Trans Mountain Pipeline ULC, Westridge Marine Terminal Clearing, Erosion, Sediment Control Plan Phase 1 and Phase 2

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Down to Earth Biology

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EXECUTIVE SUMMARY

The Trans Mountain Pipeline ULC (Trans Mountain) was established in 1951 to construct and operate the Trans Mountain Pipeline between Strathcona County, AB and Burnaby, BC. The pipeline and terminals began operation in 1953, creating a reliable energy supply for Canada and the United States. During that period, average daily throughput has been progressively increased from 150,000 BPD to today's 300,000 BPD.

Trans Mountain is regulated by the National Energy Board (NEB), a fully independent agency of the Government of Canada. Trans Mountain also complies with all ancillary legislation, unless it conflicts with federal legislation, in which case Trans Mountain will comply with federal legislation as ultimately determined by the NEB.

The Westridge Marine Terminal is the western coastal loading and shipping facility for the Trans Mountain Pipeline. It is an existing facility that has been in operation for over 50 years, providing distribution of refined and crude oil products. As part of the Trans Mountain Expansion Project (TMEP), the Westridge Marine Terminal will be expanded to include a new dock complex, access road, substation and transmission line, product lines, as well as a utility dock, decommissioning of the existing berth and the construction of a tunnel to convey two new 30-inch delivery lines from the Burnaby Terminal under Burnaby Mountain. Trans Mountain will also be undertaking modifications at the Westridge Terminal to upgrade the security infrastructure.

The onshore and foreshore expansion of the Westridge Marine terminal has been broken into four main permit phases that align with the permitting approach taken by Trans Mountain with the BC Ministry of Environment and Climate Change Strategy (BC MoE). The main permit phases are described in the table below.

Phase	Description
Phase 1	Early site works (outside of the permitted discharge area for the existing waste discharge permit #3678 at Westridge Marine Terminal) that does not require treatment of stormwater
Phase 2	Early construction activities (outside of the permitted discharge area for the existing waste discharge permit #3678 at Westridge Marine Terminal) that requires treatment of stormwater
Phase 3	General construction works for the Westridge Marine Terminal expansion that requires: relocation of the eastern outfall, as well as treatment of stormwater, concrete waste water and tunnel seepage water under the existing waste discharge permit #3678 at Westridge Marine Terminal and installation of new collection and treatment works.
Phase 4	Design and operation of new collection and treatment works under the existing waste discharge permit #3678 at Westridge Marine Terminal

This Erosion and Sediment Control Plan (ESCP) provides site-specific erosion and sediment control (ESC) prescriptions for the onshore Phase 1 and Phase 2 works which will guide the activities and the roles and responsibilities specific to ESC planning and execution. The ESCP also outlines the requirements for monitoring and reporting including protective measures and guidance to be implemented during the construction work. In addition, the intent of this ESCP is to address a combination of municipal, provincial and federal regulatory requirements.

A separate ESCP will be developed for the Phase 3 general construction works within the existing terminal and expanded foreshore area. The Phase 4 scope of work encompasses the design and operation of the new collection and treatment works but does not included any construction activities. As such, an ESCP for the Phase 4 works is not required.

AUTHORSHIP

This report was prepared by EDI Environmental Dynamics Inc. As per the Province of British Columbia a Qualified Environmental Professional (QEP) is an "*applied scientist or technologist who is registered and in good standing with an appropriate BC professional organization constituted under an Act. The QEP must be acting under that association's code of ethics, and subject to the organization's disciplinary action.*" A QEP can be a professional Biologist, Agrologist, Forester, Geoscientist, Engineer, or Technologist. All of the staff who contributed to this project are considered QEPs as they belong to either the College of Professional Biologists as Registered Professional Biologists (R.P.Bio) or to the BC Institute of Agrologists as Professional Agrologists (P.Ag.). Two of our team who contributed and provided review are Certified Professionals in Erosion and Sediment Control (CPESC) by the Erosion and Sediment Control Association of Canada. This international designation is considered the top tier of knowledge in Canada related to erosion and sediment control management. More information can be found on their website at http://www.escac.ca/.

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All of the site-specific information presented in the plan was provided by Kiewit Ledcor TM Partnership (KLTP) and the Trans Mountain Expansion Project website[1]).

[1] https://www.transmountain.com/

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF TABLES

LIST OF FIGURES

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GLOSSARY / LIST OF ACRONYMS

BC	British Columbia
BC MoE	BC Ministry of Environment and Climate Change Strategy
BMP	Best Management Practice
BPD	Barrels Per Day
CECs	Contractor Environmental Coordinators
CEM	Contractor Environmental Manager
Chief EI	TM Chief Environmental Inspector
cm	centimeter
CM&I	Construction Monitoring and Inspection
CP	Canadian Pacific Rail
CWQMP	Construction Water Quality Monitoring Plan
DFO	Department of Fisheries and Oceans
EI	Environmental Inspector
EI Team	TM Environmental Inspection Team
EM	TM Environmental Manager
EPP	Environmental Protection Plan
ESC	Erosion and Sediment Control
ESCP	Erosion and Sediment Control Plan
kg/ha	kilograms per hectare
KLTP	Kiewit Ledcor Trans Mountain Partnership
km	kilometers
L/min	liters per minute
m	metre

mg/L	milligrams per liter
mm	millimetres
NEB	National Energy Board
OCP	Official Community Plan
QEP	Qualified Environmental Professional
RS	Resource Specialist
SFU	Simon Fraser University
TMEP	Trans Mountain Expansion Project
TSS	Total Suspended Solids
WTP	Water Treatment Plant
VFPA	Vancouver Fraser Port Authority

1 INTRODUCTION

The Westridge Marine Terminal is the western coastal loading and shipping facility for the Trans Mountain Pipeline. It is an existing facility that has been in operation since 1954, providing distribution of refined and crude oil products (Figure 1-1). As part of the Trans Mountain Expansion Project (TMEP), the Westridge Marine Terminal will be expanded to include: three new marine berths, an expanded foreshore area, a manifold station, a metering station, emission control equipment, an expanded access road, a substation, a transmission line, new product lines, a new utility dock, a double perimeter fence will be installed requiring clearing and grubbing around the periphery of the site, and a tunnel to convey two new 30-inch delivery lines from the Burnaby Terminal to the Westridge Marine Terminal under Burnaby Mountain. (Figure 1-2 and Figure 1-3)

Figure 1-1. Location overview

Figure 1-2. Westridge Marine Terminal - Marine Expansion

Figure 1-3. Westridge Marine Terminal - Foreshore and Onshore Expansion.

