC MFLNRO, 2008a; Land of British Columbia: National Topographic Data Base, 2007; Land of Washington State: Washington State Department of Ecology, 1994; BC Shore Types: BC MFLNRO, 2005; Washington Shore Types: Washington State DNR, 2006.

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TRANS MOUNTAIN

FIGURE: 4.2-19d

DISTRIBUTION OF SHORE TYPES IN THE MARINE RSA INSET 4

TRANS MOUNTAIN EXPANSION PROJECT

4.2.6.5.2 Pacific Herring

Pacific herring are small pelagic fish found along the West Coast of North America from Baja California to the Beaufort Sea, along the coast of Asia from the Yellow Sea to the Bering Sea and along the Eurasian Arctic coast from the Bering Sea to northeast Europe (DFO 2013f, Laakkonen *et al.* 2013). They have a maximum weight of about 550 g and reach a maximum length of about 33 cm, and a life span of over 15 years (DFO 2013f, Ware 1985). Herring are targeted in commercial, recreational and Aboriginal fisheries in BC. They are also considered to be an ecologically important species as they are important forage fish for many species of fish, birds, and marine mammals, including Pacific salmon and killer whales (Gustafson *et al.* 2006, Livingston 1993, Saulitis *et al.* 2000).

Adult Pacific herring form large schools in the water column from the surface to depths of 400 m (National Oceanic and Atmospheric Administration [NOAA] 2012). In southern BC, most Pacific herring populations migrate offshore to feeding grounds located off southwest Vancouver Island during the summer months and begin migrating to inshore spawning areas through Juan de Fuca Strait in November and December (DFO 2013f, Taylor 1964). Small populations in the Strait of Georgia are known to be non-migratory and reside year-round in the inside waters near their spawning grounds (Taylor 1964, Therriault *et al.* 2009). Upon reaching deeper channels near their spawning sites, Pacific herring will school for several weeks before transitioning to sheltered, shallower areas such as bays or estuaries where they spawn in mass aggregations (DFO 2013f).

In the Strait of Georgia, Pacific herring spawn in late winter between January and June, with the peak spawning period occurring in March (DFO 2013f, Hart 1973, Hay 1985, Hay and McCarter 2012). Spawning occurs along the shoreline in the intertidal to shallow subtidal zones between high tide and depths of 11 m (Hart 1973, Rooper *et al.* 1999). The eggs are very sticky and once deposited, adhere in large masses to a variety of substrates, including rocks, pilings, debris and marine vegetation (Hart 1973, Taylor 1964). The dominant substrates are eelgrass (*Zostera marina*) and surfgrass (*Phyllospadix scoulerii*) in sheltered bays and along sandy beaches, rockweed (*Fucus gardneri*) along rocky shores, and kelp (*Laminaria* sp.) in shallow subtidal areas (Hart 1973, Taylor 1964).

Pacific herring will spawn every year after reaching maturity, and each female may deposit as many as 20,000 eggs (Hay 1985, DFO 2013f). However, the rate of spawn mortality is high with estimates ranging from 56 to 100 per cent depending on the spawning location (Rooper *et al.* 1999, Taylor 1964). Major causes of spawn mortality are predation by birds and the degree of exposure to wave action and to the air (Taylor 1964). The mortality rate attributed to predation by birds is estimated to be 30 to 55 per cent (Taylor 1964).

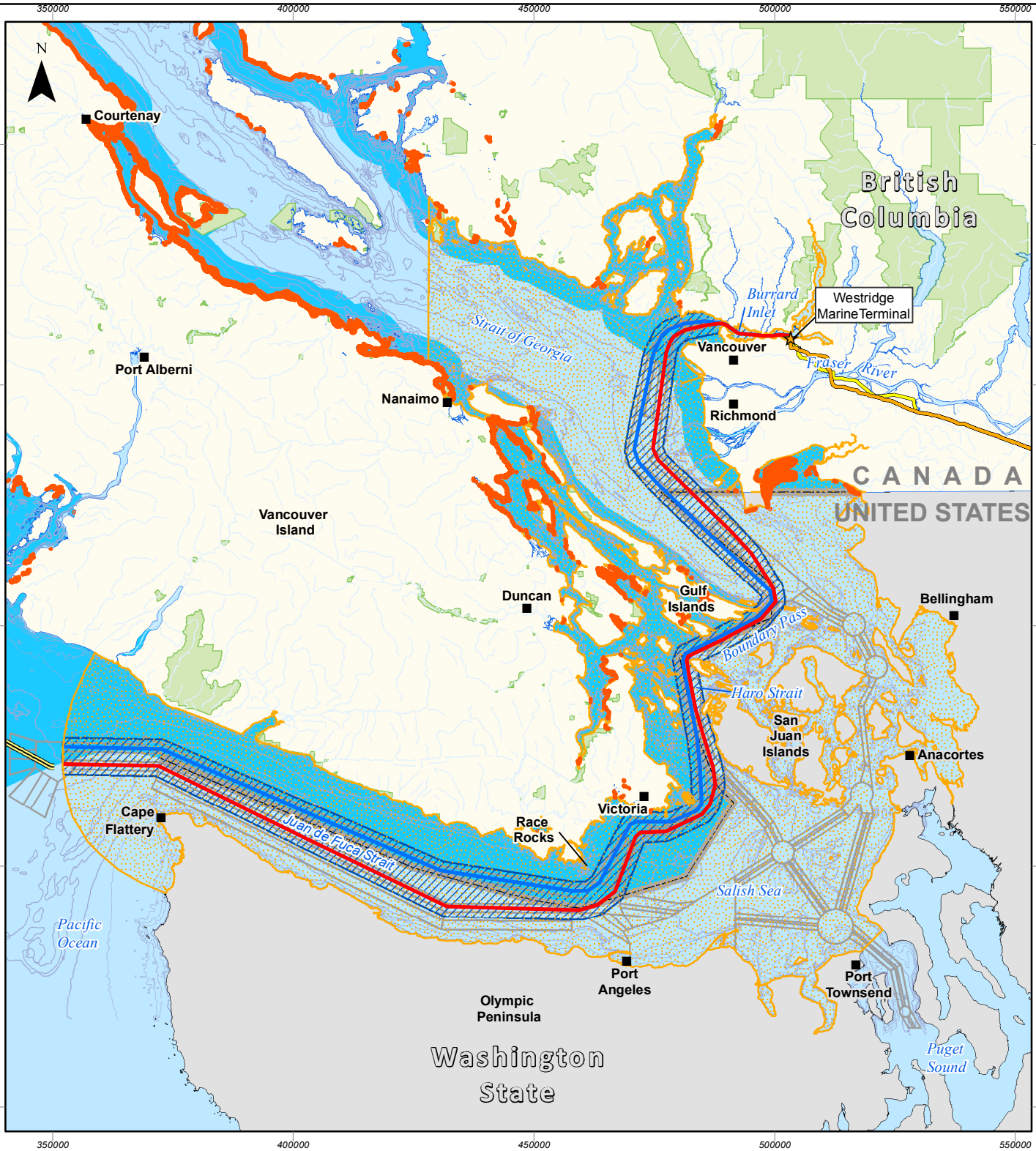
When spawning is followed by poor weather and increased wave action, marine vegetation can become dislodged or the eggs themselves can break loose and wash up on shore (Hart 1973). Studies on spawn mortality due to wave action during storm events have estimated resulting mortality rates of 26 to 74 per cent (Hart and Tester 1934, Hay and Miller 1982, Rooper 1996). Rooper *et al.* (1999) studied a variety of habitat factors controlling egg loss in Prince William Sound, Alaska including depth of spawn, wave exposure, substrate type, and vegetation type, among others. They found that the depth of spawn was the primary factor determining egg loss. Analysis of wave exposure at spawning sites found that egg loss was consistently higher in protected areas than in exposed areas; however, the factors driving this trend were not known. Substrate type and vegetation type were not found to be major contributors in rates of egg loss. Taylor (1955) notes that spawn survival is highest near zero tide level and in locations partially

protected from wave action, and survival is reduced in both exposed and well-protected localities. This suggests that a moderate amount of wave action may improve hatching success (Gustafson *et al.* 2006). According to Hay and Miller (1982), most of the Pacific herring spawn in BC waters is deposited in the subtidal zone and, therefore, is relatively protected from wave action.

Although there is inter-annual variation in specific spawning locations, general spawning areas are relatively consistent from one year to the next (Hay 1985), and Pacific herring spawn over large areas of the Strait of Georgia. Spawning areas and DFO Important Areas for Pacific herring in the Marine RSA are shown in Figure 4.2.20. DFO Important Areas are considered relevant to a species in terms of uniqueness, aggregation and/or fitness (DFO 2013f). According to Therriault *et.al.* (2009) and Hay and McCarter (2012), the most important spawning areas are located in Boundary Bay and along the east side of Vancouver Island, especially near Denman Island. Since the 1980s, the spawning distribution of Pacific herring in the Strait of Georgia has shifted to the northwest, with reduced concentrations of spawning activity in the south and east (Therriault *et al.* 2009). The causes of this shift are unknown; however, they may be related to changing climate conditions in the Salish Sea (Therriault *et al.* 2009).

In BC waters, herring eggs incubate for about three weeks before hatching (Hay and Fulton 1983). After hatching, larvae will feed and develop in sheltered nearshore waters near the spawning grounds for two to three months (NOAA 2012). Juveniles form schools in shallow waters where they feed until the fall, when they migrate to deep waters where they spend two to three years before they begin returning to inshore waters as adults to spawn (NOAA 2012). Once spawning is complete, adult Pacific herring will return to offshore feeding areas (NOAA 2012). The diet of Pacific herring changes as they develop. Young herring feed primarily on small crustaceans, decapod larvae, mollusk larvae, and other zooplankton and phytoplankton. Adults typically prey on small fish and crustaceans (NOAA 2012).

Since 1993, Pacific herring stocks in the Strait of Georgia have been managed by DFO as the Strait of Georgia Stock Assessment Region, one of five such assessment regions in BC (Martell *et al.* 2011). DFO regularly assesses the status of these stocks to inform management of the fishery. In the Strait of Georgia, Pacific herring abundance increased through the 1980s, reaching a historical high in 2003, then declined between 2004 and 2008 before increasing again in 2009 and stabilizing in 2010 (Cleary *et al.* 2009, Cleary and Schweigert 2011, Johannesen and McCarter 2010, Schweigert and Haist 2007, Therriault *et al.* 2009). Changes in herring abundance are largely driven by variation in juvenile survival, which is influenced by a number of factors including ocean conditions (*e.g.,* temperature and salinity), prey availability, predation pressure and anthropogenic stressors (Johannesen and McCarter 2010).



Stantec

SCALE: 1:1,150,000

0 10 20 30 40 km

ALL LOCATIONS APPROXIMATE

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MAP NUMBER: 10494_EA_TRANS_MAR_04_02_20		PAGE: SHEET 1 OF 1
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- Watercourse
- Existing Trans Mountain Pipeline
- Trans Mountain Expansion Proposed Pipeline Corridor
- Waterbody
- Provincial Park
- Traffic Separation Scheme
- Land of British Columbia
- Land of Washington State
- Marine Fish and Fish Habitat LSA (Transportation)
- Marine RSA (Transportation)
- Pacific Herring Spawning Areas
- DFO Important Areas for Pacific Herring

Projection: UTM Zone 10N; Marine Vessel Inbound Shipping Lane: Moffatt & Nichol, 2013a; Marine Vessel Outbound Shipping Lane: Moffatt & Nichol, 2013b; International Border: British Columbia Ministry of Energy and Mines, 2013; Canadian 12 Nautical Mile Territorial Boundary and Traffic Separation Scheme: Canadian Hydrographic Service, 2013; Bathymetry: Canadian Hydrographic Service, 2011; Watercourse: National Hydro Network, 2007; Existing Pipeline: Kinder Morgan Canada, 2012; Trans Mountain Expansion Proposed Pipeline Corridor: Universal Pegasus International, 2013; Provincial Park: BC MFLNRO, 2008a; Land of British Columbia: National Topographic Data Base, 2007; Land of Washington State: Washington State Department of Ecology, 1994; Pacific Herring Spawning Areas: Hay and McCarter, 2012; DFO Important Areas for Pacific Herring: DFO 2012a.

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

TRANS MOUNTAIN

FIGURE: 4.2-20

PACIFIC HERRING SPAWNING AREAS AND DFO IMPORTANT AREAS FOR PACIFIC HERRING IN THE MARINE RSA

TRANS MOUNTAIN EXPANSION PROJECT

4.2.6.5.3 Pacific Salmon

Pacific salmon belong to the family Salmonidae, which includes whitefishes, graylings, salmon, trout and char. There are five species of Pacific salmon in Canada belonging to the genus *Oncorhynchus,* including pink (*O. gorbuscha*), chum (*O. keta*), sockeye (*O. nerka*), coho (*O. kisutch*) and Chinook (*O. tshawytscha*). Steelhead trout (*O. mykiss*) are also closely related to Pacific salmon. Pacific salmon are considered to be an ecologically important species as they support marine, estuarine, freshwater and terrestrial food webs by providing nutrients to the ecosystem during their migration from the Pacific Ocean to rivers and streams to spawn (DFO 2013b, Hart 1973). They also have great socio-economic importance in BC and are targeted in commercial, recreational and Aboriginal fisheries.

The physical characteristics, life histories, spawning habits, distribution and abundance of Pacific salmon vary from species to species. An overview of this information is provided here. More detailed information about each species of Pacific salmon is presented in the Marine Resources – Marine Transportation Technical Report (Volume 8B, TR 8B-1).

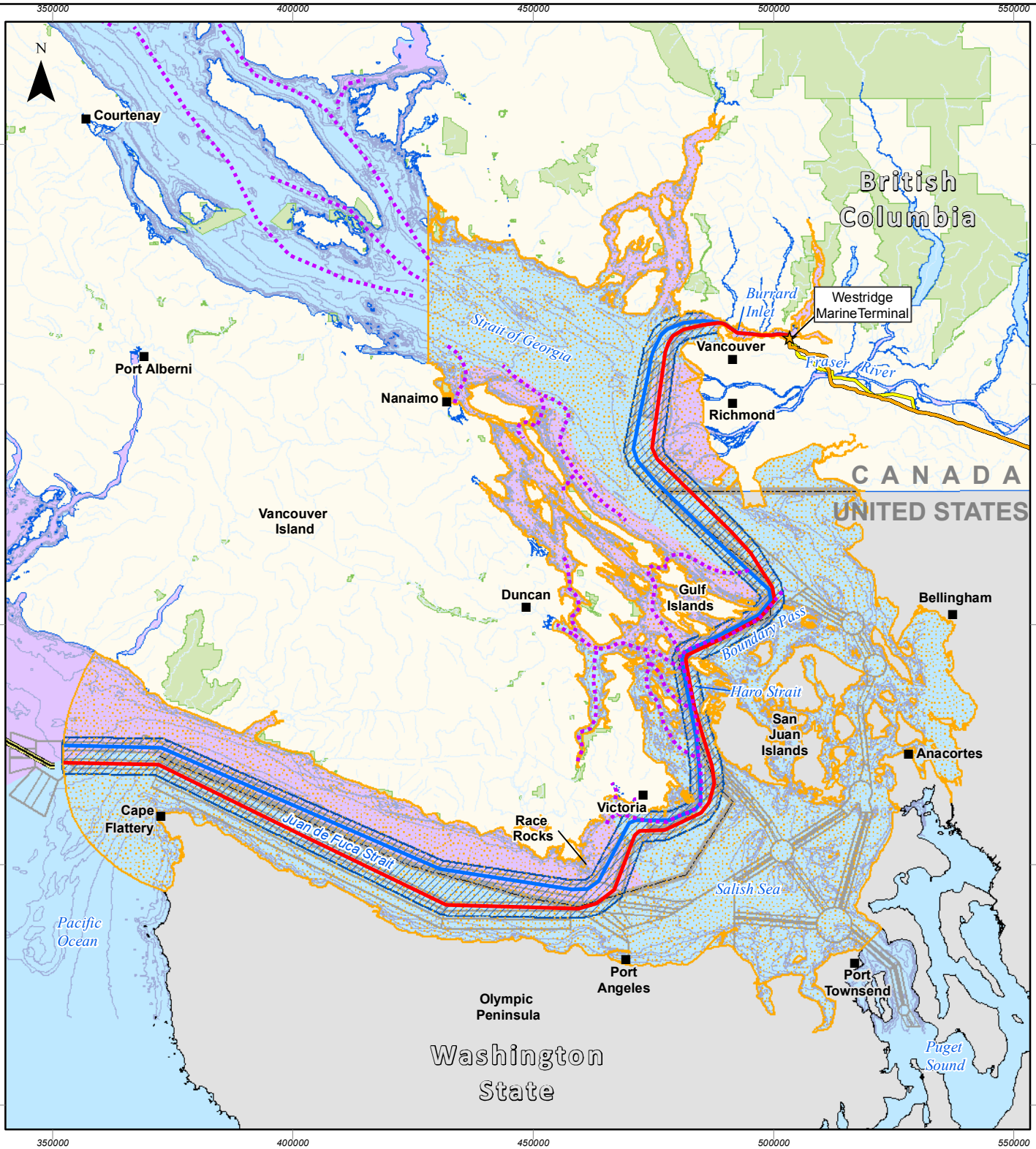
The average adult weights of Pacific salmon range from 1 to 3 kg for pink salmon and up to 6 to 18 kg for Chinook salmon (DFO 2013b). Chinook salmon are known to reach very large sizes. The largest recorded Chinook salmon weighed 57.27 kg (DFO 2013b). The life span of Pacific salmon ranges from 2 years for pink salmon to 7 years for sockeye and Chinook salmon (DFO 2001, 2013b).

Pacific salmon are anadromous, which means that they spawn in fresh water yet spend the majority of their lives in marine waters where they feed until maturity (DFO 2013b). Depending on the species, salmon will spend one to seven years in marine waters before returning to their natal streams to spawn from spring to fall (DFO 2001, 2013b). Spawning female salmon seek out stream beds with gravel substrate to deposit their eggs. The eggs hatch into alevins in mid-winter and emerge as fry in spring, and they remain in freshwater streams and lakes for periods ranging from one week to two years, depending on the species (DFO 2013b). All Pacific salmon are semelparous, meaning that individual fish spawn once in their lifetime and then die. In the ocean, Pacific salmon feed primarily on plankton and crustaceans such as tiny shrimp, while Chinook and coho salmon also eat smaller fish, such as herring (DFO 2013b).

The range of Pacific salmon includes the North Pacific Ocean, Bering Strait, southwestern Beaufort Sea and surrounding freshwater rivers and streams (DFO 2013b). Pacific salmon occur in an estimated 1,300 to 1,500 rivers and streams in BC and the Yukon (DFO 2013b). The most important rivers for Pacific salmon in BC include the Skeena and Nass rivers in the north and the Fraser River in the south, which account for 75 per cent of the salmon population in the province (DFO 2013b). The Fraser River system, which drains into the Marine RSA, is considered the largest single salmon production system in the world (Northcote and Larkin 1989) and accounts for, on average, about 50 per cent of salmon production in BC (Henderson and Graham 1998). The locations of salmon migration routes and DFO Important Areas for Pacific salmon in the Marine RSA are shown in Figure 4.2.21 (Jamieson and Levesque 2012a,b). DFO Important Areas are considered relevant to a species in terms of uniqueness, aggregation and/or fitness (DFO 2013b).

Pacific salmon are sensitive to changes in both marine and freshwater ecosystems (DFO 2013b). Fishing pressure and loss of habitat from human activities such as logging and agriculture are the key threats to Pacific salmon populations (COSEWIC 2002, 2003a,b, 2006; DFO 2001, 2013b). There are four populations of Pacific salmon that have been designated as Species of Conservation Concern by COSEWIC, including one coho population, one Chinook

population, and two sockeye populations (see Table 4.2.6.1). No Pacific salmon populations are currently listed under *SARA*. DFO's 2013 salmon outlook identified a number of Pacific salmon stocks of conservation concern in southern BC, including the West Coast of Vancouver Island Chinook stock, the south coast coho stock, Fraser River Chinook stocks, the lower Strait of Georgia Chinook stock and the North Vancouver Island/Johnstone Strait Chinook stock (DFO 2013b).



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ALL LOCATIONS APPROXIMATE

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MAP NUMBER		PAGE
10494_EA_TRANS_MAR_04_02_21		SHEET 1 OF 1
DATE	REF.	REVISION
Nov 2013	7894	0
SCALE	PAGE SIZE	DISCIPLINE
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- Westridge Marine Terminal
- Town / City
- Marine Vessel Inbound Shipping Lane
- Marine Vessel Outbound Shipping Lane
- International Border
- Canadian 12 Nautical Mile Territorial Boundary
- Bathymetry
- Watercourse
- Existing Trans Mountain Pipeline
- Trans Mountain Expansion Proposed Pipeline Corridor
- Waterbody
- Provincial Park
- Traffic Separation Scheme
- Land of British Columbia
- Land of Washington State
- Marine Fish and Fish Habitat LSA (Transportation)
- Marine RSA (Transportation)
- DFO Important Areas for Pacific Salmon
- Pacific Salmon Migration Routes

Projection: UTM Zone 10N; Marine Vessel Inbound Shipping Lane: Moffatt & Nichol, 2013a; Marine Vessel Outbound Shipping Lane: Moffatt & Nichol, 2013b; International Border: British Columbia Ministry of Energy and Mines, 2013; Canadian 12 Nautical Mile Territorial Boundary and Traffic Separation Scheme: Canadian Hydrographic Service, 2013; Bathymetry: Canadian Hydrographic Service, 2011; Watercourse: National Hydro Network, 2007; Existing Pipeline: Kinder Morgan Canada, 2012; Trans Mountain Expansion Proposed Pipeline Corridor: Universal Pegasus International, 2013; Provincial Park: BC MFLNRO, 2008a; Land of British Columbia: National Topographic Data Base, 2007; Land of Washington State: Washington State Department of Ecology, 1994; DFO Important Areas for Pacific Salmon: DFO 2012b; Pacific Salmon Migration Routes: DFO 2012c.

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

TRANS MOUNTAIN

FIGURE: 4.2-21

PACIFIC SALMON MIGRATION ROUTES AND DFO IMPORTANT AREAS FOR PACIFIC SALMON IN THE MARINE RSA

TRANS MOUNTAIN EXPANSION PROJECT

4.2.6.6 Aboriginal Traditional Knowledge

Marine fish, invertebrates and algae have been traditionally harvested by coastal Aboriginal communities throughout southern BC, including Burrard Inlet, Strait of Georgia, Gulf Islands and Juan de Fuca Strait. Pacific salmon are of particular importance to the coastal Aboriginal communities for sustenance as well as for social, economic and ceremonial purposes. Sockeye, pink, chum, coho and Chinook salmon can all be found within the Lower Fraser River as well as in marine waters throughout the area. The Fraser River system is used by over 100 Aboriginal communities, including those along Juan de Fuca and Johnstone straits (Canadian Environmental Assessment Agency 2006). The Fraser Canyon, located outside the Marine RSA, is an area where Pacific salmon are most abundant, and conditions for preparing the meat (*i.e.*, wind-drying) are ideal (Carlson 2001).

Available literature indicates that Aboriginal people traditionally harvested at least 71 animal species on the southern coast of BC (Burrard Inlet Environmental Action Program [BIEAP] 2011, 2012; Gardner 2009). Important fish species include: salmon; eulachon; sturgeon; lingcod; Pacific cod; halibut; skate; black cod; dogfish; shiners; herring; flounder; and trout (Esquimalt Nation 2010a, Hul'qumi'num Treaty Group 2005). Important invertebrate species include: barnacles; mussels; butter, horse, littleneck, manila and cockle clams; geoduck; northern abalone; giant red chiton; oysters; scallops; red and green sea urchin; sea cucumber; Dungeness and red rock crab; prawns; and octopus (Esquimalt Nation 2010a, Hul'qumi'num Treaty Group 2005). Numerous species of seaweed have also been traditionally harvested by Aboriginal people, including: kelp; rockweed; sea lettuce; and other green, brown and red algae species. Kelp and eelgrass beds are especially important harvesting areas as they serve as a key habitat for other major food species (Esquimalt Nation 2010b).

4.2.6.7 US Waters

The US portion of the Marine RSA includes southern portions of the Strait of Georgia and Juan de Fuca Strait along the coast of Washington.

4.2.6.7.1 Intertidal Habitat

Intertidal habitat in the US and Canadian portions of the Marine RSA has very similar biophysical characteristics. The Washington State Department of Ecology adopted the BC Biophysical Shore-Zone Mapping System and has mapped the various shore types along the state's shoreline (Washington State Department of Ecology 2006). The distribution of shore types in the US portion of the Marine RSA is shown in Figure 4.2.19. The length and relative abundance of shore types in the US portion of the Marine LSA and Marine RSA are shown in Table 4.2.6.3. A discussion of shore types in the Canadian portion of the Marine RSA is provided in Section 4.2.6.5.

TABLE 4.2.6.3

LENGTH AND RELATIVE ABUNDANCE OF SHORE TYPES IN THE US PORTION OF THE MARINE LSA AND MARINE RSA

Shore Type	Marine LSA - Length (km)	Marine LSA - % Total Length	Marine RSA - Length (km)	Marine RSA - % Total Length
Channel	0.0	0.0	0.2	0.0
Estuary, marsh or lagoon	0.0	0.0	104.9	6.8
Gravel beach	0.2	1.8	29.7	1.9
Gravel flat	0.0	0.0	2.7	0.2

TABLE 4.2.6.3

LENGTH AND RELATIVE ABUNDANCE OF SHORE TYPES IN THE US PORTION OF THE MARINE LSA AND MARINE RSA (continued)

Shore Type	Marine LSA - Length (km)	Marine LSA - % Total Length	Marine RSA - Length (km)	Marine RSA - % Total Length
Man-made	0.0	0.0	86.8	5.6
Mud flat	0.0	0.0	76.7	5.0
Rock cliff	8.7	88.8	312.2	20.2
Rock platform	0.0	0.0	37.9	2.5
Rock with gravel beach	0.0	0.0	77.7	5.0
Rock, sand and gravel beach	0.6	5.8	143.3	9.3
Rock with sand beach	0.0	0.0	59.2	3.8
Sand and gravel beach	0.2	1.7	263.9	17.1
Sand and gravel flat	0.0	0.0	112.1	7.3
Sand beach	0.2	2.0	80.9	5.2
Sand flat	0.0	0.0	157.7	10.2
Total	9.8	100.0	1,545.9	100.0

A total of 15 different shore types have been identified within the Marine RSA in the US. The total length of shoreline in the US portion of the Marine RSA is approximately 1,546 km. “Rock cliff” is the most common shore type in the Marine RSA covering approximately 312 km and 20.2 per cent of the shoreline (Washington State Department of Ecology 2006). “Sand and gravel beach” and “sand flat” shore types are the second and third most common covering 17.1 per cent and 10.2 per cent of the shoreline, respectively (Washington State Department of Ecology 2006).

The total length of shoreline in the US portion of the Marine LSA is about 10 km, along which a total of five different shore types have been identified (Washington State Department of Ecology 2006). “Rock cliff” is by far the most common shore type in the Marine LSA covering approximately 9 km or 90 per cent of the total shoreline (Washington State Department of Ecology 2006).

4.2.6.7.2 Pacific Herring

The range of Pacific herring populations in the Marine RSA includes both Canadian and US waters, and the border has no biological significance. Pacific herring populations in the Marine RSA are managed by the US National Marine Fisheries Service’s Georgia Basin Pacific herring distinct population segment (DPS), which extends from the southern end of Puget Sound proper to the northern end of the Strait of Georgia near Discovery Passage in Canadian waters and westward to Cape Flattery (Gustafson *et al.* 2006, Stout *et al.* 2001). As a whole, the Georgia Basin Pacific DPS demonstrated a trend of increasing abundance between 1990 and 2004 (Gustafson *et al.* 2006). Herring spawning areas within the US portion of the Marine RSA include: Discovery Bay and Dungeness Bay in Juan de Fuca Strait; Semiahmoo Bay; Cherry Point; Samish-Portage Bay; Fidalgo Bay and the northwest San Juan Islands; and the interior San Juan Islands in North Puget Sound/southern Strait of Georgia (Gustafson *et al.* 2006, Stout *et al.* 2001).

In 2004, the US stocks in the Marine RSA, including the northwest San Juan Islands, Cherry Point, and Discovery Bay stocks, were in severe decline. The Fidalgo, Dungeness and Semiahmoo Bays and Interior San Juan Islands stocks had experienced moderate declines, while the Samish-Portage Bay stock was considered healthy (Gustafson *et al.* 2006, Stout *et al.* 2001). In the 2008 stock assessment (the most recent assessment conducted), spawner abundance in all stocks in the US portion of the Marine RSA remained largely unchanged from 2004. The Cherry Point, Discovery Bay and Dungeness Bay stocks were reported to be in critical condition. The Fidalgo Bay and Interior San Juan Island stocks were reported to be depressed. The Semiahmoo Bay stock was reported to be moderately healthy, and the Samish-Portage Bay stock was considered to be healthy (Stick and Lindquist 2009). The exception was the Northwest San Juan Islands stock, which was reported to have disappeared following five years of no observable spawn (Stick and Lindquist 2009).

4.2.6.7.3 Pacific Salmon

While Pacific salmon stocks spawn in rivers and streams on either side of the Canada-US border, they may use all marine waters in the Marine RSA as habitat for migration and foraging. Chinook and coho salmon stocks that spawn in the US portion of the Marine RSA are managed by the Pacific Fishery Management Council as part of the Washington coastal Chinook/coho stocks and the Puget Sound Chinook/coho stocks. The Washington coastal Chinook/coho stocks include Chinook and coho populations from coastal streams north of the Columbia River through the western Juan de Fuca Strait. The Puget Sound Chinook/coho stocks include Chinook and coho populations from tributaries in Puget Sound through the eastern Juan de Fuca Strait (Pacific Fishery Management Council 2012).

Many Pacific salmon stocks along the US West Coast have declined substantially and are now at a fraction of their historical abundance (National Marine Fisheries Service [NMFS] 2011). Contributing factors to these declines include: overfishing; loss of freshwater and estuarine habitat; hydropower development; and poor ocean conditions and hatchery practices (NMFS 2011). In the US, a total of 28 salmon and steelhead stocks along the West Coast have been listed under the Federal *Endangered Species Act*, including the Puget Sound Chinook salmon DPS and the Hood Canal summer chum salmon DPS, which have been classified as Threatened and whose range includes portions of the Marine RSA (NMFS 2011).

4.2.7 Marine Mammals

This subsection provides an overview of the marine mammals that use habitat along the marine shipping lanes, from the Westridge Marine Terminal to the 12 nautical mile limit of Canada's territorial sea (shown in Figure 4.2.1). More detailed technical information pertaining to marine mammals is presented in the Marine Resources – Marine Transportation Technical Report (Volume 8B, TR 8B-1).

Aboriginal traditional knowledge pertaining to marine mammals is summarized in Section 4.2.7.7. Information pertaining to marine mammals in US waters can be found in Section 4.2.7.8. A discussion of the potential effects of the increased Project-related marine vessel traffic and associated mitigation as well as a discussion of the spatial boundaries for marine mammals are located in Section 4.3.7.

4.2.7.1 General Information

The marine waters of BC are used year-round by a broad range of marine mammal species, including cetaceans (whales, dolphins and porpoises), pinnipeds (seals and sea lions) and sea

otters. The productive straits and sounds of southern BC provide important habitat for marine mammal foraging, breeding, socializing and migration. While many species of marine mammal can be observed in the waters along the shipping lanes year-round and, consequently, depend on this environment for all aspects of their life history, other species are predominantly seasonal in their presence, coming to feed for a season or simply passing through during migration.

4.2.7.2 Field Data Collection

Information on marine mammal resources within the region is readily available in published literature and on government and research group websites and is deemed to be sufficient for the assessment of potential effects of the increased Project-related marine vessel traffic on marine mammals. Therefore, Project-specific field studies for this aspect of data gathering were not considered necessary.

4.2.7.3 Database and Information Gathering

The marine mammal knowledge base is derived from a review of relevant scientific literature, publications, and technical reports as well as local and regional data including;

- DFO Canadian Science Advisory Secretariat (CSAS) reports;
- COSEWIC assessments and status reports;
- BC Cetacean Sightings Network (BC CSN) data;
- the BC CDC; and
- the BC MCA.

The collection of information from these sources focused on marine mammal life history, broad habitat use, distribution, abundance and effects of underwater noise.

4.2.7.4 Conservation Status

Based on a review of the COSEWIC reports and *SARA* public registry list (Schedule 1) and the BC CDC Red and Blue lists, nine species of marine mammals of conservation concern have been identified as potentially occurring within the Marine RSA (BC CDC 2013). This includes regular sightings of southern resident and Bigg's (or transient) killer whales, humpback whales, harbour porpoises and Steller sea lions as well as occasional sightings of fin and grey whales, northern fur seals and sea otters.

Table 4.2.7.1 provides an overview of the 33 species (or ecotypes) of marine mammal found in BC, their conservation status and their relative likelihood of occurrence and predicted use of the Marine RSA. Of the eight listed species identified on Schedule 1 of *SARA*, one is Endangered (*i.e.,* southern resident killer whale), three are Threatened (*i.e.,* humpback whale, fin whale and Bigg's killer whale) and four are of Special Concern (*i.e.,* grey whale, harbour porpoise, Steller sea lion, and sea otter). Additionally, northern fur seals are listed as Threatened by COSEWIC; however, they have no status under *SARA.* Many species of marine mammals are wide-ranging, and the categorization of "predicted occurrence" in Table 4.2.7.1 is meant to qualitatively reflect the standard distribution of most species, although specific occurrence within the Marine RSA fluctuates and, therefore, is uncertain at any given time.

TABLE 4.2.7.1

MARINE MAMMALS OF BC, THEIR CONSERVATION STATUS AND PREDICTED OCCURRENCE IN AND USE OF THE MARINE RSA

Species Name	Status			Predicted Occurrence In and Use of the Marine RSA
	COSEWIC[1]	*SARA*[1]	BC List[1]	
Baleen Whales – Best Represented in the RSA by Humpback Whale Indicator				
Humpback whale *Megaptera novaeangliae*	Special Concern	Threatened Schedule 1	Blue	Relatively common and abundant, especially during summer and fall. Some presence year-round. The western-most portion of the Marine RSA overlaps critical habitat for this species. Use area primarily for foraging. Individuals may remain resident for several months while others migrate through. Numbers have been increasing in this area in recent years.
Blue whale *Balaenoptera musculus*	Endangered	Endangered Schedule 1	Red	No recorded presence. Unlikely, given understood historical distribution and preferred habitat (*i.e.,* primarily offshore).
Fin whale *Balaenoptera physalus*	Threatened	Threatened Schedule 1	Red	Rare sightings in Juan de Fuca Strait. May occasionally use western portion of Marine RSA for foraging. Understood historical distribution and preferred habitat is primarily offshore.
Sei whale *Balaenoptera borealis*	Endangered	Endangered Schedule 1	Red	No recorded presence. Unlikely, given understood historical distribution and preferred habitat (*i.e.,* primarily offshore). Now extremely rare throughout BC waters due to historical over-exploitation.
Minke whale *Balaenoptera acutorostrata*	Not at Risk	Not listed	Yellow	Fairly common but not generally abundant. Likely a year-round resident. Most frequently found in nearshore waters and passages around Haro Strait.
Grey whale *Eschrichtius robustus*	Special Concern	Special Concern Schedule 1	Blue	Fairly common but not generally abundant. Most common to western Vancouver Island, some whales remain resident throughout summer to forage. May also be observed at other times of year during migration.
North Pacific Right whale *Eubalaena japonica*	Endangered	Endangered Schedule 1	Red	One recent sighting in off western portion of Marine RSA; otherwise, no recorded presence. Unlikely, given understood historical distribution and preferred habitat (*i.e.,* primarily offshore). Now extremely rare throughout BC waters due to historical over-exploitation.