1.1 PURPOSE AND SCOPE

The intent of this Erosion and Sediment Control Plan (ESCP) is to provide site-specific erosion and sediment control (ESC) prescriptions for the onshore Phase 1 and Phase 2 early construction works including protective measures and guidance to be implemented and to address requirements of municipal, provincial and federal regulatory bodies including:

- City of Burnaby;
- Province of British Columbia;
- Vancouver Fraser Port Authority (VFPA);
- National Energy Board (NEB); and
- Fisheries and Oceans Canada (DFO).

The ESC mitigation prescriptions will follow applicable Best Management Practices (BMPs) along with site-specific measures for water management during construction. The mitigation measures and strategies outlined in the ESCP will assist construction practices with meeting or exceeding the Projects regulatory conditions. More specifically, the ESCP is intended to prevent or minimize the entrainment, transport, and deposition of sediments and soil particulates from the project site into environmentally sensitive areas such as Burrard Inlet.

Throughout this ESCP, references to soil indicate general site material including spoils, excavated material, mineral soil and topsoil, unless specifically referenced. Sediment is considered soil in water.

1.2 ASSOCIATION TO OTHER PLANS

This ESCP is consistent and supplemental to other plans prepared for TMEP as part of the National Energy Board (NEB) approval process for the pipeline and associated facilities, and references to those plans are made herein as applicable. These may include, but are not limited to:

- Westridge Marine Terminal Environmental Protection Plan (EPP);
- Marine Water Quality Management Plan;
- Burnaby Mountain Tunnel EPP;
- Compliance Management Plan; and
- Facilities EPP.

The Westridge Marine Terminal EPP (Trans Mountain Pipeline ULC 2018) includes the following relevant ESC information:

- Terrestrial Construction - Section 7;
- Erosion and Sedimentation - Sections 10 and 11;

- Monitoring - Sections 15 and 16;
    - Monitor turbidity and/or total suspended solids (TSS) concentrations during construction to ensure that water discharged from the site does not have TSS in excess of 25 mg/L (dry conditions) or 75 mg/L (rainy conditions) above background levels of the receiving water prior to discharge.
- Dust Control - Sections 17 to 23.

The Facilities EPP (Trans Mountain Pipeline ULC 2018) details relevant information with respect to the Westridge Marine Terminal site. As it pertains to ESC it discusses:

- Environmental Compliance - Section 4;
- Notification of Interested Parties - Section 5;
- General Measures - Section 6;
- Pre-Construction Activities - Section 7;
- Topsoil/Root Zone Material Handling and Grading - Section 8;
- Facility Construction - Section 9; and
- Clean-Up and Reclamation - Section 10.

Appendices to the Facilities EPP that include relevant ESC information include the following:

- Appendix A of the Facilities EPP (Contacts) provides contact information of the appropriate government authorities that are to be consulted and or contacted in the case of an emergency.
- Appendix B of the Facilities EPP (Contingency Plans) provides contingency measures that could be implemented to mitigate potential environmental effects that may occur during construction activities.
- Appendix C of the Facilities EPP (Details) illustrates and describes general mitigation measures.
- Appendix D of the Facilities EPP (Resource-Specific Mitigation Tables) detail known environmental features and recommended mitigation measures at each construction site.
- Appendix E of the Facilities EPP (Westridge Marine Terminal Environmental Facility Drawing) illustrates environmental considerations at the Westridge Marine Terminal construction site.

The relevant sections of the Compliance Management Plan (Trans Mountain Pipeline ULC 2017d) that are applicable to ESC management include:

- Roles and responsibilities – Sections 1.5 and 1.6;
- Compliance verification – Section 3.0;
- Non-compliance identification, reporting and correction – Section 3.2;
- Environmental compliance – Section 4.0; and

- Incident reporting – Section 5.0.

The Marine Water Quality Management Plan (Trans Mountain Pipeline ULC 2017c) has sections relevant to ESC management, specifically:

- Use of turbidity curtain – throughout the document (Section 5.0); and
- Monitoring of water quality during in-water rip rap removal – Section 6.0.

2 REGULATORY REQUIREMENTS AND GUIDELINES

In addition to the existing terrain and site conditions, the ESCP for the project must take into consideration many other aspects of the approval and permitting process.

There are federal and provincial legislation, regulations and permits, and municipal bylaws pertaining to the protection of water quality during construction activities that are applicable to this project. A summary of the legislative requirements that influence ESC planning are summarized in the following sections.

2.1 FEDERAL

Fisheries and Oceans Canada: *Fisheries Act* (1985, updated in 2012):

There are several sections of the *Fisheries Act* that are relevant to the topic of erosion and sediment control:

- 35 (1) No person shall carry on any work, undertaking or activity that results in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery.
- 36 (3) Subject to subsection (4), no person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish or in any place under any conditions where the deleterious substance or any other deleterious substances that result from the deposit if the deleterious substance may enter any such water. Note that sediment has been defined under case law as a deleterious substance.

The marine works will need to be reviewed federally by Fisheries and Oceans Canada to ensure that the proposed works do not pose any serious harm to fish as per the *Fisheries Act*. A Request for Review will be submitted to DFO (Trans Mountain Pipeline ULC 2018), describing the work, the anticipated impacts to fish and fish habitat, and impact mitigation. If, after a project review, it is determined that the project will cause serious harm to fish that are part of or that support a commercial, recreational or Aboriginal fishery, it will be necessary to apply for an Authorization (Paragraph 35(2)(b) of *Fisheries Act*) to ensure compliance with the *Act*.

National Energy Board: *National Energy Board Act* (1985)

Of the 157 required conditions identified by the NEB in November 2016, six conditions have an ESC component. All require ESC planning prior to commencing construction, or prior to commencing construction of specified Project components. One ESC related commitment is required after construction (Condition 151, Post-Construction Environmental Monitoring Reports) (Table 2-1).