TABLE 4.2.7.1

MARINE MAMMALS OF BC, THEIR CONSERVATION STATUS AND PREDICTED OCCURRENCE IN AND USE OF THE MARINE RSA (continued)

Species Name	Status			Predicted Occurrence In and Use of the Marine RSA
	COSEWIC[1]	*SARA*[1]	BC List[1]	
Toothed Whales – Best Represented in the Marine RSA by Southern Resident Killer Whale Indicator				
Killer whale – southern resident ecotype *Orcinus orca*	Endangered	Endangered Schedule 1	Red	Common and regular sightings, particularly during summer and fall, but some presence in all months. Marine RSA overlaps the majority of the identified critical habitat for this species (100% of critical habitat within Canadian waters).
Killer whale – northern resident ecotype *Orcinus orca*	Threatened	Threatened Schedule 1	Red	Occasional visitors, particularly in western extent of Marine RSA; however, less common than southern resident killer whales given this population's generally more northern BC distribution.
Killer whale – Bigg's (previously west coast transient) ecotype *Orcinus orca*	Threatened	Threatened Schedule 1	Red	Regular sightings; however, less predictable than southern resident killer whales. Present year-round primarily for hunting. Wide-ranging, hunt and breed throughout large area.
Killer whale – offshore *Orcinus orca*	Threatened	Threatened Schedule 1	Red	Not well understood. May be occasional visitors; however, uncommon given generally more offshore distribution.
Sperm whale *Physeter macrocephalus*	Not at Risk	No Status No Schedule	Blue	Rare sightings. Unlikely, given understood historical distribution and preferred habitat (*i.e.,* primarily offshore). Males move further inshore in summer to feed. Calving may occur offshore.
Pacific white-sided dolphin *Lagenorhynchus obliquidens*	Not at Risk	No Status No Schedule	Yellow	Regular sightings in Strait of Georgia. Likely use area for foraging. When observed, often in large schools.
Dall's porpoise *Phocoenoides dalli*	Not at Risk	No Status No Schedule	Yellow	Common, use area for foraging and calving. Likely year-round residents.
Harbour porpoise *Phocoena phocoena*	Special Concern	Special Concern Schedule 1	Blue	Common, use area for foraging and calving. Likely year-round residents. Most commonly found in shallow (< 200 m) nearshore areas.
Striped dolphin *Stenella coeruleoalba*	Not at Risk	No Status No Schedule	Yellow	No recorded presence. Unlikely – generally an offshore species and only a rare visitor to BC.
Common dolphin (short-beaked) *Delphinus delphis*	Not at Risk	No Status No Schedule	Accidental	No recorded presence. Unlikely – generally an offshore species and only a rare visitor to BC.
Risso's dolphin *Grampus griseus*	Not at Risk	No Status No Schedule	Yellow	Rare sightings. Unlikely - generally an offshore species.
Northern right whale dolphin *Lissodelphis borealis*	Not at Risk	No Status No Schedule	Yellow	Rare sightings. Unlikely - generally an offshore species.

TABLE 4.2.7.1

MARINE MAMMALS OF BC, THEIR CONSERVATION STATUS AND PREDICTED OCCURRENCE IN AND USE OF THE MARINE RSA (continued)

Species Name	Status			Predicted Occurrence In and Use of the Marine RSA
	COSEWIC[1]	*SARA*[1]	BC List[1]	
Short-finned pilot whale *Globicephala macrorhynchus*	Not at Risk	No Status No Schedule	Yellow	Rare sightings. Unlikely – generally an offshore species and only a rare visitor to BC.
False killer whale *Pseudorca crassidens*	Not at Risk	No Status No Schedule	Accidental	Rare sightings. Unlikely – generally a more tropical/subtropical species and only a rare visitor to BC.
Baird's beaked whale *Berardius bairdii*	Not at Risk	No Status No Schedule	Unknown	No recorded presence. Unlikely – generally an offshore species.
Stejneger's beaked whale *Mesoplodon stejneri*	Not at Risk	No Status No Schedule	Unknown	No recorded presence. Unlikely – generally an offshore species.
Hubbs' beaked whale *Mesoplodon carlhubbsi*	Not at Risk	No Status No Schedule	Unknown	No recorded presence. Unlikely – generally an offshore species.
Cuvier's beaked whale *Ziphius cavirostris*	Not at Risk	No Status No Schedule	Yellow	No recorded presence. Unlikely – generally an offshore species.
Pygmy sperm whale *Kogia breviceps*	Not at Risk	No Status No Schedule	Accidental	No recorded presence. Unlikely – generally an offshore species.
Dwarf sperm whale *Kogia simus*	Data Deficient	No Status No Schedule	Accidental	No recorded presence. Unlikely – generally an offshore species.
Pinnipeds – Best represented in the Marine RSA by Steller Sea Lion Indicator				
Steller sea lion *Eumetopias jubatus monteriensis*	Special Concern	Special Concern Schedule 1	Blue	Common. Year-round presence. Peak numbers in Marine RSA during fall and winter. No rookeries (pupping areas) in Marine RSA. One major year-round haulout (*i.e.,* Carmanah Point) and numerous major winter haulouts, including one at Race Rocks, which is protected within an MPA. Use area to forage and haul out (*e.g.*, to rest, socialize).
California sea lion *Zalophus californianus*	Not at Risk	No Status No Schedule	Yellow	Not abundant, but regular sightings off Victoria and at Race Rocks. More common than Steller sea lion in Washington waters. Most likely from September through May when males and sub-adults migrate north while females remain near rookeries off California and Mexico.
Harbour seal *Phoca vitulina richardsi*	Not at Risk	No Status No Schedule	Yellow	Common and abundant. Ubiquitous throughout BC. Year-round resident. Use area to forage and breed.

TABLE 4.2.7.1

MARINE MAMMALS OF BC, THEIR CONSERVATION STATUS AND PREDICTED OCCURRENCE IN AND USE OF THE MARINE RSA (continued)

Species Name	Status			Predicted Occurrence In and Use of the Marine RSA
	COSEWIC[1]	*SARA*[1]	BC List[1]	
Northern elephant seal *Mirounga angustirostris*	Not at Risk	No Status No Schedule	Yellow	Uncommon. Recent sightings of small numbers at Race Rocks and other locations in the Marine RSA. Foraging occurs offshore in northern waters – individuals may be seen hauled out within Marine RSA during migration. Winter breeding rookeries and moulting sites in Mexico and California.
Northern fur seal *Callorhinus ursinus*	Threatened	No status No schedule	Red	Uncommon. Occasional sightings in Marine RSA. Historical distribution overlaps western-most portion of Marine RSA. Summer is spent at rookeries in Alaska. Winter is spent in the open water off continental shelf and shelf break though some overwinter up inlets.
Other – Not Assessed Explicitly as an Indicator				
Sea otter *Enhydra lutris*	Special Concern	Special Concern Schedule 1	Blue	Occasional. Most likely in western-most portion of Marine RSA. Year-round residents of central- and northwestern Vancouver Island. Washington population has known sightings around Tatoosh and Waadah Islands.

Sources: Species list taken from Heise *et al.* 2007. Principle sources of information include: COSEWIC Status Reports, DFO Recovery Strategies, Management Plans, and CSAS Reports, the BC CSN, the BC CDC, DFO, NMFS, and WDFW government websites and reports, and professional judgment of the Discipline Lead. List was last updated on November 25, 2013.

Note: 1 See Section 4.2.1.3 for definitions of COSEWIC, *SARA* and BC List status.

4.2.7.5 Critical Habitat and Important Areas

Critical habitat for southern resident killer whales has been officially designated for the trans-boundary waters of Haro Strait, Boundary Pass, the eastern portion of Juan de Fuca Strait and the southern portion of the Strait of Georgia (DFO 2009b; see Figure 4.2.22). The area designated as critical habitat under *SARA* is legally protected, and human activities that could potentially destroy the geophysical attributes of critical habitat are prohibited (DFO 2008, 2011). Ecosystem features, such as availability of prey and environmental quality are important to killer whale recovery, and according to DFO (2008), "a variety of legislative and policy tools are available to manage and mitigate threats to these functions of the Resident Killer Whale critical habitat, to individuals and to populations". Legislative and policy tools include (however, are not limited to) use of the:

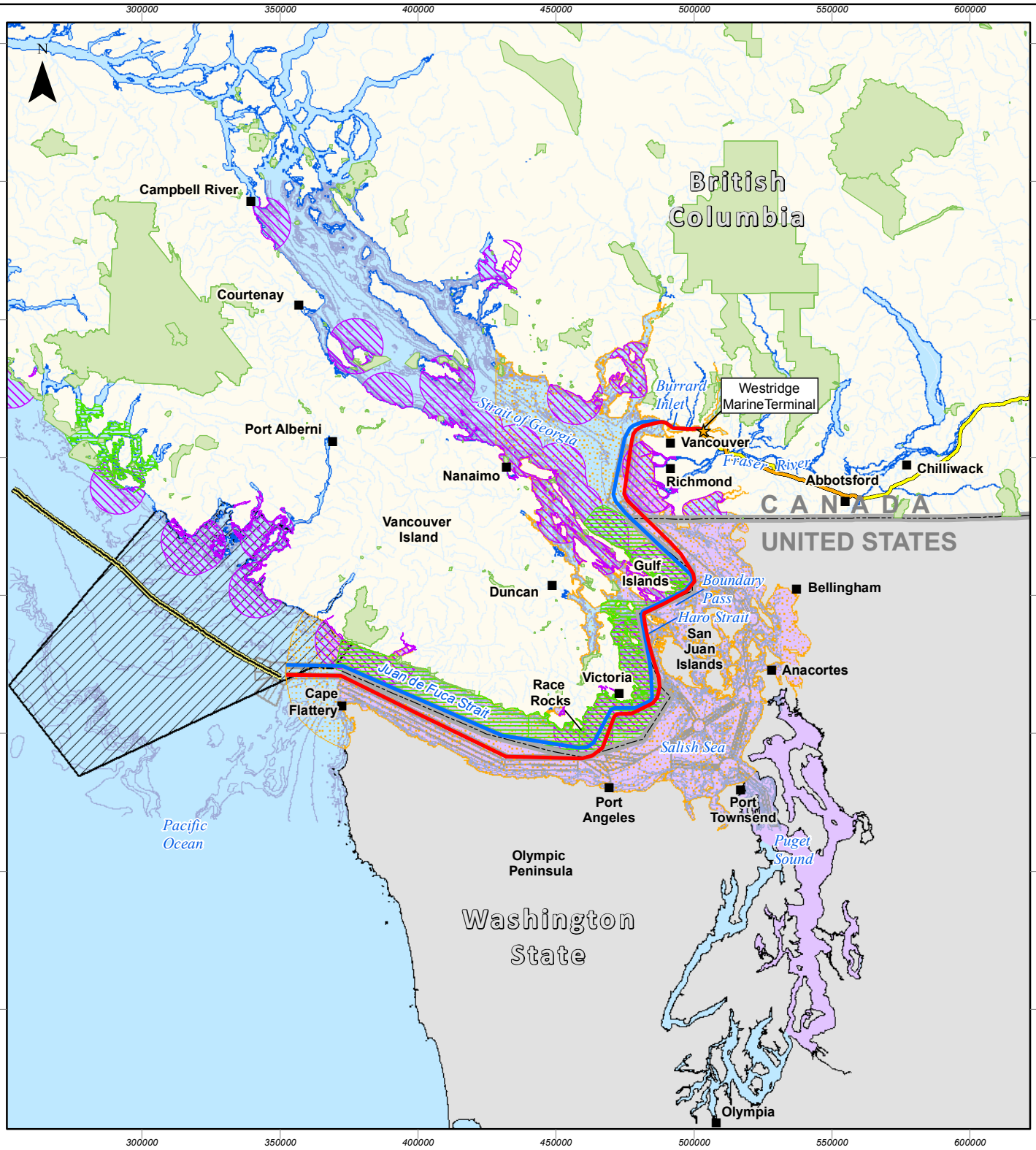
- *Fisheries Act*, 1985;
- Marine Mammal Regulations;
- Whale Watching Guidelines (Wild Whales 2006);

- Statement of Canadian Practice with Respect to the Mitigation of Seismic Sound in the Marine Environment (DFO 2013g);
- CEPA, 1999;
- Wild Salmon Policy (DFO 2005); and
- Integrated Fisheries Management Plans (DFO 2012b).

Critical habitat has also been identified in DFO's 2013 *Recovery Strategy for the North Pacific Humpback Whale (Megaptera novaeangliae) in Canada* (DFO 2013h). While not all potential critical habitat in BC has yet been identified for humpback whales, one of the identified areas includes Swiftsure Bank, southwest Vancouver Island. The western-most portion of the Marine RSA overlaps this critical habitat (see Figure 4.2.22), which has been identified as an area of importance for a potentially distinct sub-population of humpback whales that occupies southern BC and northern Washington waters (DFO 2013h).

DFO Important Areas have been identified for harbour porpoises and harbour seals in the Marine RSA and are also shown in Figure 4.2.22.

There is a major year-round haulout site for Steller sea lions on Carmanah Point and a number of major winter haulouts; however, no rookeries (*i.e.,* breeding colonies) within the Marine RSA (Figure 4.2.22).



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MAP NUMBER: 10494_EA_TRANS_MAR_04_02_22		PAGE: SHEET 1 OF 1
DATE: Nov 2013	REF.: 7894	REVISION: 0
SCALE: 1:2,000,000	PAGE SIZE: 8.5x11	DISCIPLINE: SD
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- Westridge Marine Terminal
- Town / City
- Marine Vessel Inbound Shipping Lane
- Marine Vessel Outbound Shipping Lane
- International Border
- Canadian 12 Nautical Mile Territorial Boundary
- Bathymetry
- Watercourse
- Existing Trans Mountain Pipeline
- Trans Mountain Expansion Proposed Pipeline Corridor
- Waterbody
- Provincial Park
- Traffic Separation Scheme
- Land of British Columbia
- Land of Washington State
- Marine RSA (Transportation)
- Humpback Whale Critical Habitat
- Southern Resident Killer Whale Critical Habitat
- DFO Important Areas for Harbour Seal
- DFO Important Areas for Harbour Porpoise

Projection: UTM Zone 10N; Marine Vessel Inbound Shipping Lane: Moffatt & Nichol, 2013a; Marine Vessel Outbound Shipping Lane: Moffatt & Nichol, 2013b; International Border: British Columbia Ministry of Energy and Mines, 2013; Canadian 12 Nautical Mile Territorial Boundary and Traffic Separation Scheme: Canadian Hydrographic Service, 2013; Bathymetry: Canadian Hydrographic Service, 2011; Watercourse: National Hydro Network, 2007; Existing Pipeline: Kinder Morgan Canada, 2012; Trans Mountain Expansion Proposed Pipeline Corridor: Universal Pegasus International, 2013; Provincial Park: BC MFLNRO, 2008a; Land of British Columbia: National Topographic Data Base, 2007; Land of Washington State: Washington State Department of Ecology, 1994; Humpback Whale Critical Habitat: DFO, 2013b; Critical Habitat for Southern Resident Killer Whale: DFO, 2011; DFO Important Areas for Harbour Seal: Olesiuk, P. [pers. comm.] in DFO, 2013a. DFO Important Areas for and Harbour Porpoise: Hall, A.H., 2004, DFO, 2013a.

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

TRANS MOUNTAIN

FIGURE: 4.2-22

CRITICAL HABITAT AND DFO IMPORTANT AREAS FOR MARINE MAMMALS IN THE MARINE RSA

TRANS MOUNTAIN EXPANSION PROJECT

4.2.7.6 Indicator Species

Three indicator species were selected to assess potential effects of the increased Project-related marine traffic on marine mammals: southern resident killer whale; humpback whale; and Steller sea lion (see Table 4.2.7.2). These species are intended to broadly represent the overall diversity of life history strategies displayed by the various marine mammal species using the habitats present within the Marine RSA boundaries. All of these species are highly mobile and are, at times, widely distributed throughout the Marine RSA. See Section 4.3 for more information regarding indicators.

TABLE 4.2.7.2

SUMMARY OF SELECTED MARINE MAMMALS INDICATORS

Common Name	Scientific Name	*SARA* (Schedule 1 Status)[1]	COSEWIC Status[1]	BC List Status[1]
Southern resident killer whale	*Orcinus orca*	Endangered Schedule 1	Endangered	Red
Humpback whale	*Megaptera novaeangliae*	Threatened Schedule 1	Special Concern	Blue
Steller sea lion	*Eumetopias jubatus monteriensis*	Special Concern Schedule 1	Special Concern	Blue

Note: 1 See Section 4.2.1.3 for definitions of COSEWIC, SARA and BC List status

4.2.7.6.1 Southern Resident Killer Whale

Killer whales are toothed whales (Odontocetes) and the largest member of the dolphin family (Delphinidae) (DFO 2011a). They have a distinctive black and white colouration and recognizable dorsal fin (COSEWIC 2008, Ford *et al.* 2000). Individual killer whales can be distinguished and identified based on the unique shape of their dorsal fin and the pattern of their saddle patch (*i.e.,* a grey to white coloured area at the base of their dorsal fin) (Ford *et al.* 2000).

Killer whales inhabit all of the world's oceans. In BC, they have been seen in almost all marine waters including long inlets, narrow channels, and deep embayments (DFO 2011a). In the Canadian Pacific waters, there are three sympatric population assemblages of killer whales: Bigg's killer whales (previously known as West Coast transients); residents; and offshores (COSEWIC 2008, Ford *et al.* 2000). While their ranges may overlap, there are morphological and genetic differences between these three assemblages as well as differences in acoustics, preferred prey and social structure (Barrett-Lennard and Ellis 2001, Ford *et al.* 1998, 2000). Resident killer whales are further subdivided into a northern and southern population, which are also recognized as separate designatable units, and which do not associate and rarely, if ever, interbreed (Barrett-Lennard and Ellis 2001, COSEWIC 2008).