Table 2-1. National Energy Board Conditions

Condition #	Requirement
35	Marine Sediment Management Plan (Not required as dredging is not required at the Westridge Marine Terminal)
45	Weed and Vegetation Management Plan
47	Access Management Plan(s)
78	Facilities Environmental Protection Plan
81	Westridge Marine Terminal Environmental Protection Plan
151	Post-Construction Environmental Monitoring Reports

Vancouver Fraser Port Authority

The Vancouver Fraser Port Authority, a federal port authority doing business as Port Metro Vancouver (PMV), manages lands under the purview of the *Canada Marine Act*, which imparts responsibilities for environmental protection. The Vancouver Fraser Port Authority accordingly conducts project and environmental reviews of works and activities undertaken on these lands to ensure that the works and activities will not be likely to cause significant adverse environmental effects. The Project and Environmental Review Process applies to all proposed physical works and activities on federal lands and waters partially or wholly within the Vancouver Fraser Port Authority's jurisdiction. Approval will be required for works in the Shore Area and ESC planning and mitigation will be required.

2.2 PROVINCIAL

Ministry of Environment and Climate Change Strategy: *Environment Management Act* (2003)

The *Environmental Management Act* regulates industrial and municipal waste discharge and provides the authority for introducing wastes into the environment, while protecting public health and the environment. The Westridge Marine Terminal currently has a Waste Discharge Permit for effluent discharge from the diked tank farm. This is for surface water collected and treated with oil-water separators discharged at two locations into Burrard Inlet.

Trans Mountain is obtaining a waste discharge approval permit from BC Ministry of Environment and Climate Change Strategy (BC MoE) for Phase 2 works described in this ESCP. A Construction Water Quality Monitoring Plan (CWQMP) is attached in Appendix A. The CWQMP will be implemented to ensure compliance with the BC MoE waste discharge permit requirements. A final permit amendment will be required for the design and operation of the new collection and treatment works required for the TMEP.

2.3 MUNICIPAL

City of Burnaby: Sediment Control Notes

The City of Burnaby, Department of Environment, provides guidance to land developers for managing sediment on their construction sites. These Sediment Control Notes (2016a) define the water quality limits for discharge to the City of Burnaby's storm system.

"The performance criteria for project sediment control shall be a requirement that total suspended solids (T.S.S. [*sic*]) in downstream storm runoff from the project site shall not exceed a maximum of 25 mg/L above background levels for normal dry day and 75 mg/L above background levels during rain or storm event. The pH level of water discharging from the site shall be within the range of 6 to 8.5. Runoff outside this range must be neutralized prior to discharge."

3 EXISTING SITE CONDITIONS

3.1 TOPOGRAPHY

The Westridge Marine Terminal is located at 7094 Bayview Drive in the City of Burnaby, BC, north of Burnaby Mountain. The property is situated on the lower slopes of a north-facing hillside and extends to the Burrard Inlet shoreline. The elevations of the project area range from approximately 58 m at the top of the property down to -6 m in the waters of Burrard Inlet. Aside from the relatively flat foreshore, most of the property is steeply sloped (approximately 26% gradient). Figure 3-1 illustrates existing topography.

3.2 GEOLOGICAL SETTING AND SOILS

The site is located in the Georgia Depression Physiographic Region, a flat valley floor 1-5 km wide, steep valley walls, gently rolling uplands and ridges, gently rolling to flat lowlands of terraces and plains, and deltas. The geologic types found at the Westridge Marine Terminal include coarse-grained clastics and volcanic rock types overlaid with surficial glaciofluvial soils. From an ESC perspective this means, the site has an initial surface layer that may be easily erodible with relatively stable underlying layer.

3.3 CLIMATE

The project is located in the Fraser Lowland Ecosection within the Lower Mainland Ecoregion (Province of British Columbia 2016a), an area of high rainfall, with precipitation increasing towards the Coast Mountains and Cascade ranges. Pacific air can stall in this region bringing intense rain or snow to the adjacent mountains. Infrequently, Arctic air moving through the area can bring winter storms with cold temperature and deep snow. The extreme minimum temperature recorded at the weather station at Simon Fraser University (SFU) is -19.4 °C (December 2, 1968) (Environment Canada 2016). Hot, dry air from the south can bring warm, very dry conditions in the summer (BC MoE 2016a), with an extreme maximum temperature recorded at SFU of 34.5 °C (September 3, 1988). Daily average maximum temperatures are highest in June and July at 21.2 °C, with daily average minimums lowest in December and January at approximately 1°C. Average precipitation recorded at the monitoring station at SFU between 1981 and 2010 is 2009.9 mm per year, with 89.3 cm of this falling as snow. Figure 3-2 summarizes the climate normals (average monthly precipitation, monthly average, minimum and maximum temperatures) for the SFU monitoring station.

Figure 3-1. Existing site topography.

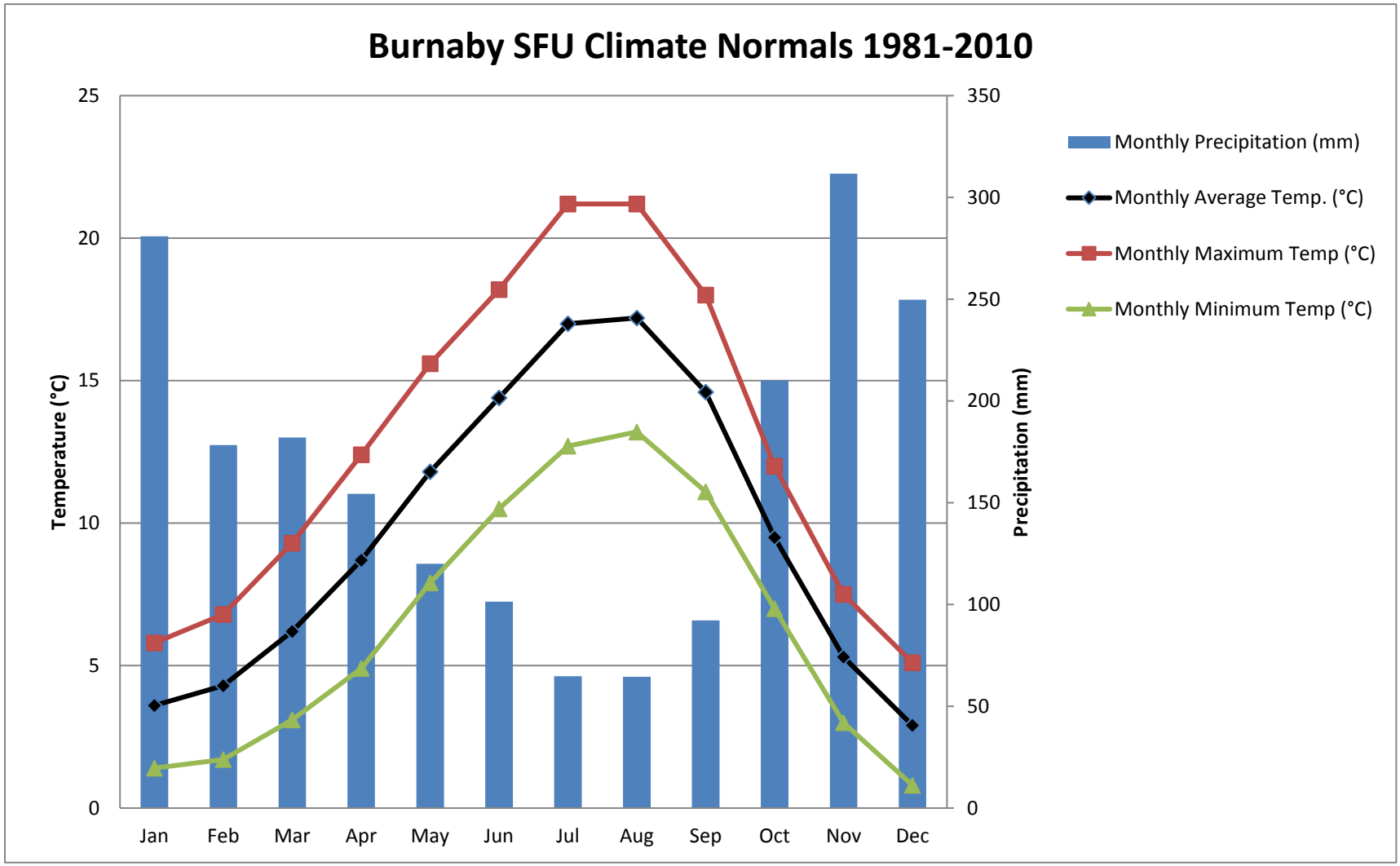

Figure 3-2. Climate normals for the site taken at Simon Fraser University (SFU), displaying total rainfall for each month of the year in addition to average, maximum and minimum monthly temperatures.

3.4 HYDROLOGY

Current onsite drainage for the Westridge Marine Terminal captures surface runoff and directs it to a number of drains/ditches, with direct discharge points into Burrard Inlet (Figure 3-3). From an erosion control perspective, the existing drains/ditches will need to be managed to reduce inputs of sediment as the detention capacity is not known at this time and they directly feed into Burrard Inlet; therefore, if sediment were to enter the existing drainage network there appears to be little capacity to detain and treat water before it enters the marine environment.

3.5 WATERCOURSES

Based on a site visit (December 20, 2016) and available geographic databases (Province of British Columbia 2016b, City of Burnaby 2016b), no fish-bearing watercourses are noted within the Project area. A vegetated drainage ditch runs parallel to the Canadian Pacific (CP) railway on the south side of the tracks, but this appears to be only seasonally wetted. A manmade ditch on the west side of the property boundary also runs north to the same east-west vegetated drainage ditch. Another small watercourse (non-fish bearing stream) crosses onto the property on the south side from Inlet Drive directly south of the Tunnel portal area and flows north across the site.

3.6 GROUND COVER

Ground cover in the Westridge Marine Terminal property is largely dominated by paved surfaces with some maintained grass lawn surrounding the existing infrastructure and forested lands in the undisturbed areas of the property. Undeveloped areas of the property, particularly through the south and eastern sections of the property and the periphery, are dominated by mature mixed wood forest, with deciduous species being dominant. Tree species include black cottonwood (*Populus trichocarpa*), red alder (*Alnus rubra*), and western hemlock (*Tsuga heterophylla*). Although most of the foreshore is currently paved, the top of bank is vegetated with a narrow strip of shrub species.