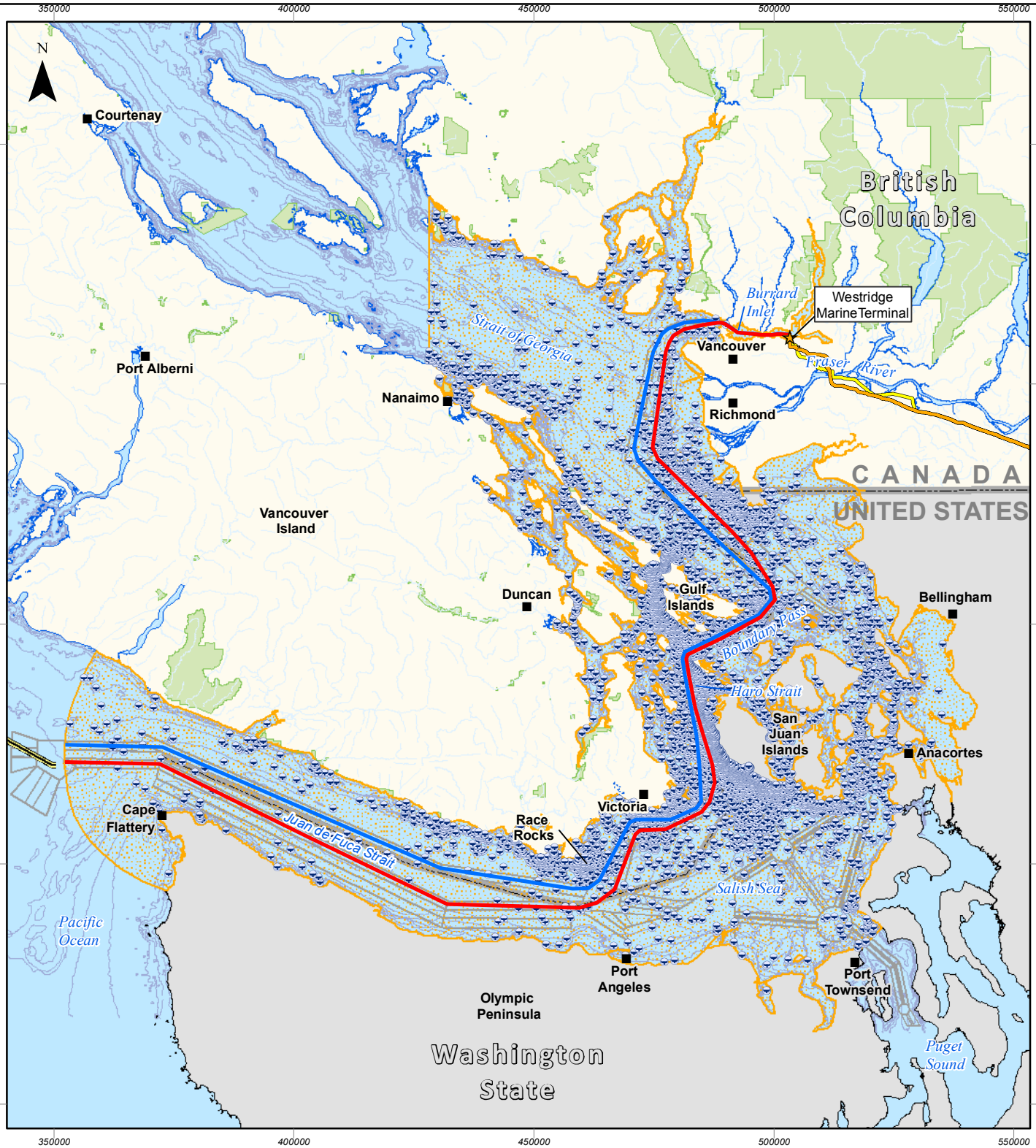
Resident killer whales have a complex social structure, composed of matrilines, pods and clans (Ford 1991, Ford *et al.* 2000). The basic social unit is the matriline – a stable, long-term maternally-related kin group composed of an older female (*i.e.,* matriarch), her sons and daughters and her daughters' offspring. Typical matrilines are composed of two to four generations of whales; whales tend to mate outside their matrilines. The term "pod" is assigned to collections of matrilines that spend most of their time together. The southern resident killer whale population has 3 pods: J, K and L. While northern residents are divided into different clans, based on related vocal dialects, southern residents all belong to the same clan.

The range of the southern resident population extends from Haida Gwaii, BC to Monterey Bay, CA (COSEWIC 2008). The principal prey of southern resident killer whales is Chinook and chum salmon, and their distribution during summer and fall is closely linked to that of the Chinook salmon (Ford and Ellis 2006). Their diet in the winter and spring is largely unknown (DFO 2011a). Killer whales in BC do not migrate to specific breeding or calving areas that are separate from their feeding grounds.

The southern resident population is listed as Endangered under Schedule 1 of *SARA*. This is due in large part to its small population, which was reduced in the 1960s and 70s due to capture for display in aquaria. This population increased from 70 whales in 1973 to 96 whales by 1996, before declining again by 4.4 per cent between 1997 and 2006 (COSEWIC 2008). As of July 1, 2013, there are 82 individuals in the southern resident population (*i.e.,* J Pod = 26, K Pod = 19 and L Pod = 37) (Center for Whale Research 2013). Key threats to the southern resident population include: reductions in the availability or quality of prey (primarily Chinook salmon); physical and acoustic disturbance; and chemical and biological contaminants (COSEWIC 2008, DFO 2011a).

The transboundary area between BC and Washington, which includes the southern portion of the Strait of Georgia, the Southern Gulf Islands, Boundary Pass, Haro Strait and Juan de Fuca Strait, has been designated as critical habitat under *SARA* (DFO 2008, 2009b, 2011a) (see Figure 4.2.22). This is based on consistent and prolonged seasonal occupancy of southern resident killer whales in this area (DFO 2011a). Based on a dataset maintained by the Whale Museum going back to 1976 (Osborne 1999, Osborne *et al.* 2001), on average, J Pod spends some of its time in the Marine RSA during every month of the year. L and K pods are less common in March and April; however, are commonly observed in every other month (the Whale Museum 2011). Opportunistic killer whale sightings in the Marine RSA, compiled by the BC CSN for the period of 1975 to 2013, are shown in Figure 4.2.23 (note that sightings presented on this map do not differentiate between potential killer whale populations). Data obtained from the BC Cetacean Sightings Network were collected opportunistically with limited knowledge of the temporal or spatial distribution of observer effort. As a result, absence of sightings at any location does not demonstrate absence of cetaceans. Killer whales are frequently observed in or within close proximity to the marine shipping lanes.

Further information on killer whales and other toothed whales in the Marine RSA is presented in the Marine Resources – Marine Transportation Technical Report (Volume 8B, TR 8B-1).



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MAP NUMBER		PAGE
10494_EA_TRANS_MAR_04_02_23		SHEET 1 OF 1
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- Waterbody
- Provincial Park
- Traffic Separation Scheme
- Land of British Columbia
- Land of Washington State
- Marine RSA (Transportation)
- Killer Whale Sighting

Note: Sightings data supplied by the BC Cetacean Sightings Network. Sightings are opportunistic and not corrected for effort. A sighting may be a single or multiple individuals.

Projection: UTM Zone 10N; Marine Vessel Inbound Shipping Lane: Moffatt & Nichol, 2013a; Marine Vessel Outbound Shipping Lane: Moffatt & Nichol, 2013b; International Border: British Columbia Ministry of Energy and Mines, 2013; Canadian 12 Nautical Mile Territorial Boundary and Traffic Separation Scheme: Canadian Hydrographic Service, 2013; Bathymetry: Canadian Hydrographic Service, 2011; Watercourse: National Hydro Network, 2007; Existing Pipeline: Kinder Morgan Canada, 2012; Trans Mountain Expansion Proposed Pipeline Corridor: Universal Pegasus International, 2013; Provincial Park: BC MFLNRO, 2008a; Land of British Columbia: National Topographic Data Base, 2007; Land of Washington State: Washington State Department of Ecology, 1994; Killer Whale Sightings: BC Cetacean Sightings Network, 2013.

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TRANS MOUNTAIN

FIGURE: 4.2-23

BC CSN OPPORTUNISTIC KILLER WHALE SIGHTINGS IN THE MARINE RSA 1975 TO 2013

TRANS MOUNTAIN EXPANSION PROJECT

4.2.7.6.2 Humpback Whale

Humpback whales are large baleen whales (Mysticetes) belonging to the family Balaenopteridae. They have a variable dark grey to black colouration, a short, stubby dorsal fin and white on the undersides of their long pectoral flippers (COSEWIC 2011, Shore 2011). They often raise their tail flukes while diving, and the shape, scars and colour patterns of their flukes can be used to identify individuals. Humpbacks are surprisingly acrobatic for a large whale and common behaviours include breaching, fin and tail slapping.

Their diet is highly variable, consisting of zooplankton (primarily euphausiids and copepods), cephalopods and small schooling fish such as Pacific herring, capelin, sandlance, Pacific sardine, juvenile salmon, Pacific cod, mackerel and anchovy (COSEWIC 2011). Many of these species are abundant in BC waters during the summer and fall, attracting humpback whales to the region to feed.

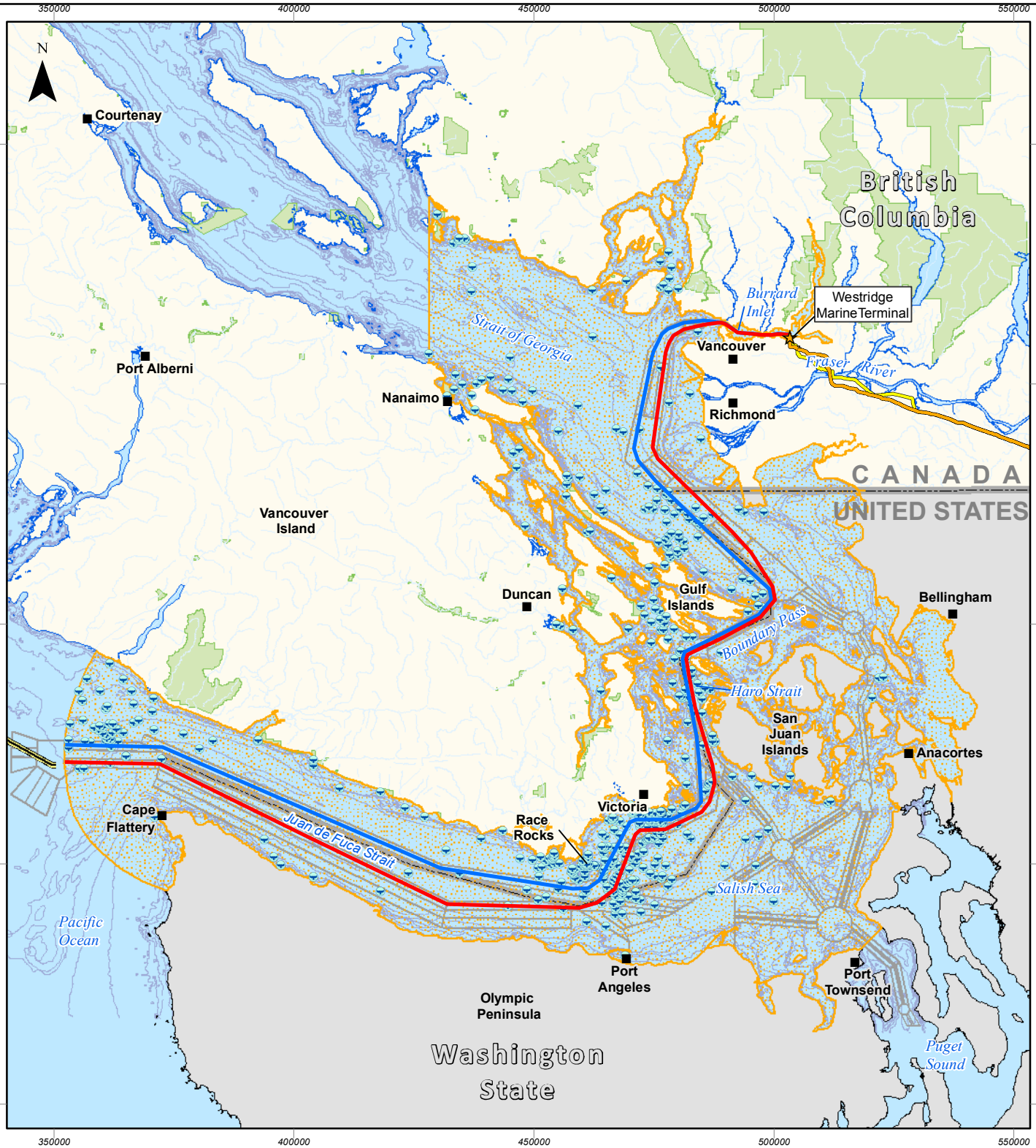
Humpback whales are widely distributed and are found in tropical, temperate and sub-polar waters of the world's oceans. Humpback whales undertake long migrations from breeding to feeding grounds. They breed and calf between November and May near Hawaii, Mexico, Central America, Japan and the Philippines (COSEWIC 2011). In Canadian Pacific waters, humpback whales range the length of the BC coast including both offshore and inshore waters and are most common from May through October. Small numbers may feed in these areas throughout the year (COSEWIC 2011, Dalla Rosa *et al.* 2012, Ford *et al.* 2009, Williams and Thomas 2007). Individual whales show considerable fidelity to feeding sites, where they return annually (COSEWIC 2011, Ford *et al.* 2009, Rambeau 2008).

Humpback whales are among the most commonly observed large cetaceans in BC (COSEWIC 2011, Ford *et al.* 2010, Williams and Thomas 2007). Concentrations of humpback whales have been observed during summer in the area east of Barkley Canyon and between La Pérouse Bank and Nitinat Canyon, and on the shelf edge near the southern portion of Juan de Fuca Canyon (Ford *et al.* 2010). Humpback whales appear to be present in most of the Marine RSA in a comparatively lower density than some other areas of BC (DFO 2013h). DFO has identified portions of humpback whale critical habitat in BC, one of which overlaps with the western-most portion of the Marine RSA off southwest Vancouver Island (DFO 2013h) (see Figure 4.2.22). Opportunistic humpback whale sightings in the Marine RSA, compiled by the BC CSN for the period of 1975 to 2013, are shown in Figure 4.2.24. Humpback whales are regularly observed in or within close proximity to the marine shipping lanes.

Humpback whales in the North Pacific Ocean appear to be recovering from previous heavy exploitation during commercial whaling (Cascadia Research 2008, COSEWIC 2011, Williams and Thomas 2007). The SPLASH project (Structure of Populations, Levels of Abundance and Status of Humpback Whales in the North Pacific) provided the most recent (2006) population size estimate for adult humpback whales in the North Pacific of 18,302 individuals, suggesting an annual increase of about 4.9 per cent since 1993 (Cascadia Research 2008). Regional estimates from SPLASH suggest seasonal (summer/fall) abundances of 3,000 to 5,000 humpback whales in northern BC and southeast Alaska (combined) and 200 to 400 individuals in southern BC and northern Washington (Cascadia Research 2008). Williams and Thomas (2007) estimated a 2005 population size for BC's inner waters of approximately 1,310 humpback whales, based on line transect surveys. A photo-identification study conducted by DFO suggests a 2006 estimate for humpback whales throughout BC waters of around 2,145 individuals (COSEWIC 2011, DFO 2009c, DFO 2013h, Ford *et al.* 2009, Ford *et al.* 2010, Rambeau 2008). Over the period of 1992 to 2006, the BC humpback population is estimated to

have grown at an annual rate of approximately 4.1 per cent, which is a reasonable growth rate for a population that is recovering from previous heavy exploitation (COSEWIC 2011, DFO 2009c, DFO 2013h, Ford *et al.* 2009, Ford *et al.* 2010, Rambeau 2008).

In 2011, COSEWIC down-listed the humpback whale from Threatened (in the 2003 assessment) to Special Concern (COSEWIC 2011); however, on the recommendation of the Minister of the Environment, this assessment has recently been referred back to COSEWIC, and the humpback whale remains listed as Threatened under Schedule 1 of *SARA* (Her Majesty the Queen in Right of Canada 2013). Key threats to the eastern North Pacific humpback whale include: noise disturbance; habitat degradation; entanglement in fishing gear and debris, and ship strikes (COSEWIC 2011). Activities identified by DFO as “likely to destroy or degrade critical habitat” include vessel traffic, toxic spills, overfishing, seismic exploration, sonar, and pile driving (DFO 2013h).



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Note: Sightings data supplied by the BC Cetacean Sightings Network. Sightings are opportunistic and not corrected for effort. A sighting may be a single or multiple individuals.

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TRANS MOUNTAIN

FIGURE: 4.2-24

BC CSN OPPORTUNISTIC HUMPBACK WHALE SIGHTINGS IN THE MARINE RSA 1975 TO 2013

TRANS MOUNTAIN EXPANSION PROJECT

Further information on humpback whales and other baleen whales in the Marine RSA is presented in the Marine Resources – Marine Transportation Technical Report (Volume 8B, TR 8B-1).

4.2.7.6.3 Steller Sea Lion

Steller sea lions are pinnipeds belonging to the family Otariidae (*i.e.,* the eared seals). They inhabit cool temperate and subarctic coastal waters from southern California north to the Bering Strait and south along the Asian coastline of the North Pacific Ocean (COSEWIC 2003c). Pinnipeds spend a considerable amount of time on land at haulouts and rookeries.

Steller sea lions in BC belong to the eastern Pacific stock. In 2009, Phillips *et al.* argued for sub-species designation between the western and eastern stocks of Steller sea lion. In 2012, the Society for Marine Mammalogy Ad-Hoc Committee on Taxonomy recognized these two subspecies of *Eumetopias jubatus* as: the western Steller sea lion (*E. j. jubatus*) and the Loughlin's northern sea lion (*E. j. monteriensis*). It is the latter subspecies that is found in BC. However, since the use of "Loughlin's northern sea lion" is relatively new, and at the time of writing of this document, the term "Steller sea lion" is still used by COSEWIC, the *SARA* registry, and the BC CDC, the more common "Steller sea lion" has been used throughout the application.

Sexually mature individuals use rookeries during the summer, with dispersal to non-breeding areas beginning in late August (DFO 2010a). Female Steller sea lions exhibit strong site fidelity, returning to the rookery where they were born or to a nearby adjacent rookery, to mate and give birth (COSEWIC 2003c). There are four Steller sea lion breeding areas along the coast of BC: the Scott Islands off northwest Vancouver Island (which support 33 per cent of the total eastern population); Cape St. James off the southern tip of Haida Gwaii; the Sea Otter Group off the Central Mainland coast; and off Banks Island on the North Mainland coast (DFO 2010a).