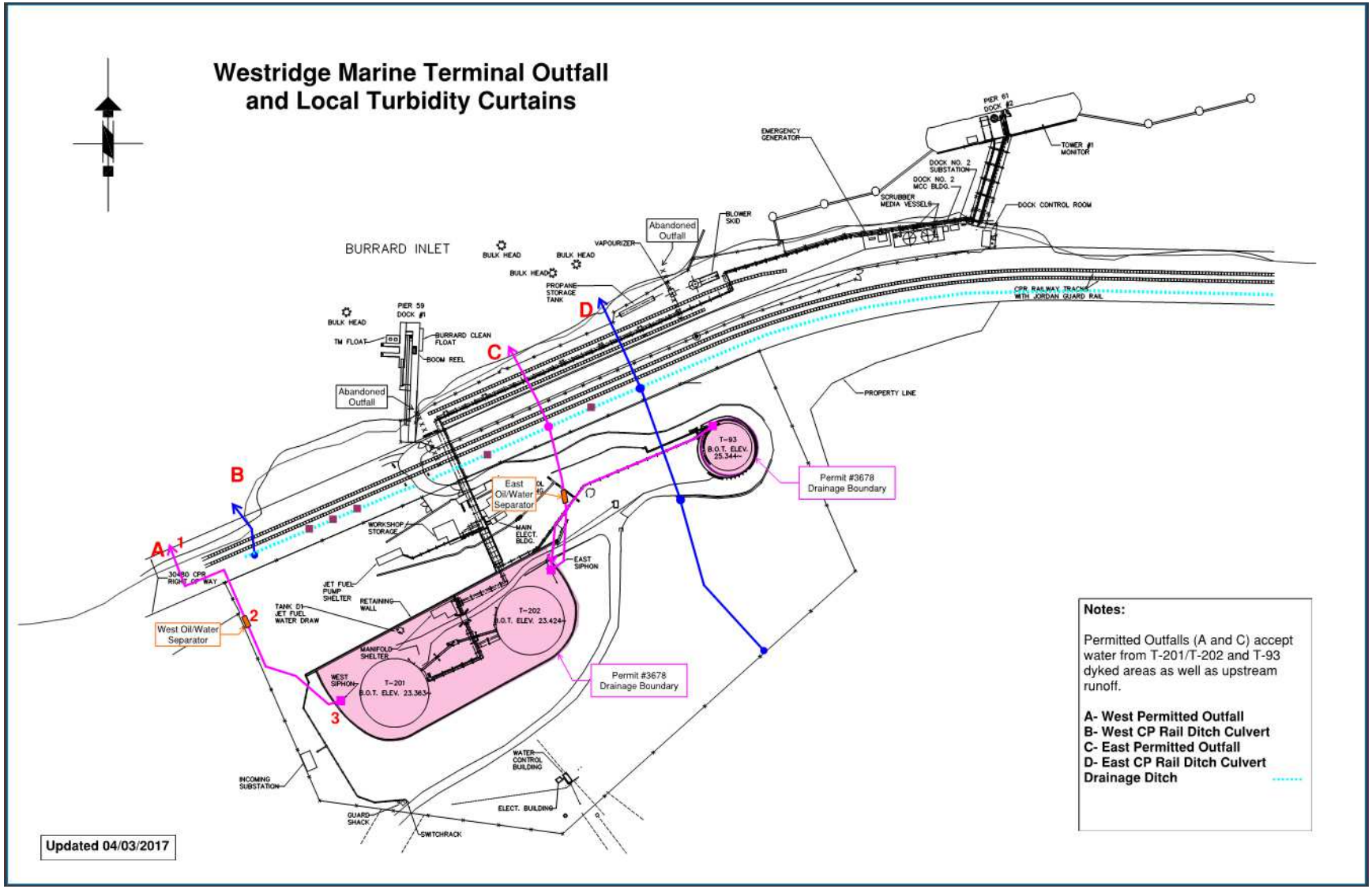

Figure 3-3. Existing drainage and catch basins

3.7 AQUATIC RESOURCES

Data collected as part of the NEB Application (Trans Mountain Pipeline ULC 2013) documented at least 75 species of fish known to use Burrard Inlet of which almost half were found directly in the proposed marine construction area. These include all five species of Pacific salmon (Chinook [*Oncorhynchus tschawytscha*], Chum [*Oncorhynchus keta*], Coho [*Oncorhynchus kisutch*], Pink [*Oncorhynchus gorbusha*], and Sockeye [*Oncorhynchus nerka*]), Pacific Herring (*Clupea pallasii*), Anchovy (*Engraulis mordax*), Lingcod (*Ophiodon elongates*), Copper Rockfish (*Sebastes caurinus*), Quillback Rockfish (*Sebastes maliger*), and kelp species. Marine fish use of the area includes marine riparian, intertidal, and subtidal for spawning, rearing, migration, and foraging. The proposed marine construction area (Shore Area) overlaps with a Rockfish Conservation Area called the Eastern Burrard Inlet Rockfish Conservation Area and will result in an environmental impact. Therefore, consideration of an offset is proposed using removed rip rap material to create subtidal rock reefs. Shellfish present in the area include Dungeness Crab (*Metacarcinus magister*) and Red Rock Crab (*Cancer productus*). A DFO Important Area for Dungeness Crab has been identified within the proposed construction footprint. Pacific harbour seal (*Phoca vitulina richardsi*) are likely the most prevalent marine mammal with the potential to be near the Shore Area construction, although other marine mammal species have been identified in Burrard Inlet. DFO has identified a least risk timing window for Burrard Inlet between August 16 and February 28 when in-water works should be conducted.

3.8 LAND USE

The current footprint of the Westridge Marine Terminal is zoned as M3 (Heavy Industrial District) according to the City of Burnaby Official Community Plan (OCP) (Figure 3-4). The property is immediately bordered to the west, south and east by the Barnet Marine Park, zoned P3, then by areas zoned as residential districts (R2 and R11).

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Figure 3-4. Westridge Marine Terminal zoning

4 EROSION POTENTIAL AND RISK ASSESSMENT

The selection of ESC practices and appropriate level of effort for ESC management is based on the risk of erosion within the site during construction. The determination of the site-specific risk of erosion and sedimentation has been completed based on the Transportation Association of Canada's approach to assessing risk using erosion potential combined with the consequence of sedimentation on downstream or off-site resources (i.e., environmental, regulatory and project related consequences) (Transportation Association of Canada 2005). Risk assessment is integrated into ESC planning.

Geological mapping of the Vancouver Metropolitan Area indicates that soils at the Westridge Marine Terminal site are characterized primarily as tills (Turner et al. 1998). Till is a heterogenous glacial deposit consisting of clay, silt, sand and stones ranging from pebble to boulder size. Silt- and clay-bearing tills disturbed during construction activities can be a major source of water siltation.

The property is effectively divided into the steep slopes south of the railway tracks and a relatively flat foreshore to the north of the railway tracks. The average gradient on the hillside is approximately 26%, although this is characterized by steeper pitches broken by occasional flatter benches, both natural and anthropogenic (e.g. road, tank containment area) (City of Burnaby 2016b). It is anticipated that many slope lengths will be no more than 10 m, thus reducing erosion potential (TAC 2005). Areas with higher and longer gradients are considered higher risk and will require the implementation of additional ESC measures.

In addition, the project is scheduled to occur during the time of the year when the highest cumulative rainfalls occur (refer to Figure 3-2). Therefore, a combination of highly erodible soils, slope, and high rainfalls will have to be considered in the planning and implementation of the ESCP.

The potential consequences of erosion and sedimentation are considered high in areas where there is direct stormwater discharge to Burrard Inlet. Areas with moderate to high erosion potential and high consequences require an increased level of erosion and sediment control, including project planning and design BMPs, procedural BMPs, water management BMPs, erosion control BMPs and sediment control BMPs (TAC 2005). For effective erosion control, the project must incorporate sound planning and the implementation of multiple, complementary ESC measures and practices.

5 BEST MANAGEMENT PRACTICES

Procedures and processes will be incorporated into construction schedules and site planning, where possible, to minimize erosion and prevent sediment transport off the site prior to construction or as contingency measures during construction. Various guiding principles apply to construction works:

- Reduce movement of exposed soil on sloped areas or salvaged/stockpiled material by installing temporary control structures;
- Minimize the input of sediment into non-contact water by minimizing, to the extent possible, the surface area of disturbed at any given time;
- Manage drainage and stormwater into, through and around work sites and direct contact water to a vegetation for infiltration or centralized water treatment plant locations;
- Prevent the discharge of untreated sediment laden water to the environment, utilizing water treatment plant systems, incorporating water retention areas with sufficient storage capacity to manage for major storm events (e.g., from dewatering work sites, surface runoff due to rain events, etc.);
- Prevent erosion at discharge points e.g., by maintaining or reducing existing flow velocities and/or by providing dissipation measures; and
- Maintain water quality at discharge points.

The general BMPs (Table 5-1) outlined in this ESCP largely draw upon recommendations from the Trans Mountain Pipeline ULC Facilities Environmental Protection Plan (Trans Mountain Pipeline ULC 2017a) and the appended associated contingency plans (e.g., Soil Handling Contingency Plan, Wet/Thawed Soils Contingency Plan and Soil Erosion and Sediment Control Contingency Plan), Standards and Best Practices for Instream Works (BC MWLAP 2004), Land Development Guidelines for the Protection of Aquatic Habitat (DFO 1993), and the National Guide to Erosion and Sediment Control on Roadway Projects (TAC 2005). The BMPs are intended to be used throughout the project site in conjunction with site-specific prescriptions identified in Section 5.

Table 5-1. Best Management Practices.

BMP	Comments
Procedural	
Minimize exposed soils	Cover exposed soils as quickly as possible (e.g., capping with gravel, seeding, mulching). Hydroseed permanently exposed soils and cover temporarily exposed soils with plastic/poly sheeting on an as required basis based on the instructions and judgement of an ESC QEP.
Minimize clearing	Only clear areas as required to complete work within the approved clearing boundaries. No clearing and/or grubbing will take place within established 15m riparian buffer adjacent to streams
Minimize site access	Limit access points within the project area and gravel high use access roads when feasible.
Stockpile management	Stockpiles should not be located within 30 m of a watercourse or ditch leading to fish-bearing waters.

BMP	Comments
Maximize favourable weather	Where possible, schedule construction activities in high risk areas during periods of lower precipitation.
Prepare for shutdowns	Be prepared for scheduled or unplanned work stoppages and ensure contingency supplies are available and high risk areas are addressed promptly.
Operate during least risk fisheries windows	Schedule marine works during the least risk fisheries window or apply for variance to conduct works during other anticipated low risk periods.
Install BMPs early	Install runoff, erosion and sediment control measures before works in a given area occur or as soon as practicable.
Restore early	Restore or reclaim completed areas as soon as possible (e.g., hydroseed/dry-seed and mulch).
Water Management	
Keep clean water clean	Collect clean water (non-contact) and convey it through work site using pipes, culverts, or diversion channels. Maintain natural drainage patterns (natural draws) throughout the construction footprint where possible.
Use energy dissipater	Install rip rap in areas such as culvert outlets to reduce flow velocities and provide erosion protection.
Diversion ditches/berms	Collect runoff with perimeter ditches at the tops of slopes and convey non-contact water around exposed areas.
Stormwater treatment	Convey all runoff to vegetation for infiltration or water treatment plant prior to releasing water offsite.
Erosion Control	
Slope texturing/grading	Track completed slopes perpendicular to the grade as soon as final grades are achieved, or if slope is being left for extended periods of time.
Seeding	Establish vegetative cover as soon as possible.
Tackifier/Mulching	Cover with exposed soils with straw mulch or use a tackifier to minimize surface erosion.
Hydroseeding	Conduct hydroseeding in stages to stabilize any exposed soils and take advantage of the growing season. Alternatively, exposed soils may be dry-seeded using an approved seed mixture and application rate.
Fibre rolls and wattle slope interrupters	Reduces slope length, slows runoff and traps silt on steeper slopes (up to 1:1). Also provides sediment control.
Polyethylene sheeting/tarp	Temporary fills, exposed slopes or stockpiles should be covered with polyethylene sheeting or tarps.
Rolled erosion control products	Cover completed slopes following seeding.
Rip rap	Provide energy dissipation of flowing water, particularly at culvert outlets.
Check dams	Construct clear crush berms back-armoured with large clean rock to reduce flow velocities within drainage ditches to allow suspended sediment to settle out. Require regular inspection and maintenance.
Sediment Control	
Sediment fencing	Slow runoff to allow suspended sediment to settle out. Applicable to sheet flow only. Must be regularly inspected and maintained as necessary.
Sediment basin or trap	Slow runoff to allow sediment to settle but requires sufficient space to hold anticipated flow levels and require regular maintenance to remove accumulated sediment.
Sediment bags/socks	Act as a filter by retaining sediment in a closed bag while allowing cleaner water to discharge.

Adapted from TAC (2005).

The ESCP is based on two key principals: keep clean water clean and minimize sediment transport by implementing erosion control. This will minimize the volume of water to be treated and the amount of sediment that will have to be captured in sediment controls. To achieve this, the following will be carried out at each of the work areas:

- Construct or extend perimeter ditches before any clearing is started. These ditches will allow non-contact water from upslope areas to be intercepted and prevented from entering the work areas. Non-contact water will continue to be discharged directly into Burrard Inlet.
- Minimize cleared areas and minimize time that soil is exposed to rainfall or snowmelt runoff. This will involve the implementation of various erosion and sediment control best management practices (BMPs) to reduce erosion and sediment transport.
- Contain contact water. A series of internal interception pathways will be created to contain contact water and direct it to the stormwater treatment/retention areas, where water will be detained and treated as required before releasing it off-site.

The water management infrastructure is critical to the success of the ESCP. Therefore, it is critical that perimeter and containment ditches, and the water treatment plants (WTPs) are constructed before largescale clearing activities begin.

5.1 SLOPE AND SURFACE PROTECTION

Surface soil erosion and movement of sediments from slopes are affected by the soil type, gradient and moisture content (TAC 2005). Project soils comprised of silt, sands, mixed sand and gravel, and topsoil, are overlaid on long steep slopes and have the potential for high precipitation loading, and therefore they will need to be stabilized. General approaches used for temporary ESC on slopes are as follows:

- Design and installation of interceptor ditches;
- Application of surface protection; and
- Application of sediment fences or wattles/fibre rolls.

During active construction, the following general guidelines will be followed where practicable to protect exposed soils:

- All cut/fill and cleared slopes and surfaces should have erosion controls implemented immediately following reaching the final angle of repose.
- Erosion control should be implemented immediately on completion of the grading operations of the worked area.
- Temporary graded areas should be protected from erosion through the use of straw mulch, silt fencing, straw bales, coir matting, polyethylene tarps or other appropriate measures in non-traffic areas; a gravel cap should be utilized in zones of construction traffic. Final graded or landscaped

areas should have the appropriate permanent surface protection or landscaping in place as soon as possible.