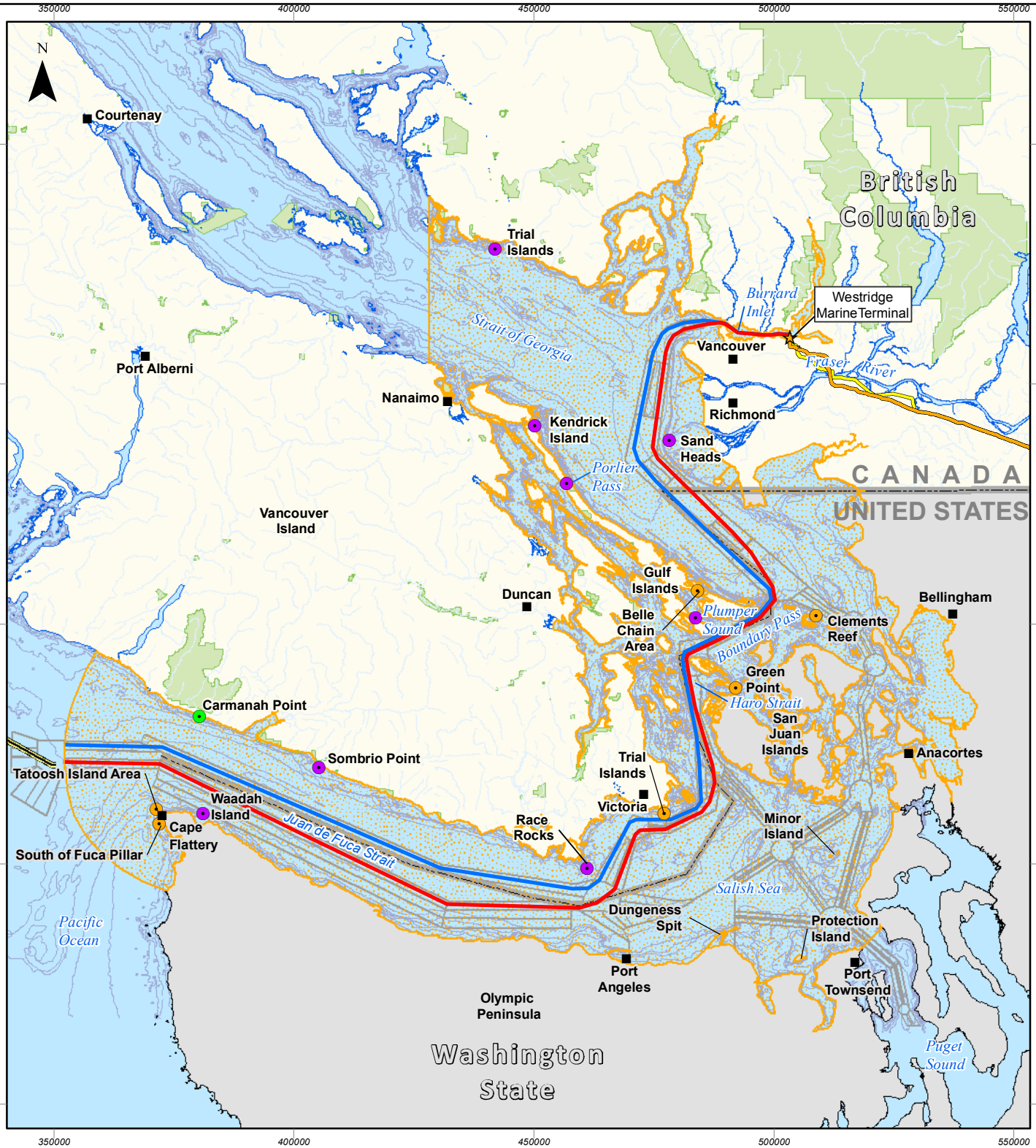
None of the four Canadian breeding areas discussed above is located within the Marine RSA, and the closest rookeries in US waters are in southern Oregon (Allen and Angliss 2012, Jeffries *et al.* 2000). In addition to rookeries, there are at least 23 year-round haulouts in BC and multiple major winter haulouts (DFO 2010a). Both male and female Steller sea lions are present year-round in the Marine RSA. In addition to one year-round haulout at Carmanah Point, and several major winter haulouts, there are several minor haulouts located in the Marine RSA (major year-round and winter haulouts near the Marine RSA are shown in Figure 4.2.25).

The Steller sea lion is listed as Special Concern under Schedule 1 of *SARA* and is the only pinniped species at risk likely to occur on a regular basis in the Marine RSA. Since receiving protection from hunting under the *Fisheries Act* in 1970, the population of Steller sea lions in BC has increased several-fold (DFO 2010a). The *Oceans Act* of 1996 allowed for the creation of a MPA at Race Rocks, which protected an important winter haulout site within the Marine RSA (COSEWIC 2003c) (see Figure 4.2.25). The maximum number of Steller sea lions observed at one time on Race Rocks increased from 7 individuals in 1965 to 680 individuals in 2009 (Edgell and Demarchi 2012).

Threats to Steller sea lions include:

- degradation of or displacement from essential habitat;
- acoustic disturbance in aquatic habitat;

- disturbance on and around terrestrial habitat;
- reproductive impairment from environmental contaminants;
- toxic spills;
- predator control at fish farms;
- incidental mortality from fishing gear and other sources; and
- shifts in prey abundance and distribution (COSEWIC 2003c, DFO 2010a).



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MAP NUMBER		PAGE
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- Marine RSA (Transportation)

Steller Sea Lion Haulouts

- Major Winter Haulouts
- Year-round Haulout
- Haulouts with Timing Unknown

Projection: UTM Zone 10N; Marine Vessel Inbound Shipping Lane: Moffatt & Nichol, 2013a; Marine Vessel Outbound Shipping Lane: Moffatt & Nichol, 2013b; International Border: British Columbia Ministry of Energy and Mines, 2013; Canadian 12 Nautical Mile Territorial Boundary and Traffic Separation Scheme: Canadian Hydrographic Service, 2013; Bathymetry: Canadian Hydrographic Service, 2011; Watercourse: National Hydro Network, 2007; Existing Pipeline: Kinder Morgan Canada, 2012; Trans Mountain Expansion Proposed Pipeline Corridor: Universal Pegasus International, 2013; Provincial Park: BC MFLNRO, 2008a; Land of British Columbia: National Topographic Data Base, 2007; Land of Washington State: Washington State Department of Ecology, 1994; Stellar Sea Lion Haulouts: Bigg, 1985; Edgell and Demarchi, 2012; DFO, 2010; Jefferies et al., 2000; NOAA Fisheries Service, 2012.

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TRANS MOUNTAIN

FIGURE: 4.2-25

MAJOR STELLER SEA LION HAULOUTS IN THE MARINE RSA

TRANS MOUNTAIN EXPANSION PROJECT

Further information on Steller sea lions and other pinnipeds in the Marine RSA is presented in the Marine Resources – Marine Transportation Technical Report (Volume 8B, TR 8B-1).

4.2.7.7 Aboriginal Traditional Knowledge

The literature review indicates that marine resource extraction was, and continues to be, an important activity for coastal Aboriginal communities in the Marine RSA. Marine mammals have traditionally been harvested at the intersection of the Fraser River and the Pacific Ocean, throughout the Gulf Islands, in the Strait of Georgia and along the southern coast. Traditionally hunted marine mammal species included grey whales, Steller sea lions, Pacific white-sided dolphins, killer whales, harbour seals and porpoises (BC Transmission Corporation 2006, Canadian Environmental Assessment Agency 2006, Simonsen *et al.* 1995).

4.2.7.8 *US Waters*

Since the Marine RSA straddles the international border between Canada and the US, the literature search also included a review of US sources for local marine mammal research, such as the Center for Whale Research, the Whale Museum, Orca Network, Cascadia Research Collective, and NMFS. Baseline information regarding marine mammals in US waters is expected to be consistent with baseline information in Canadian waters. Further detail on marine mammal sightings and research conducted in US waters is presented in the Marine Resources – Marine Transportation Technical Report (Volume 8B, TR 8B-1).

4.2.8 Marine Birds

This subsection provides an overview of the marine bird species and habitats along the marine shipping lanes, from the Westridge Marine Terminal to the 12 nautical mile limit of Canada's territorial sea (shown in Figure 4.2.1). More detailed technical information pertaining to marine birds is presented in the Marine Birds – Marine Transportation Technical Report (Volume 8B, TR 8B-2).

Aboriginal traditional knowledge pertaining to marine birds is summarized in Section 4.2.8.7. Information pertaining to marine birds in US waters can be found in Section 4.2.8.8. A discussion of the potential effects of the increased Project-related marine vessel traffic and associated mitigation as well as a discussion of the spatial boundaries for marine birds are located in Section 4.3.8.

4.2.8.1 Spatial Boundaries

The existing environmental conditions for marine birds are described with regard to the Marine Birds LSA, which includes the inbound and outbound marine shipping lanes, the area between the shipping lanes where it exists and a 1 km buffer extending from the outermost edge of each shipping lane. The shipping lanes extend from the Westridge Marine Terminal in Burnaby, through Burrard Inlet, south through southern part of the Strait of Georgia, the Gulf Islands and Haro Strait, then westward past Victoria and though Juan de Fuca Strait out to the 12 nautical mile limit of Canada's territorial sea. The Marine Birds LSA is shown on Figure 4.2.2.

4.2.8.2 General Information

The Marine RSA falls within the Strait of Georgia, Haro Strait and Juan de Fuca Strait, all within the Salish Sea, an inland area of ocean that extends from Olympia, Washington northward to Campbell River, BC. The Salish Sea supports diverse populations of seasonally present birds, abundant marine bird breeding colonies, designated IBAs and Reserves, and seasonally

important foraging areas, such as marine upwellings, shallow open water and the continental shelf. The Marine RSA encompasses large breeding colonies and other sensitive marine bird foraging and staging areas proximate to the shipping lanes.

There are an estimated 124 marine bird species (Campbell *et al.* 1990, Stevens 1995) using coastal terrestrial habitats (above the high-water mark), foreshore (shoreline from high-water to low-water tide mark), nearshore (low-water mark to water extending 10 m seaward) and offshore areas (nearshore to the continental shelf) of the Marine RSA. Some of these species may comprise populations of tens of thousands of breeding, migrant or wintering birds. Species of conservation concern found using marine habitats within the Marine RSA include short-tailed albatross, Brandt's cormorant, double-crested cormorant, western grebe, great blue heron, common murre, horned puffin, marbled murrelet, surf scoter, red knot, long-billed curlew and peregrine falcon (Badzinzki *et al.* 2008, BC CDC 2013). Breeding colonies of double-crested cormorants, pelagic cormorants, black oystercatchers, rhinoceros auklets, Cassin's auklets, tufted puffins, pigeon guillemots, great blue herons, fork-tailed and Leach's storm-petrels and glaucous-winged gulls are documented within the Salish Sea (Chatwin *et al.* 2002, Elliot *et al.* 2005, Vermeer 1983, Wahl *et al.* 1981). Substantial breeding areas in the Salish Sea are located on Protection Island, Tatoosh Island, Smith and Minor Islands in the US, and Mandarte Island and Race Rocks in Canada (Wahl *et al.* 1981). Multiple non-colonial species also breed in these areas (Wahl *et al.* 1981, Burton 2010).

In BC, marine habitats are adversely affected by recreational activities, commercial fishing, fish farms, industrial developments, timber harvesting and vessel operations, which have reduced important habitats for marine birds, with the exception of some designated conservation areas. Marine and coastal ecosystems are subject to large-scale changes and fluctuations in productivity.

4.2.8.2.1 Conservation Areas

Provincially designated conservation areas include Wildlife Management Areas, MPAs, RCAs, Ecological Reserves, and Provincial Parks (Table 4.2.8.1, Figure 4.2.3). Both pelagic and coastal waters are used seasonally by a wide variety of breeding, foraging and over-wintering marine birds especially in extensive tidal mudflats, eelgrass beds, rocky offshore islets and old-growth forest (Parks Canada 2009b). Federal protection designations include Migratory Bird Sanctuaries (CWS), DFO MPAs, National Marine Conservation Areas (Parks Canada), National Parks of Canada (Parks Canada), National Wildlife Areas (CWS) and Critical Habitat (*SARA*) (Figure 4.2.26).

TABLE 4.2.8.1

CONSERVATION AREAS WITHIN AND NEAR THE MARINE RSA

Conservation Area Type	Conservation Area Title
MPA	Race Rocks
Migratory Bird Sanctuary	George C. Reifel Migratory Bird Sanctuary
National Wildlife Area	Alaksen National Wildlife Area
RAMSAR	Fraser River Delta
National Marine Conservation Area Reserve	Southern Strait of Georgia National Marine Conservation Area Reserve (PROPOSED)
RCA	Mayne Island North
RCA	McCall Bank
RCA	Halibut Bank

TABLE 4.2.8.1

CONSERVATION AREAS WITHIN AND NEAR THE MARINE RSA (continued)

Conservation Area Type	Conservation Area Title
RCA	Valdes Island East
RCA	Galiano Island North
WMA	Roberts Bank WMA
WMA	Boundary Bay WMA
WMA	Sturgeon Bank WMA
WMA	South Arm Marshes WMA
Ecological Reserve	Oak Bay Islands Ecological Reserve
Ecological Reserve	Ten Mile Point Ecological Reserve
Ecological Reserve	Trial Islands Ecological Reserve
Ecological Reserve	Race Rocks Ecological Reserve
Ecological Reserve	Galiano Island Ecological Reserve
Ecological Reserve	Ballingall Islets Ecological Reserve
Ecological Reserve	Canoe Islets Ecological Reserve
Ecological Reserve	Rose Islets Ecological Reserve
Ecological Reserve	Hudson Rocks Ecological Reserve
Ecological Reserve	Satellite Channel Ecological Reserve

4.2.8.2.2 Important Bird Areas

There are 20 IBAs present within the Marine RSA (Table 4.2.8.2, Figure 4.2.2.6), which range in size from 140 ha to 153,717 ha. Detailed information on the importance of each of these IBAs was gathered from Bird Studies Canada and Nature Canada (2012) and BirdLife International (2012a).

TABLE 4.2.8.2

IMPORTANT BIRD AREAS FOUND WITHIN AND NEAR THE MARINE RSA

IBA Name	Regulatory Prov/State	Central Coordinates	Size (ha)	Details	Bird Colonies	IBA Trigger Species	Globally Significant Species	Proximity to Marine Bird LSA and Marine RSA
Active Pass (BC015)	BC	123° 18.06' W 48° 52.25' N	1,700 (4.5 km long)	• Between Galiano and Mayne Islands in the southwest of the Strait of Georgia • Approximately 40 km south of Vancouver and 50 km north of Victoria • High intertidal and subtidal biodiversity • Rich feeding ground for fish-eating avifauna during tidal ebbs in spring, fall and winter	• None	• 2,000 individual Pacific loons • 4,000 individual Brandt's cormorants • 10,000 individual Bonaparte's gulls	• Pacific loon • Brandt's cormorant • Bonaparte's gull	Within the Marine RSA, approximately 12 km northwest of the Marine Birds LSA
Boundary Bay and Roberts Bank (BC017)	BC	123º 7.26' W 49º 9.05' N	76,000	• Encompasses Boundary Bay and the estuarine coastal wetland areas of Sturgeon Bank and Roberts Bank, the waters north and south of the south arm of the Fraser River and Point Roberts (US) • Includes 3 separate areas (Boundary Bay, Roberts Sturgeon Banks) that many species move frequently between • A variety of habitats include mudflats and intertidal marshes • Low tides expose large mudflats and extensive eelgrass beds in bays	• Great blue heron	• 46,700 individual snow geese • 4,751 individual Brants • 526 individual Trumpeter swans • 30,500 individual American wigeons • 20,950 individual mallards • 24,940 individual northern pintails • 2,576 individual red-necked grebes • 3,000 individual western grebes • 1,600 individual grey plovers • 500,000 individual western sandpipers • 29,000 individual dunlins • 19,000 individual glaucous-winged gulls	• N/A	Within the Marine RSA, adjacent (< 2 km) to the Marine Birds LSA
English Bay and Burrard Inlet (BC020)	BC	123º 5.52' W 49º 17.87' N	14,009	• Burrard Inlet is a sheltered fjord of Strait of Georgia • Includes False Creek and English Bay, Vancouver Harbour, Port Moody Arm and Indian Arm • Most of shoreline is rocky or built up with port facilities and seawalls • Extensive tidal sandflats, mudflats and saltwater marshes, inlets and coastal features	• Purple martin (nest boxes) • Great blue heron	• 183 breeding pairs of great blue heron	• Western grebe • Barrow's goldeneye • Surf scoter	Within the Marine RSA and Marine Birds LSA near Westridge Marine Terminal
White Islets and Wilson Creek (BC025)	BC	123° 42' 43.2" W 49° 25' 4.7994" N	2,938	• Located approximately 6 km southeast of Sechelt, where Wilson Creek discharges into the Strait of Georgia, the shoreline on both sides of Wilson Creek and approximately 2 km offshore in a 2 km radius around the islets • White Islets are small and rocky with rock crevices • Wilson Creek shoreline is composed of sand and gravel substrates • Sub-tidal habitats are ideal feeding areas for surf scoters and harlequin ducks	• None	• 490 breeding pairs of glaucous-winged gulls • 1,000 breeding pairs of surfbirds	• Surfbird	Within the Marine RSA, approximately 27 km northwest of the Marine Birds LSA

TABLE 4.2.8.2

IMPORTANT BIRD AREAS FOUND WITHIN AND NEAR THE MARINE RSA (continued)

IBA Name	Regulatory Prov/State	Central Coordinates	Size (ha)	Details	Bird Colonies	IBA Trigger Species	Globally Significant Species	Proximity to Marine Bird LSA and Marine RSA
Chain Islets and Great Chain Island (BC045)	BC	123° 16.16' W 48° 25.22' N	140	• Located in Oak Bay in Juan de Fuca Strait, approximately 2 km from Victoria • Encompasses a radius of approximately 700 m^2 of marine water • 18 small islets and rocks clustered within Mayor Channel • Shorelines comprise steep cliff faces, rocky outcrops, boulders, crevices and small gravel beaches • Waters are shallow with emerging rocky reefs	• Pelagic cormorant	• 2,432 breeding pairs of glaucous-winged gulls • 2,000 individual Brandt's cormorants • 510 breeding pairs of double-crested cormorants	• Glaucous-winged gull • Brandt's cormorant	Within the Marine RSA, adjacent (<2 km) to the Marine Birds LSA
Sidney Channel (BC047)	BC	123º 21' 28.8'' W 48º 37' 33.59'' N	8,710	• Situated along the extreme southeast shore of Vancouver Island between James Island and Sidney Island • 4 km wide channel that connects Haro Strait and the Strait of Georgia • Lagoon present at the northwestern end of Sidney Island • Supports large schools of sand lance in the marine substrate that provide food for marine birds in spring and summer	• None	• 3,000 individual Brants • 20 breeding pairs of black oystercatchers • 900 individual Brandt's cormorants • 50 individual great blue herons • 500 individual mew gulls • 300 individual pigeon guillemots	• Brandt's cormorant • Mew gull	Within the Marine RSA, approximately 5 km east of Marine Birds LSA
Cowichan Estuary (BC048)	BC	123º 34.48' W 48º 44.35' N	1,300	• No site description	• None	• 216 individual Trumpeter swans • 724 individual mew gulls • 530 individual Thayer's gulls	• N/A	Within the Marine RSA, approximately 20 km northwest of the Marine Birds LSA
Porlier Pass (BC052)	BC	123° 35' 27.59" W 49° 0' 43.2" N	1,558 (2 km long)	• Situated in the Southern Gulf Islands between the south end of Valdes Island and the north end of Galiano Island • 1.5 km radius • Extends along the north shoreline of Galiano Island from Alcala Point to Dionisio Point, and from Shah Point to Cardale Point on the south end of Valdes Island • Strong tidal currents surge through the pass each day causing strong upwellings in the narrow passage	• Glaucous-winged gull • Black oystercatchers	• 1,000 individual mew gulls	• Mew gull	Within the Marine RSA, approximately 12 km east of the Marine Birds LSA
Snake Island (BC055)	BC	123° 53' 27.6" W 49° 12' 57.6" N	396	• Approximately 3 km northwest of Gabriola Island in the Strait of Georgia on the approach to Nanaimo Harbour • Encompasses a long, narrow sandstone island surrounded by the marine waters in a 1 km radius	• Glaucous-winged gull • Pelagic cormorant	• 673 breeding pairs of glaucous-winged gulls • 74 breeding pairs of pelagic cormorants	• N/A	Within the Marine RSA, approximately 35 km east of the Marine Birds LSA

TABLE 4.2.8.2

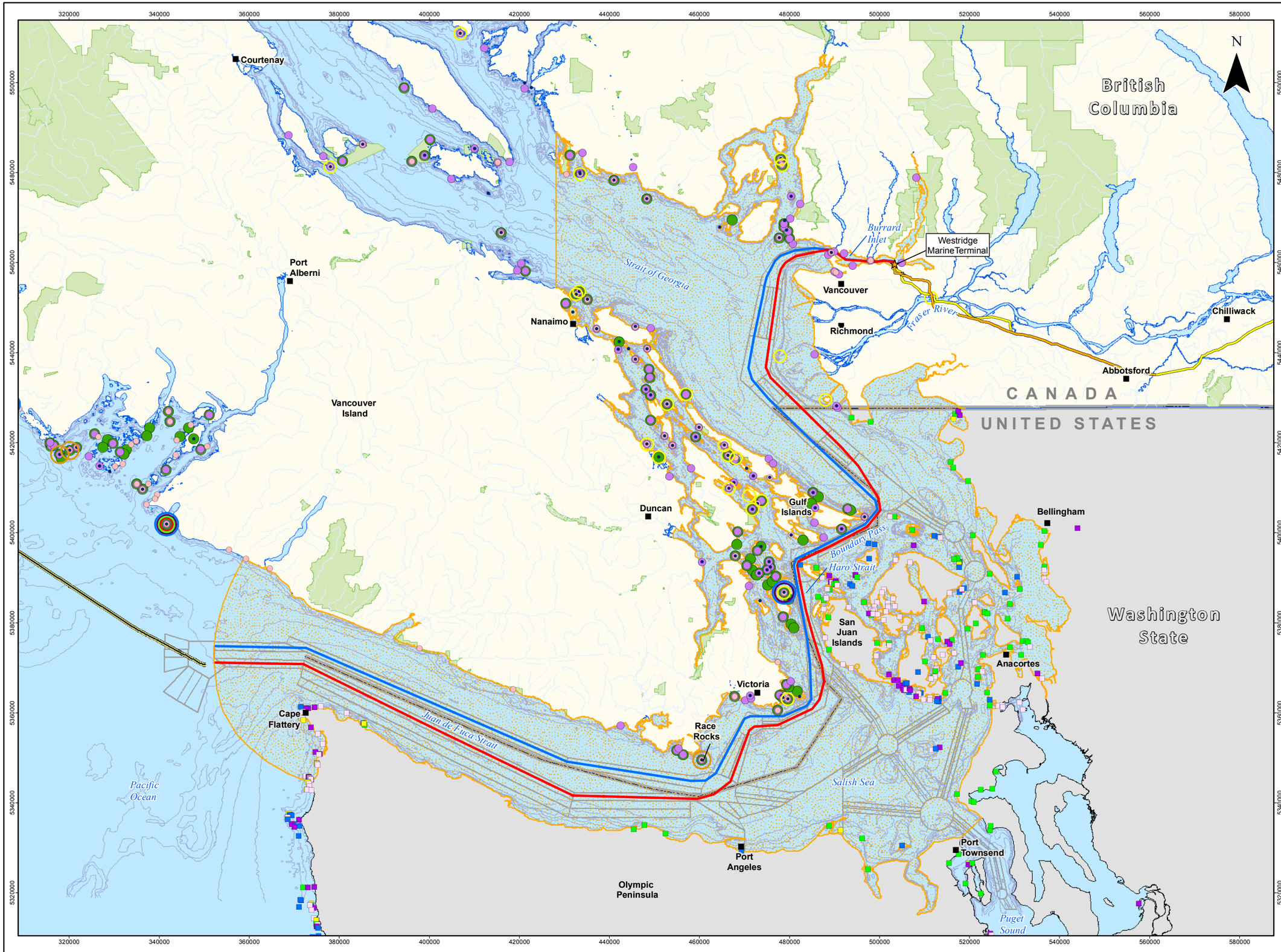
IMPORTANT BIRD AREAS FOUND WITHIN AND NEAR THE MARINE RSA (continued)

IBA Name	Regulatory Prov/State	Central Coordinates	Size (ha)	Details	Bird Colonies	IBA Trigger Species	Globally Significant Species	Proximity to Marine Bird LSA and Marine RSA
Little Qualicum Estuary to Nanoose Bay (BC056)	BC	124º 12.86' W 49º 18.37' N	17,000	• Encompasses 30 km of Vancouver Island coastline from Little Qualicum River estuary to Nanoose Harbour, and extends a few km upriver in several estuaries and into the Strait of Georgia • Includes some small islands off Nanoose Bay Peninsula • Shoreline mostly comprised of rock and large tidal flats of sand, rock, pools, eelgrass beds and mud	• None	• 5,415 individual Brant geese • 4,800 individual western grebes • 960 individual Thayer's gulls	• Brant goose	Within the Marine RSA, approximately 55 km east of the Marine Birds LSA
Amphitrite and Swiftsure Banks (BC097)	BC	125º 19.86' W 48º 43.25' N	10,800	• Two small areas of rich productive water off the West Coast of Vancouver Island • Amphitrite Bank (approximately 90 km²) is about 6 km southwest of Ucluelet • Swiftsure Bank (18 km²) is separate and further to the south, being about 15 km southwest of the western end of Nitinat Lake	• None	• 15,000 individual California gulls	• N/A	Within the Marine RSA, approximately 15 km north of the Marine Birds LSA
Western Strait of Juan de Fuca	Washington	124º 5' 59.9'' W 48º 12' 0'' N	153,717 (100 km long)	• Extends from Koitlah Point at the northwest corner of Neah Bay eastward to the mouth of Dry Creek, 3.5 km east of the mouth of the Elwha River • The entire site is within the nearshore ecological zone (*i.e.*, < 30 m depth) except on the stretches of coast between Tongue Point and Observatory Point, and between Slip Point and Pillar Point	• None	• 1,116 individual marbled murrelets	• Marbled murrelet	Within the Marine RSA, approximately 5 km southeast of the Marine Birds LSA
Port Angeles MAMU	Washington	123º 30' 43.2'' W 48º 9' 43.2'' N	8,729	• Located in the Puget Trough/Georgia Basin Marine Ecoregion • Extensive estuary with a long narrow sands spit and a large deep-water harbor • Olympic National Park has old-growth forests, breeding habitat for Marbled Murrelet	• None	• 870 breeding individual of marbled murrelets	• N/A	Within the Marine RSA, approximately 5 km south of the Marine Birds LSA
Port Angeles Harbor/ Ediz Hook	Washington	123º 25' 58.8'' W 48º 7' 58.8'' N	1,364	• Includes Port Angeles Harbor, Ediz Hook, and shallow marine waters immediately north and west of Ediz Hook • Port Angeles Harbor is the deepest harbor on the US West Coast, with depths up to 50 m • Protected from the open marine waters by Ediz Hook, a 5 km-long spit comprising about 80 ha of sand/gravel beach and rocky breakwater • Highly industrialized • Contains large shipping facilities, a marina and commercial net pens	• None	• 400 individual Heermann's gulls	• N/A	Within the Marine RSA, approximately 5 km south of the Marine Birds LSA

TABLE 4.2.8.2

IMPORTANT BIRD AREAS FOUND WITHIN AND NEAR THE MARINE RSA (continued)

IBA Name	Regulatory Prov/State	Central Coordinates	Size (ha)	Details	Bird Colonies	IBA Trigger Species	Globally Significant Species	Proximity to Marine Bird LSA and Marine RSA
Dungeness Bay	Washington	123º 9’ 0’’ W 48º 10’ 12’’ N	2,203	• North shore of the Olympic Peninsula, • includes intertidal and subtidal waters of Dungeness Bay, Dungeness Spit, the Dungeness River estuary and adjacent wetlands • Comprises extensive sandflats and mudflats • Adjacent coastal wetlands contain fresh water, estuarine marshes and ponds maintained by a seasonally high water table	• None	• 25 individual bald eagles • 8,000 individual Brants • 100 individual common loons • 83 individual great blue herons • 3 individual merlins • 3 individual Peregrine falcons	• N/A	Within the Marine RSA, approximately 20 km southeast of the Marine Birds LSA
Sequim Bay	Washington	123º 1’ 11.9’’ W 48º 4’ 12’’ N	14,950	• Includes open waters and intertidal zones of Sequim Bay, Washington Harbor, Travis Spit, Gibson Spit, the beaches and bluffs north of Gibson Spit as far north as Marlyn Nelson county park at Port Williams and the marine waters of Juan de Fuca Strait adjacent to the mouth of Sequim Bay	• None	• 215 individual black-bellied plovers • 1,775 individual dunlins • 260 individual Heermann’s gulls	• N/A	Within the Marine RSA, approximately 35 km southeast of the Marine Birds LSA
Protection Island	Washington	122º 54’ 0’’ W 48º 6’ 0’’ N	275	• No site description	• None	• 300 breeding pairs of double-crested cormorants • Glaucous-winged gull • Pelagic cormorant • Pigeon guillemot • Rhinoceros auklet • Tufted puffin	• N/A	Within the Marine RSA, approximately 30 km southeast of the Marine Birds LSA
Deception Pass	Washington	122º 35’ 59.9’’ W 48º 23’ 59.9’’ N	300	• Marine waters in Deception Pass State Park Deception Pass Bridge past West Point to Deception Island and past Lighthouse Point to Northwest Island • Narrow and shallow • Huge volumes of tidewater funnel through at speeds up to 8 knots • Water speeds decrease rapidly within 0.8 km of the pass • Bounded by rocky shores and cliffs with a few beaches	• None	• 17 individual black oystercatchers • 378 individual pigeon guillemots • 670 non-breeding individual red-throated loons	• N/A	Within the Marine RSA, approximately 35 km east of the Marine Birds LSA
Samish/Padilla Bays	Washington	122º 30’ 0’’ W 48º 30’ 0’’ N	59,000	• Located near Anacortes • Extensive shallow bays (Similk, Fidalgo, Padilla and Samish) and associated mudflats and sloughs • Sheltered bays and sloughs provide critical wintering area for seabirds, ducks and geese • Shelter and food for large concentrations of seabirds • Some of the most extensive eelgrass beds on the West Coast	• None	• 60 non-breeding individual black oystercatchers • 1,130 non-breeding individual Brants • 11,456 non-breeding individual dunlins • 1,105 breeding individual great blue herons • 102 non-breeding individual marbled murrelets • 89 non-breeding individual red-necked grebes • 984 non-breeding individual trumpeter swans • 520 non-breeding individual western grebes	• Brant • Trumpeter swan	Within the Marine RSA, approximately 40 km east of the Marine Birds LSA



TRANS MOUNTAIN

FIGURE: 4.2-26

BIRD BREEDING AREAS IN AND NEAR THE MARINE RSA

TRANS MOUNTAIN EXPANSION PROJECT

- Westridge Marine Terminal
- Town / City
- Marine Vessel Inbound Shipping Lane
- Marine Vessel Outbound Shipping Lane
- International Border
- Canadian 12 Nautical Mile Territorial Boundary
- Bathymetry
- Watercourse
- Existing Trans Mountain Pipeline
- Trans Mountain Expansion Proposed Pipeline Corridor
- Waterbody
- Provincial Park
- Traffic Separation Scheme
- Land of British Columbia
- Land of Washington State
- Marine RSA (Transportation)

BC Marine Bird Colonies

- Pigeon Guillemot Colonies
- Pelagic Cormorant Colonies
- Glaucous-winged Gull Colonies
- Black Oystercatcher Breeding Areas
- Double-crested Cormorant Colonies
- Cassin's Auklet Colonies
- Brandt's Cormorant Colonies
- Rhinoceros Auklet Colonies
- Tufted Puffin Colonies
- Fork-tailed and Leach's Storm-petrels Colonies

Washington Marine Bird Colonies

- Alcids (Possibly Others)
- Commorants (Possibly Others)
- Alcids and Commorants (Possibly Others)
- Other Seabirds
- Unknown

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Projection: UTM Zone 10N; Marine Vessel Inbound Shipping Lane: Moffatt & Nichol, 2013a; Marine Vessel Outbound Shipping Lane: Moffatt & Nichol, 2013b; International Border: British Columbia Ministry of Energy and Mines, 2013; Canadian 12 Nautical Mile Territorial Boundary and Traffic Separation Scheme: Canadian Hydrographic Service, 2013; Bathymetry: Canadian Hydrographic Service, 2011; Watercourse: National Hydro Network, 2007; Existing Pipeline: Kinder Morgan Canada, 2012; Trans Mountain Expansion Proposed Pipeline Corridor: Universal Pegasus International, 2013; Provincial Park: BC MFLNRO, 2008a; Land of British Columbia: National Topographic Data Base, 2007; Land of Washington State: Washington State Department of Ecology, 1994; Bird Colonies: Environment Canada, 2008; Coastal Resource Information Management System (CRIMS), 2011; Washington State DFW, 1989.

Stantec

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

MAP NUMBER		PAGE
10494_EA_TRANS_MAR_04_02_26		SHEET 1 OF 1
DATE	TERA REF.	REVISION
Nov 2013	7894	0
SCALE	PAGE SIZE	DISCIPLINE
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ALL LOCATIONS APPROXIMATE

10494_ea_trans_mar_04_02_26_important_breeding_areas_in_and_near_rsa.mxd

4.2.8.3 Field Data Collection

The abundant literature and data resources currently available for marine ecological information within the Marine RSA is deemed sufficient for the assessment of potential effects of the increased Project-related marine traffic on indicator species. Studies to pursue the collection of additional marine bird biological field data were considered unnecessary.

4.2.8.4 Database and Information Gathering

The marine bird knowledge base is derived from a review of relevant literature and databases from peer-reviewed journals, government reports and other documents, local publications, technical reports, electronic resources including:

- BC Species and Ecosystems Explorer;
- COSEWIC assessments and status reports;
- Species at Risk Public Registry; and
- Washington State Coastal Atlas.

Local and regional data (Bird Studies Canada, BC Breeding Bird Atlas, BC Marine Bird Atlas, Project Feederwatch, Great Backyard Bird Count, eBird), the Marine Atlas of Pacific Canada and the Pacific North Coast Integrated Management Area, were also used to supplement the published reports. The information gathered was focused on marine bird ecology and life history, seasonal distribution and habitat use, abundance, and the effects of wake, visual disturbance, in-air and underwater noise, and avoidance of preferred foraging habitat.

Long-term data sets compiled by Naturecounts (Bird Studies Canada 2013a) have facilitated the characterization of marine bird distribution and abundance in the Marine RSA (Table 4.2.8.3) for species recorded between 1946 and 2012. These compiled data were derived from the following databases managed by Bird Studies Canada (2013):

- BC Breeding Bird Atlas (2008 to 2012);
- BC Coastal Waterbird Surveys (1999 to 2013);
- BC Marine Bird Atlas (2008 to 2009);
- Project Feederwatch (1988 to 2009);
- eBird (1946; 1967 to 1975; 1977 to 2013); and
- Great Backyard Bird Count (1998 to 2011).