  - Soil surfaces to be treated should be roughened. Recommendations from TMEP SME include a cover crop species based on the season, fall rye if seeding occurs between July and Feb. Use an annual and perennial local ryegrass mix if seeding between March and June.
  - Cover the seeded area with at least 5 cm of certified weed free straw, preferably applied by hand but if necessary with a blower. The straw should be held in place with staked straw bales/wattles, silt fencing, hydroseed application of wood fiber mulch at 500 kg/ha and a tackifier at 40 kg/ha, or with netting, depending upon the slope gradient.

- Soil that is stockpiled for more than 7 days and less than 2 months should be covered with polyethylene and totally contained by a sediment fence as a temporary measure to prevent erosion.
- Topsoil stockpiles shall be contoured, and an appropriate seed mix should be applied as soon as possible, utilizing a tackifier to reduce erosion prior to germination. A containment structure of some kind is required for all topsoil piles to prevent contamination of water resources and to control sedimentation (i.e. silt fence, berm or ditch). Sufficient capacity must be provided by the berm to prevent overtopping during precipitation events.
- Always be prepared for possible wet conditions.

5.2 WATER CONVEYANCE SYSTEMS

5.2.1 CULVERTS

Culverts are closed systems used under roads or other structures usually set 900 mm below grade. They can have aprons depending upon the intended volume of flow. Specifications for typical culverts to be used on this project are detailed in Figure 5-1.

5.2.2 DITCH TYPES

There are three types of ditches used on site (Figure 5-1).

- Type A is a lined 1:1.5 open ditch 600 mm wide and 600 mm deep.
- Type B is a shotcrete open swale 300 mm deep and wide. This has drain rock and a perforated pipe at the centre.
- Type C is a lined 1:1.5 open ditch 600 mm wide and 700 mm deep.

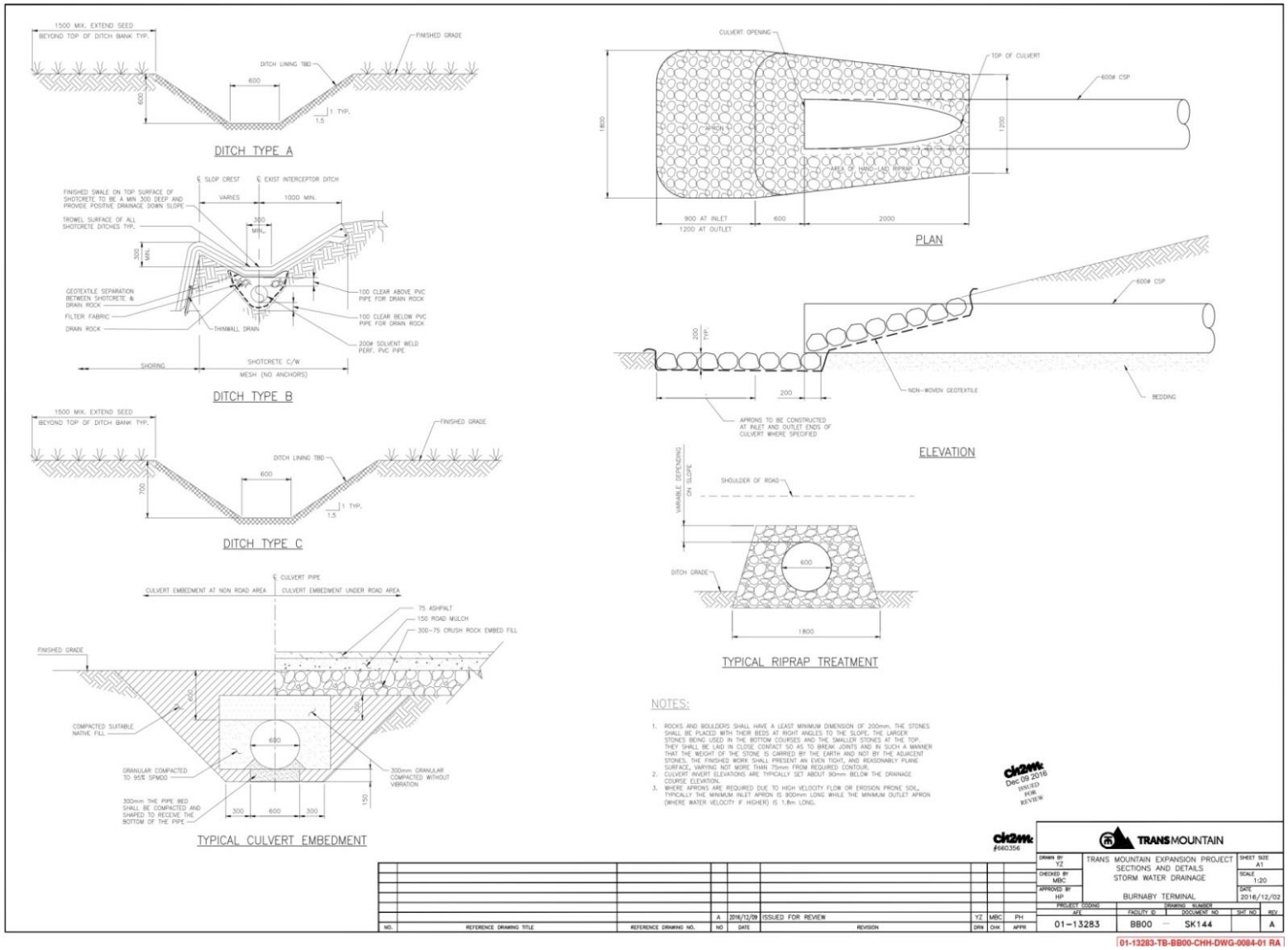

Figure 5-1. Ditch and culvert types

5.2.3 CONTACT VS NON-CONTACT WATER MANAGEMENT

The general approach to onsite stormwater management during construction will be in the context of water exposed to construction areas (contact water) and water not exposed to construction areas (non-contact water). All water in contact with construction areas will be kept separate from non-contact water. During construction, water is summarized in the following way:

Water from Non-Construction Areas (Non-contact)

All stormwater drainage that has not been exposed or in contact with construction areas will be collected in exterior diches and directed to the existing stormwater system. This primarily addresses the upper slopes of the property and the area around the tanks. Four culverts currently convey non-contact stormwater to Burrard Inlet through the foreshore (Figure 3-3). The existing stream that enters the site at the southern extent of the property from Inlet Drive will receive a new culvert under the fence and at the secant pile wall for the tunnel will be diverted around the tunnel construction area via culvert to reconnect with the existing drainage off site.