TABLE 4.2.8.3

MARINE BIRDS OF THE MARINE RSA

Species	Survey Type (No. Individuals Observed)						Total Number of Individuals Observed	Per Cent of Overall Observations	BC List Status[1]	*SARA* Status[1]
	BC Coastal Waterbird Surveys	BC Marine Bird Atlas	BC Breeding Bird Atlas	Great Backyard Bird Count	Project Feederwatch	eBird				
American Avocet	5			34	2		41	0.01	Red	
American Bittern	16		6	331			353	0.11	Blue	
American Black Duck	1			7	1		9	0.003	Exotic	
American Coot	240		3	2,763	22		3,028	0.93	Yellow	
American Golden-Plover	7			93			100	0.03	Blue	
American White Pelican				8			8	0.002	Red	
American Wigeon	2,716	4	6	6,698	144		9,568	2.92	Yellow	
Ancient Murrelet	60	63		207			330	0.1	Blue	Schedule 1 Special Concern (2006)
Arctic Loon				2			2	0.0006	Not listed	
Arctic Tern	1						1	0.0003	Yellow	
Baird's Sandpiper	15			406			421	0.13	Unknown	
Bald Eagle	2,839	103	204	9,871	360	191	13,568	4.15	Yellow	
Barrow's Goldeneye	1,854	11		746	91		2,702	0.83	Yellow	
Bar-tailed Godwit				40			40	0.01	Accidental	
Belted Kingfisher	1,391	1	88	3,039	52	8	4,579	1.4	Yellow	
Black Brant				32			32	0.01		
Black Guillemot	2						2	0.001	Not listed	
Black Oystercatcher	1,401	63	72	3,048	59		4,643	1.42	Yellow	
Black Scoter	444	2		450	8		904	0.28	Yellow	
Black Swift			4	109			113	0.03	Yellow	
Black Turnstone	824	20		2,032	21		2,897	0.89	Yellow	
Black-bellied Plover	433	2		1,761	6		2,202	0.67	Yellow	
Black-crowned Night-Heron	14		1	1,121			1,136	0.35	Red	
Black-footed Albatross				5			5	0.002	Blue	Schedule 1 Special Concern (2009)
Black-headed Gull				5			5	0.002	Accidental	
Black-legged Kittiwake	1			22			23	0.01	No Status	
Black-necked Stilt			4	13			17	0.01	No Status	
Blue-winged Teal	8		9	494			511	0.16	Yellow	
Bonaparte's Gull	483	59		1,725	8		2,275	0.7	Yellow	
Brandt's Cormorant	794	115	1	1,203	21		2,134	0.65	Red	
Brant	320	8		968	7		1,303	0.4	Blue	
Brown Pelican	3			75			78	0.02	No Status	
Buff-breasted Sandpiper				33			33	0.01	No Status	
Bufflehead	3,488	39	1	5,889	283		9,700	2.97	Yellow	
Buller's Shearwater				1			1	0.00	Blue	

TABLE 4.2.8.3

MARINE BIRDS OF THE MARINE RSA (continued)

Species	Survey Type (No. Individuals Observed)						Total Number of Individuals Observed	Per Cent of Overall Observations	BC List Status[1]	*SARA* Status[1]
	BC Coastal Waterbird Surveys	BC Marine Bird Atlas	BC Breeding Bird Atlas	Great Backyard Bird Count	Project Feederwatch	eBird				
Cackling Goose	14			318	1		333	0.10	Blue	
Small Cackling Goose				2			2	0.0006		
Taverner's Cackling Goose				1			1	0.0003		
California Gull	691	109		2,864	21		3,685	1.13	Blue	
Canada Goose	2,095	54	156	6,904	210		9,419	2.88	Yellow	
Canvasback	92			939	3		1,034	0.32	Yellow	
Caspian Tern	127	2	2	1400			1,531	0.47	Blue	
Cassin's Auklet	4	1		37			42	0.01	Blue	
Cattle Egret				22			22	0.01	No Status	
Cinnamon Teal	13		9	613			635	0.19	Yellow	
Clark's Grebe		1		12			13	0.004	Red	
Cliff Swallow			18	726			744	0.23	Yellow	
Common Eider				2			2	0.001	Accidental	
Common Goldeneye	2,387	6		2,594	123		5,110	1.56	Yellow	
Common Loon	2,910	19	3	3,586	62		6,580	2.01	Yellow	
Common Merganser	1,567	8	33	2,689	104		4,401	1.35	Yellow	
Common Murre	511	205		1,652	7		2,375	0.73	Red	
Common Raven	425	1	162	3,691	206	200	4,685	1.43	Yellow	
Common Snipe					1		1	0.0003	Not listed	
Common Tern	33			210			243	0.07	Yellow	
Crested Auklet				3			3	0.0009	Accidental	
Curlew Sandpiper				11			11	0.0034	Accidental	
Double-crested Cormorant	4,208	86	28	7,036	126		11,484	3.51	Blue	
Dunlin	599	5		2,604	19		3,227	0.99	Yellow	
Eared Grebe	93	4		235	3		335	0.10	Yellow	
Elegant Tern				11			11	0.0034	Accidental	
Emperor Goose				11			11	0.0034	Accidental	
Eurasian Wigeon	462			1,193	38		1,693	0.52	No Status	
Far Eastern Curlew				1			1	0.0003	Accidental	
Flesh-footed Shearwater				2			2	0.0006	Blue	
Fork-tailed Storm-Petrel				9			9	0.0028	Yellow	
Franklin's Gull	4			53	1		58	0.02	Yellow	
Gadwall	262		17	3,363	5		3,647	1.11	Yellow	
Garganey				7			7	0.0021	Accidental	
Glaucous Gull	9			44	6		59	0.02	No Status	
Glaucous-winged Gull	5,382	519	125	13,178	236	3	19,443	5.94	Yellow	

TABLE 4.2.8.3

MARINE BIRDS OF THE MARINE RSA (continued)

Species	Survey Type (No. Individuals Observed)						Total Number of Individuals Observed	Per Cent of Overall Observations	BC List Status[1]	*SARA* Status[1]
	BC Coastal Waterbird Surveys	BC Marine Bird Atlas	BC Breeding Bird Atlas	Great Backyard Bird Count	Project Feederwatch	eBird				
Great Blue Heron	2,659	27	88	10,054	162	11	13,001	3.97	Blue	Schedule 1
Great Egret	3			20			23	0.01	Accidental	
Greater Scaup	705	3		1,822	17		2,547	0.78	Yellow	
Greater White-fronted Goose	30	4		506			540	0.17	Yellow	
Greater Yellowlegs	473			2,690	9		3,172	0.97	Yellow	
Green Heron	6		2	50			58	0.02	Blue	
Green-winged Teal	957	1	7	4,393	23		5,381	1.64	Yellow	
Green-winged Teal (American)				300	14		314	0.1		
Green-winged Teal (Eurasian)	4			25			29	0.01		
Harlequin Duck	2,354	51	2	2,646	73		5,126	1.57	Yellow	
Heermann's Gull	186	24		1,490			1,700	0.52	Yellow	
Herring Gull	312			538	53	1	904	0.28	Yellow	
Hooded Merganser	1,136	9	25	2,690	73		3,933	1.20	Yellow	
Horned Grebe	2,213	14		2,721	51		4,999	1.53	Yellow	
Hudsonian Godwit	1			54			55	0.02	Red	
Iceland Gull	2			19			21	0.01	Accidental	
Ivory Gull				11			11	0.003	Accidental	
Killdeer	620		70	3,404	21		4,115	1.26	Yellow	
King Eider	1			4			5	0.0015	Accidental	
Kittlitz's Murrelet				3			3	0.0009	Accidental	
Leach's Storm-Petrel				3			3	0.0009	Yellow	
Least Bittern				1			1	0.0003	Accidental	
Least Sandpiper	60			1,647	1		1,708	0.52	Yellow	
Lesser Golden-Plover	1						1	0.00		
Lesser Sand-Plover				5			5	0.00	Accidental	
Lesser Scaup	355			1,940	19		2,314	0.71	Yellow	
Lesser Yellowlegs	45			1,243	1		1,289	0.39	Yellow	
Little Gull				5			5	0.002	Accidental	
Little Stint				6			6	0.002	Accidental	
Long-billed Curlew	41			256			297	0.09	Blue	Schedule 1
Long-billed Dowitcher	88	1		1,767	3		1,859	0.57	Yellow	
Long-tailed Duck	855	29		806	8		1,698	0.52	Blue	
Long-tailed Jaeger	2			3			5	0.002	No Status	
Mallard	3,046	6	102	9,597	219	16	12,986	3.97	Yellow	
Mallard x Northern Pintail	1						1	0.0003		
Mallard x Northern Pintail (hybrid)				36			36	0.01		

TABLE 4.2.8.3

MARINE BIRDS OF THE MARINE RSA (continued)

Species	Survey Type (No. Individuals Observed)						Total Number of Individuals Observed	Per Cent of Overall Observations	BC List Status[1]	*SARA* Status[1]
	BC Coastal Waterbird Surveys	BC Marine Bird Atlas	BC Breeding Bird Atlas	Great Backyard Bird Count	Project Feederwatch	eBird				
Mallard x Northern Shoveler (hybrid)				1			1	0.0003		
Mandarin Duck				1			1	0.0003	Not listed	
Marbled Godwit	52			382	1		435	0.13	Yellow	
Marbled Murrelet	475	137	6	816	6		1,440	0.44	Blue	Schedule 1
Mew Gull	3,127	239	3	5,211	98		8,678	2.65	Yellow	
Mute Swan	282	4	15	829	12		1,142	0.35	Exotic	
Northern Fulmar				20			20	0.01	Red	
Northern Pintail	932	1	2	5,016	33		5,984	1.83	Yellow	
Northern Shoveler	255		6	3,441	7		3,709	1.13	Yellow	
Northwestern Crow	2,116		197	12,411	347	344	15,415	4.71	Yellow	
Osprey	64		41	650	2		757	0.23	Yellow	
Pacific Golden-Plover	4			52			56	0.02	No Status	
Pacific Loon	1,138	47		1,283	33		2,501	0.76	Yellow	
Parasitic Jaeger	3	2		121			126	0.04	No Status	
Pectoral Sandpiper	31			834			865	0.26	Yellow	
Pelagic Cormorant	3,055	400	46	3,241	79		6,821	2.09	Yellow	
Pied-billed Grebe	227		14	1,293	9		1,543	0.47	Yellow	
Pigeon Guillemot	1,174	591	69	2,430	11		4,275	1.31	Yellow	
Pine Grosbeak					1		1	0.0003		
Pink-footed Shearwater				19			19	0.01	Blue	Schedule 1 Threatened (2005)
Pomarine Jaeger				20			20	0.01	No Status	
Purple Martin	1		66	601			668	0.20	Blue	
Red Knot	6			105			111	0.03	Red	Schedule 1 Threatened (2007)
Red Phalarope	1			20			21	0.01	Unknown	
Red-breasted Merganser	2,582	56	1	2,957	125		5,721	1.75	Yellow	
Redhead	3			92			95	0.03	Yellow	
Red-necked Grebe	1,436	3		1,443	10		2,892	0.88	Yellow	
Red-necked Phalarope	9			426			435	0.13	Blue	
Red-necked Stint	1			9			10	0.0031	Accidental	
Red-throated Loon	791	3		868	2		1,664	0.51	Yellow	
Rhinoceros Auklet	451	244	9	1,958	1		2,663	0.81	Yellow	
Ring-billed Gull	1,104	4		2,572	7		3,687	1.13	Yellow	
Ring-necked Duck	58		2	1,206	18		1,284	0.39	Yellow	
Rock Sandpiper	10			52			62	0.02	Yellow	
Ross's Goose				4			4	0.001	Accidental	
Ruddy Duck	93			705	2		800	0.24	Yellow	
Ruddy Turnstone	5			104			109	0.03	Yellow	
Ruff	1			44			45	0.01	Accidental	

TABLE 4.2.8.3

MARINE BIRDS OF THE MARINE RSA (continued)

Species	Survey Type (No. Individuals Observed)						Total Number of Individuals Observed	Per Cent of Overall Observations	BC List Status[1]	*SARA* Status[1]
	BC Coastal Waterbird Surveys	BC Marine Bird Atlas	BC Breeding Bird Atlas	Great Backyard Bird Count	Project Feederwatch	eBird				
Sabine's Gull	1			12			13	0.004	No Status	
Sanderling	277	3		798	4		1,082	0.33	Yellow	
Sandhill Crane	6		5	1,449	1		1,461	0.45	Yellow	
Semipalmated Plover	19			630			649	0.20	Yellow	
Semipalmated Sandpiper	8			488			496	0.15	No Status	
Sharp-tailed Sandpiper	2			117			119	0.04	Yellow	
Short-billed Dowitcher	38			600			638	0.20	Blue	
Short-tailed Shearwater				13			13	0.004	No Status	
Slaty-backed Gull	2			1			3	0.001	Accidental	
Smew				2			2	0.001	Accidental	
Snow Goose	152			2,031	1		2,184	0.67	Yellow	
Snowy Egret				1			1	0.0003	Accidental	
Snowy Plover				1			1	0.0003	Accidental	
Solitary Sandpiper	2			87	1		90	0.03	Yellow	
Sooty Shearwater				87			87	0.03	No Status	
Sora			9	123			132	0.04	Yellow	
South Polar Skua				1			1	0.0003	No Status	
Spoon-billed Sandpiper				2			2	0.0006	Accidental	
Spotted Redshank				3			3	0.0009	Accidental	
Spotted Sandpiper	128		34	774	3		939	0.29	Yellow	
Stilt Sandpiper	3			194			197	0.06	No Status	
Surf Scoter	3,170	55		3,766	99		7,090	2.17	Blue	
Surfbird	202	13		456	6		677	0.21	Yellow	
Terek Sandpiper				2			2	0.0006	Accidental	
Thayer's Gull	697			1,022	20		1,739	0.53	Yellow	
Trumpeter Swan	162			1,490	36	2	1,690	0.52	Yellow	
Tufted Duck				19			19	0.01	Accidental	
Tufted Puffin				21			21	0.01	Blue	
Tundra Swan	6			87			93	0.03	Blue	
Virginia Rail	17		23	636	1		677	0.21	Yellow	
Wandering Tattler	3	1		68			72	0.02	Blue	
Western Grebe	988	7		1,412	23		2430	0.74	Red	
Western Gull	189			507	17		713	0.22	Yellow	
Western Sandpiper	189			2,353	6		2,548	0.78	Yellow	
Whimbrel	28			296			324	0.10	Yellow	
White-rumped Sandpiper				12			12	0.004	Accidental	

TABLE 4.2.8.3

MARINE BIRDS OF THE MARINE RSA (continued)

Species	Survey Type (No. Individuals Observed)						Total Number of Individuals Observed	Per Cent of Overall Observations	BC List Status[1]	*SARA* Status[1]
	BC Coastal Waterbird Surveys	BC Marine Bird Atlas	BC Breeding Bird Atlas	Great Backyard Bird Count	Project Feederwatch	eBird				
White-winged Scoter	1,330	4		1,490	21		2,845	0.87	Yellow	
Willet	24			232	1		257	0.08	Accidental	
Wilson's Phalarope			2	193			195	0.06	Yellow	
Wilson's Snipe	60		7	661	1		729	0.22	Yellow	
Wood Duck	50		36	1,591	6		1,683	0.51	Yellow	
Wood Sandpiper				8			8	0.0024	Accidental	
Yellow-billed Loon	10			18			28	0.01	Blue	
Accipiter species	1						1	0.00		
Alcid species	148			14			162	0.05		
American Wigeon x Mallard				1			1	0.0003		
Common x Barrow's Goldeneye				1			1	0.0003		
Cormorant species	912	44		241			1,197	0.37		
Crow species				3			3	0.001		
Dabbler species	41						41	0.01		
Dowitcher species	24			114			138	0.04		
Duck species	341	5		223	3		572	0.17		
Eagle species				1			1	0.0003		
Eurasian x American Wigeon	4			52			56	0.02		
Glaucous-winged x Glaucous Gull				1			1	0.00		
Glaucous-winged x Western Gull	174		4	1,017	6		1,201	0.37		
Goldeneye species	73			22			95	0.03		
Goose species	26			20			46	0.01		
Grebe species	107			4			111	0.03		
Gull species	1,963	54		1,604	9	12	3,642	1.11		
Herring x Glaucous-winged Gull				47			47	0.01		
Jaeger species				17			17	0.01		
Larus species				9			9	0.00		
Loon species	303	6		92			401	0.12		
Merganser species	16			6			22	0.01		
Peep species				184			184	0.06		
Phalarope species	3			12			15	0.005		
Plover species	1			1			2	0.001		
Scaup species	350			145			495	0.15		
Scoter species	542	1		45			588	0.18		
Shearwater species				2			2	0.001		
Shorebird species	154			49			203	0.06		

TABLE 4.2.8.3

MARINE BIRDS OF THE MARINE RSA (continued)

Species	Survey Type (No. Individuals Observed)						Total Number of Individuals Observed	Per Cent of Overall Observations	BC List Status[1]	*SARA* Status[1]
	BC Coastal Waterbird Surveys	BC Marine Bird Atlas	BC Breeding Bird Atlas	Great Backyard Bird Count	Project Feederwatch	eBird				
Swan species	9			31			40	0.01		
Teal species				4			4	0.0012		
Tern species	3			1			4	0.0012		
Tringa species				1			1	0.0003		
Yellowlegs species	12			3			15	0.0046		
Total Numbers of Individuals	**87,861**	**3,603**	**1,845**	**228,967**	**4,073**	**788**	**327,137**	**--**	**--**	**--**
Total Number of Species	**154**	**62**	**51**	**214**	**89**	**10**	**222**	**--**	**--**	**--**
Indicator Species Per Cent	**10.211**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**

Sources: BC CDC 2013, Government of Canada 2013a,b.

Note: 1 See Section 4.2.1.3 for definitions of *SARA* and BC List status.

4.2.8.5 Conservation Status

Based on a review of the COSEWIC, the federal *SARA* public registry list (Schedule 1) and the BC CDC Red and Blue lists, 19 species of waterfowl and coastal seabirds at risk have been identified as potentially occurring within the Marine RSA (Table 4.2.8.4). The Conservation Framework (CF), established by the BC government, guides efforts to conserve species and ecosystems by establishing priorities for action. Management action is based on five criteria (rated on a scale of 1 [highest] to 6 [lowest]): global and provincial status; trends; threats; stewardship responsibility; and feasibility of recovery. Of all the marine birds that use marine habitats along the south coast, and whose ranges overlap with the marine transportation route, eight are identified on Schedule 1 of the *SARA* (four are Threatened and four are of Special Concern). Several others are provincially Red- or Blue-listed species (Table 4.2.8.4).

TABLE 4.2.8.4

MARINE BIRD SPECIES AT RISK POTENTIALLY OCCURRING WITHIN THE MARINE RSA

Common Name	Scientific Name	*SARA* (Schedule 1 Status)[1]	COSEWIC Status[1]	BC Status[1]	CF Priority[2]
Black-footed albatross	*Phoebastria nigripes*	Special Concern (2009)	Special Concern (2007)	Blue	2
Short-tailed albatross	*Phoebastria albatrus*	Threatened (2005)	Threatened (2003)	Red	1
Pink-footed shearwater	*Puffinus creatopus*	Threatened (2005)	Threatened (2004)	Blue	2
Brant	*Branta bernicla*	No status	No status	Blue	2
Northern fulmar	*Fulmarus glacialis*	No status	No status	Red	2
Great blue heron	*Ardea herodias fannini*	Special Concern (2010)	Special Concern (2008)	Blue	1
Double-crested cormorant	*Phalacrocorax auritus*	No status	Not at Risk (1978)	Blue	1
Brandt's cormorant	*Phalacrocorax penicillatus*	No status	No status	Red	1
Pelagic cormorant	*Phalacrocorax pelagicus pelagicus*	No status	No status	Red	2
Caspian tern	*Hydroprogne caspia*	No status	Not at Risk (1999)	Blue	2
Long-billed curlew	*Numenius americanus*	Special Concern (2005)	Special Concern (2011)	Blue	2
Red knot	*Calidris canutus roselaari*	Threatened (2007)	Threatened (2007)	Red	1
Marbled murrelet	*Brachyramphus marmoratus*	Threatened (2003)	Threatened (2012)	Blue	1
Ancient murrelet	*Synthliboramphus antiquus*	Special Concern (2006)	Special Concern (2004)	Blue	1
Tufted puffin	*Fratercula cirrhata*	No status	No status	Blue	2
Horned puffin	*Fratercula corniculata*	No status	No status	Red	2
Cassin's auklet	*Ptychoramphus aleuticus*	No status	Candidate (2011)	Blue	2

TABLE 4.2.8.4

MARINE BIRD SPECIES AT RISK POTENTIALLY OCCURRING WITHIN THE MARINE RSA (continued)

Common Name	Scientific Name	*SARA* (Schedule 1 Status)[1]	COSEWIC Status[1]	BC Status[1]	CF Priority[2]
Common murre	*Uria aalge*	No status	No status	Red	2
Thick-billed murre	*Uria lomvia*	No status	No status	Red	2

Sources: BC CDC 2013, Government of Canada 2013a,b. List was updated on November 25, 2013.

Notes: 1 See Section 4.2.1.3 for definitions of COSEWIC, SARA and BC List status

2 CF Priority: Each species receives a rank of 1 (highest) through 6 (lowest) under each of the three goals: 1) contribute to global efforts for species and ecosystem conservation; 2) prevent species and ecosystems from becoming at risk; and 3) maintain the diversity of native species and ecosystems

Species not expected to be affected by the increased Project-related marine vessel traffic include albatrosses, shearwaters, fulmars, Brandt's cormorant, long-billed curlew and red knot due to their obligate pelagic nature and/or lack of breeding records and/or very low global population numbers. These criteria indicate their potential for occurrence within the Marine Birds LSA and Marine RSA will be rare.

4.2.8.6 Indicator Species

Five indicator species were selected to represent potential Project-related effects on marine birds within the Marine Birds LSA and Marine RSA (see Table 4.2.8.5): the fork-tailed storm-petrel; Cassin's auklet; surf scoter; pelagic cormorant; and glaucous-winged gull. These species are intended to represent a set of foraging guilds in the overall diverse group of marine birds using the open water habitats present within the Marine Birds LSA and Marine RSA. All of these species are highly mobile and are, at times, widely distributed throughout the Marine RSA. See Section 4.3 for more information regarding indicators.

TABLE 4.2.8.5

SUMMARY OF SELECTED MARINE BIRD INDICATORS

Common Name	Scientific Name	SARA (Schedule 1 Status)[1]	COSEWIC Status[1]	BC List Status[1]
Fork-tailed storm-petrel	*Oceanodroma furcata*	No status	No status	Yellow
Cassin's auklet	*Ptychoramphus aleuticus*	No status	Candidate (2011)	Blue
Surf scoter	*Melanitta perspicillata*	No status	No status	Blue
Pelagic cormorant	*Phalacrocorax pelagicus pelagicus*	No status	No status	Red
Glaucous-winged gull	*Larus glaucescens*	No status	No status	Yellow

Sources: BC CDC 2013, Government of Canada 2013a,b

Note: 1 See Section 4.2.1.3 for definitions of COSEWIC, SARA and BC List status

4.2.8.6.1 Fork-Tailed Storm-Petrel

The fork-tailed storm-petrel is found only in the North Pacific Ocean, is one of the most common marine birds breeding in Alaska, and the second most abundant and widespread of the storm-petrels (5 to 10 million individuals). It nests along the North American coast from northern California to Alaska. It appears to move offshore during the nonbreeding season and is associated with the continental-shelf break. In the breeding season, it feeds close to breeding colonies, in nearshore waters over the continental shelf.

The species is often seen foraging in small groups on the continental shelf or shelf break. It often follows ships during the day, and is often attracted by boat lights at night. It is mainly pelagic, spending up to eight months of the year at sea. Pairs generally nest in burrows or crevices in talus slopes, but also use burrows they excavate or side chambers of other burrowing seabirds.

The main diet is zooplankton, nekton and small fish, which are usually captured while hovering, pattering with wings partly spread, or dipping at the surface of the sea (Boersma and Silva 2000).

4.2.8.6.2 Cassin's Auklet

The Cassin's auklet is found on islands from the Baja California Peninsula to the Aleutian Islands, Alaska. The center of population is BC, where an estimated 2 million birds were observed in the Scott Island group (1980) and 1.1 million on Triangle Island outside of the Marine RSA. Wintering populations move south, frequenting waters off the continental shelf edge.

Breeding primarily occurs along the coast of BC. This auklet nests in shallow burrows, which the birds excavate, and also in rock crevices or under trees or logs. During the non-breeding season, it spends most of its time at sea, with southern populations likely moving north and northern ones moving south to the central portion of its Pacific range. It is most abundant in waters of the continental shelf.

The preferred food includes small crustaceans, squid and larval/juvenile fish (Ainley *et al.* 2011).

4.2.8.6.3 Pelagic Cormorant

The pelagic cormorant breeds along the Pacific Coast of North America from northern Alaska to Baja California (Hobson 1997, Campbell *et al.* 1990). It is present as both a resident and a migrant species in coastal areas of southwestern BC. There are two subspecies in BC: *P. pelagicus pelagicus* along the south coast in winter (provincially Blue-listed [BC CDC 2013]), and the resident *P. p. resplendens* which breeds from southern BC northwards (Campbell *et al.* 1990).

Pelagic cormorants prefer rocky coasts and sheltered habitat such as harbours and coves, and are rarely found far within inlets. Cliffs, reefs, unvegetated rocky islets and human-made structures, such as bridges and wharves, provide roosting habitat. Breeding colonies are located on rocky cliffs of islands or headlands, in caves, and on bridge pylons, towers, navigational beacons and other human-made structures (Campbell *et al.* 1990). Within Haro Strait, they have been recorded on Mandarte, Great Chain Islands, and to the north along Strait of Georgia at Five Fingers Island, Gabriola Island cliffs, Galiano Island cliffs, Hudson Rocks and Snake Island, North Pender Island cliffs, and Arbutus Island (Chatwin *et al.* 2002). Between 1955 and 2000, the number of pelagic cormorant nests within the Strait of Georgia declined by

approximately 55 per cent (Chatwin *et al.* 2002). However, in recent years populations have been stable (Crewe *et al.* 2012).

Pelagic cormorants are divers that select prey from the littoral-benthic zone and are bottom feeders of solitary fish and invertebrates that live in rocky areas (Hobson 1997, Campbell *et al.* 1990, Ainley *et al.* 1981).

4.2.8.6.4 Surf Scoter

Surf scoters are medium-distance migrants that are widely distributed along the entire BC coastline, especially during spring migration. The Strait of Georgia and Burrard Inlet are particularly important winter and spring staging grounds. Southward migration from inland breeding areas occurs from late August to October (BC CDC 2013), usually at night (Butler and Savard 1985). Large aggregations occur from a few hundred to several thousand individuals.

Wintering surf scoters usually forage within 1 km of the shore (Vermeer 1981). Non-breeding habitat includes sheltered freshwater and marine bays, harbours and lagoons. At these sites, birds prefer shallow marine waters, less than 10 m deep, with substrates of pebbles and sand (Goudie *et al.* 1994, Campbell *et al.* 1990). This species rarely uses estuaries, except during migration (Campbell *et al.* 1990, Savard *et al.*1998). Large numbers forage near steep shores of fjords where food resources (*e.g.*, mollusks) are abundant on submarine rocky walls (Vermeer 1981, Vermeer and Bourne 1984).

Surf scoters eat aquatic invertebrates on its breeding grounds and mollusks in spring, fall, and winter (Savard *et al.* 1998).

4.2.8.6.5 Glaucous-Winged Gull

The glaucous-winged gull is an abundant resident along the northwest coast of North America, where its omnivorous food habits make it abundant in coastal cities and towns. It is present at coastal islands and cliffs from the north-central Bering Sea and Alaska, south to northwest Oregon. Relatively dense concentrations reside in all areas of the Salish Sea. Although generally an inshore species, it does venture from the coast where it is often seen around fishing vessels at sea.

In fresh water, in BC and Washington, it nests at high densities in large or small colonies on offshore islands, although it has recently begun nesting on roofs of waterfront buildings and pylons of bridges and other marine structures. Nests are typically on relatively treeless and small islands close to mainland where visibility is good. There were forty nests counted on support beams of the Ironworkers Memorial Second Narrows Crossing in 1980.

In BC, the gull feeds pelagically as far as the continental shelf (ca. within 100 km from shore), with a few individuals going as far as 300 km. It feeds in salt and brackish water (rarely freshwater) in bays, estuaries, harbors, city parks, beaches, mudflats, landfills and barren islands. A wide variety of fish, marine invertebrates, garbage, and carrion are consumed (Hayward and Verbeek 2008).

4.2.8.7 Aboriginal Traditional Knowledge

Traditional harvesting of marine resources, including marine birds for food and other purposes, has historically been and remains important for coastal Aboriginal communities in the Marine RSA. Ducks hold cultural importance to coastal communities, and their feathers are used to insulate clothing (Canadian Environmental Assessment Agency 2006, Suttles 2006). Birds may

be shot or snared, or hunted by net and spear. Common kinds of birds and eggs harvested in the Marine RSA include goldeneye, canvasback, ruddy duck, wood duck, American wigeon, northern pintail, mallard, northern shoveler, green-winged teal, grebe and murre (First Nations Health Council 2011a, Jacques Whitford Ltd. 2006, Simonsen *et al*. 1995). Extensive studies completed by Fediuk and Thom (2003) with the Elders from various Salish communities have identified 31 bird species as culturally relevant that have been traditionally harvested (*e.g.*, black scoter, white scoter, murre, bald eagle, golden eagle, ruffed grouse, blue grouse, mallard, trumpeter swan, western grebe).

4.2.8.8 US Waters

The WDFW has set aside certain areas of Puget Sound marine waters for the protection and preservation of marine species and/or habitats. These are generally known as MPAs and include 9 Conservation areas, 16 Marine Preserves and 2 Sea Cucumber and Sea Urchin Commercial Harvest Exclusion Zones. The greater San Juan Island archipelago holds the most MPAs. Many of these sites provide habitat for breeding colonies of several species of marine birds. The north coast of the state has the largest MPA, the Olympic Coast National Marine Sanctuary. Several state parks, IBAs, federal historical parks and federal marine sanctuaries are also present in Puget Sound (Van Cleve *et al.* 2009, WDFW 2013a) as well as MPAs administered by other agencies, such as the Department of Natural Resources, as mentioned above.

4.2.9 Marine Species at Risk

This subsection identifies the federally and provincially listed marine species at risk (fish, mammals and birds) that may occur within the Marine RSA (Table 4.2.9.1), including those whose potential occurrence would be considered rare or unlikely. More detailed technical information pertaining to marine species at risk and their potential occurrence in the Marine RSA is presented in the marine fish and fish habitat, marine mammals and marine birds sections (Section 4.2.6, 4.2.7 and 4.2.8 respectively).

A discussion of the potential effects of the increased Project-related marine vessel traffic for marine species at risk can be found in Section 4.3.9.

This list was developed through a review of the federal Species at Risk Public Registry, COSEWIC assessments and status reports, and the BC CDC Red and Blue lists.

A total of 53 marine species at risk have been identified as potentially occurring within the Marine RSA, including 19 marine fish and invertebrate species (or populations), 15 marine mammal species (or ecotypes) and 19 marine bird species (BC CDC 2013, Government of Canada 2013a,b).

TABLE 4.2.9.1

MARINE SPECIES AT RISK IN THE MARINE RSA

Species Name (population[s])	Taxon	*SARA* Status[1]	COSEWIC Status[1]	BC List Status[1]
Ancient murrelet *Synthliboramphus antiquus*	Marine bird	Special Concern Schedule 1	Special Concern	Blue
Basking shark *Cetorhinus maximus*	Fish	Endangered Schedule 1	Endangered	No Status
Black-footed albatross *Phoebastria nigripes*	Marine bird	Special Concern Schedule 1	Special Concern	Blue
Blue whale *Balaenoptera musculus*	Marine mammal	Endangered Schedule 1	Endangered	Red
Bluntnose sixgill *Shark Hexanchus griseus*	Fish	Special Concern Schedule 1	Special Concern	No Status
Bocaccio Sebastes paucispinis	Fish	No Status	Threatened	No Status
Brandt's cormorant Phalacrocorax penicillatus	Marine bird	No Status	No Status	Red
Brant Branta bernicla	Marine bird	No Status	No Status	Blue
Canary rockfish Sebastes pinniger	Fish	No Status	Threatened	No Status
Caspian tern *Hydroprogne caspia*	Marine bird	No Status	Not at Risk	Blue
Cassin's auklet *Ptychoramphus aleuticus*	Marine bird	No Status	Candidate	Blue
Chinook salmon *Oncorhynchus tshawytscha* (Okanagan population)	Fish	No Status	Threatened	Yellow
Common murre *Uria aalge*	Marine bird	No Status	No Status	Red
Coho salmon *Oncorhynchus kisutch* (Interior Fraser population)	Fish	No Status	Endangered	No Status
Darkblotched rockfish *Sebastes crameri*	Fish	No Status	Special Concern	No Status
Double-crested cormorant *Phalacrocorax auritus*	Marine bird	No Status	Not at Risk	Blue
Eulachon *Thaleichthys pacificus* (Fraser River population)	Fish	No Status	Endangered	Blue
Fin whale *Balaenoptera physalus*	Marine mammal	Threatened Schedule 1	Threatened	Red
Great blue heron *Ardea herodias fannini*	Marine bird	Special Concern Schedule 1	Special Concern	Blue

TABLE 4.2.9.1

MARINE SPECIES AT RISK IN THE MARINE REGIONAL STUDY AREA (continued)

Species Name (population[s])	Taxon	*SARA* Status[1]	COSEWIC Status[1]	BC List Status[1]
Grey whale *Eschrichtius robustus*	Marine mammal	Special Concern Schedule 1	Special Concern	Blue
Harbour porpoise *Phocoena phocoena*	Marine mammal	Special Concern Schedule 1	Special Concern	Blue
Horned puffin *Fratercula corniculata*	Marine bird	No Status	No Status	Red
Humpback whale *Megaptera novaeangliae*	Marine mammal	Threatened Schedule 1	Special Concern	Blue
Killer whale *Orcinus orca* (Northeast Pacific southern resident population)	Marine mammal	Endangered Schedule 1	Endangered	Red
Killer whale *Orcinus orca* (Northeast Pacific northern resident population)	Marine mammal	Threatened Schedule 1	Threatened	Red
Killer whale *Orcinus orca* (Northeast Pacific transient [or Bigg's] population)	Marine mammal	Threatened Schedule 1	Threatened	Red
Killer whale *Orcinus orca* (offshore population)	Marine mammal	Threatened Schedule 1	Threatened	Red
Long-billed curlew *Numenius americanus*	Marine bird	Special Concern Schedule 1	Special Concern	Blue
Longspine thornyhead *Sebastolobus altivelis*	Fish	Special Concern Schedule 1	Special Concern	No Status
Marbled murrelet *Brachyramphus marmoratus*	Marine bird	Threatened Schedule 1	Threatened	Blue
North Pacific right whale *Eubalaena japonica*	Marine mammal	Endangered Schedule 1	Endangered	Red
North Pacific spiny dogfish *Squalus suckleyi*	Fish	No Status	Special Concern	No Status
Northern abalone *Haliotis kamtschatkana*	Mollusc	Endangered Schedule 1	Endangered	Red
Northern fulmar *Fulmarus glacialis*	Marine bird	No Status	No Status	Red
Northern fur seal *Callorhinus ursinus*	Marine mammal	No Status	Threatened	Blue
Olympia oyster *Ostrea lurida*	Mollusc	Special Concern Schedule 1	Special Concern	Blue

TABLE 4.2.9.1

MARINE SPECIES AT RISK IN THE MARINE REGIONAL STUDY AREA (continued)

Species Name (population[s])	Taxon	*SARA* Status[1]	COSEWIC Status[1]	BC List Status[1]
Pacific sardine *Sardinops sagax*	Fish	Special Concern Schedule 3	Not at Risk	No Status
Pelagic cormorant *Phalacrocorax pelagicus pelagicus*	Marine bird	No Status	No Status	Red
Pink-footed shearwater *Puffinus creatopus*	Marine bird	Threatened Schedule 1	Threatened	Blue
Quillback rockfish *Sebastes maliger*	Fish	No Status	Threatened	No Status
Red knot *Calidris canutus roselaari*	Marine bird	Threatened Schedule 1	Threatened	Red
Rougheye rockfish type I *Sebastes* sp. *type I* & *II*	Fish	Special Concern Schedule 1	Special Concern	No Status
Sea otter *Enhydra lutris*	Marine mammal	Special Concern Schedule 1	Special Concern	Blue
Sei whale *Balaenoptera borealis*	Marine mammal	Endangered Schedule 1	Endangered	Red
Short-tailed albatross *Phoebastria albatrus*	Marine bird	Threatened Schedule 1	Threatened	Red
Sockeye salmon *Oncorhynchus nerka* (Cultus population, Sakinaw population)	Fish	No Status	Endangered	No Status
Sperm whale *Physeter macrocephalus*	Marine mammal	No Status	Not at Risk	Blue
Steller sea lion *Eumetopias jubatus*	Marine mammal	Special Concern Schedule 1	Special Concern	Blue
Thick-billed murre *Uria lomvia*	Marine bird	No Status	No Status	Red
Tope *Galeorhinus galeus*	Fish	Special Concern Schedule 1	Special Concern	No Status
Tufted puffin *Fratercula cirrhata*	Marine bird	No Status	No Status	Blue
Yelloweye rockfish *Sebastes ruberrimus* (Pacific Ocean outside waters population, inside waters population)	Fish	Special Concern Schedule 1	Special Concern	No Status
Yellowmouth rockfish *Sebastes reedi*	Fish	No Status	Threatened	No Status

Sources: BC CDC 2013, Government of Canada 2013a,b. List was last updated on November 25, 2013.

Note: 1 See Section 4.2.1.3 for definitions of COSEWIC, SARA and BC List status