Water from Construction Areas (Contact Water)

Water management related to the Phase 1 early works will be captured in culverts/ditches and directed to vegetated areas for infiltration or collected in storage tanks for removal. The remainder of Phase 2 construction water that has been exposed to or has exposed to construction areas will be directed via culverts/ditches to gravel lined sumps and subsequently pumped to respective WTPs. Water storage tanks and treatment systems are modular and will be installed based on workflow.

5.3 WATER TREATMENT SYSTEMS

5.3.1 PHASE 1 WATER TREATMENT

For the Phase 1 scope of work, water will be diverted to undisturbed vegetated or grass areas for infiltration. Infiltration and interception may be supplemented with slope interruption (see Table 5-1 BMPs).

5.3.2 PHASE 2 WATER TREATMENT PLANTS

There will be two new temporary WTPs utilized during the course of construction. When the waste discharge permit approval is received from BC MoE for Phase 2 works, these systems will be installed prior to construction. The sizing of the WTPs is based on calculated flows between 2-year and 5-year 24-hour peak rainfall events, and they will be capable of processing between 1,500 – 3,000 liters per minute (400 to 800 US gal/min). These WTPs will be installed onshore to treat contact water; on the east and west sides of the site.

The east side works is designated as construction Phase 2.1 and the west side works is designated as construction Phase 2.2. An overview of the drainage catchments for each system is illustrated in Figure 5-2 and Figure 5-3 and an example WTP system is depicted in Figure 5-4.

Contact water from the east construction works (road widening, and construction of the tunnel portal pad and the transmission line corridor) will be captured in culverts/ditches and diverted to the eastern WTP, located at the northeastern extent of the onshore area (Figure 5-2). The WTP will be capable for treating 3,000 liters per minute using flocculent to aid in the settling of the sediment from contact water. This WTP system is modular and can be scaled to meet the required demand by adding or removing tanks. This treatment plant will discharge clean water to the eastern CP ditch.

For the west construction works, the water treatment system will be located at the northwestern extent of the onshore area (Figure 5-3). This system will capture water from the manifold and pipe rack construction works. The WTP will be capable for treating 1,500 liters per minute using flocculent to aid in the settling of the sediment from contact water. This WTP system is modular and can be scaled to meet the required demand by adding or removing tanks. This treatment plant will discharge clean water to the western CP ditch and out to Burrard Inlet via a culvert outfall.

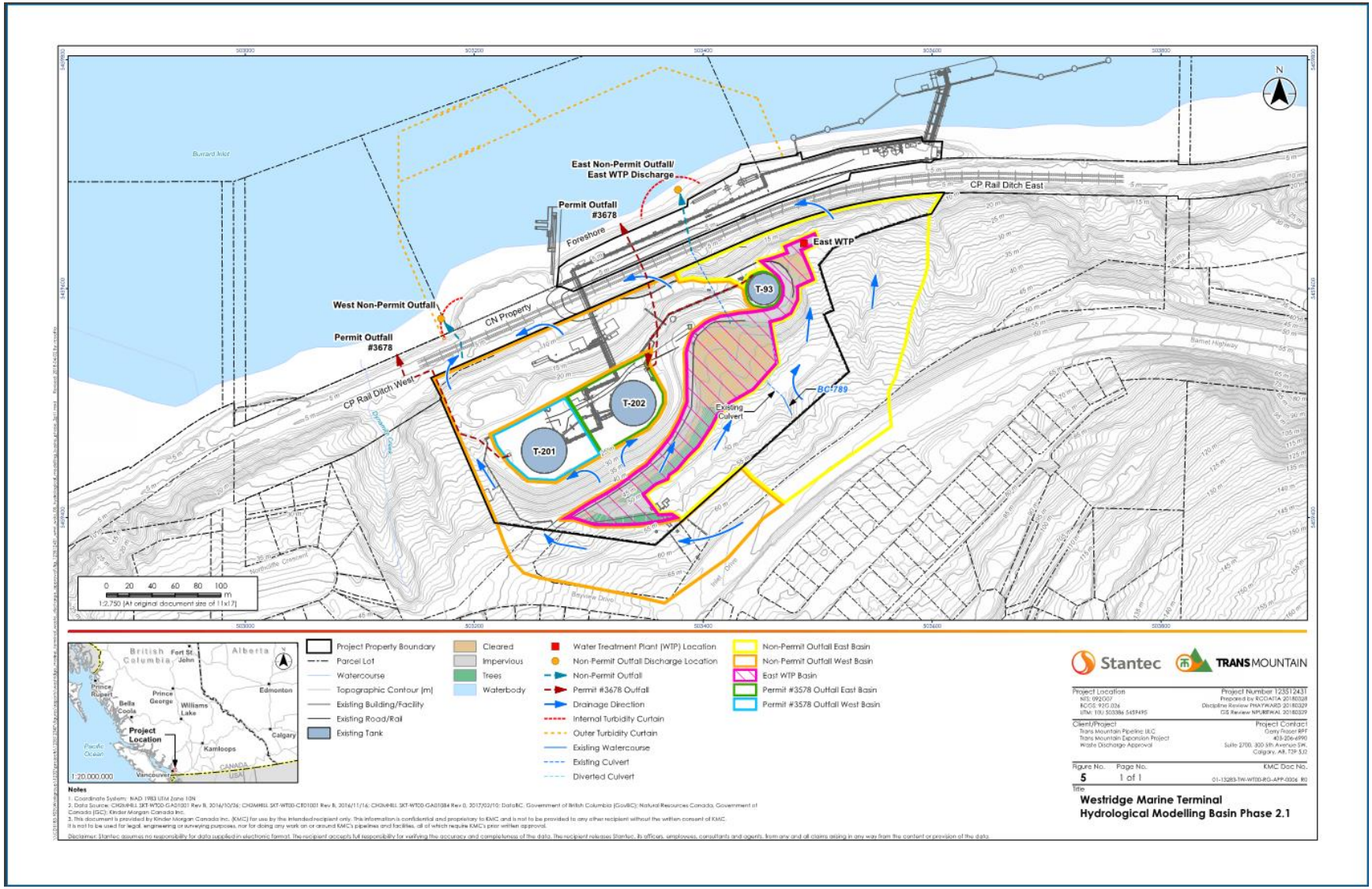

Figure 5-2 Overview of water treatment plant systems drainage catchment - Phase 2.1

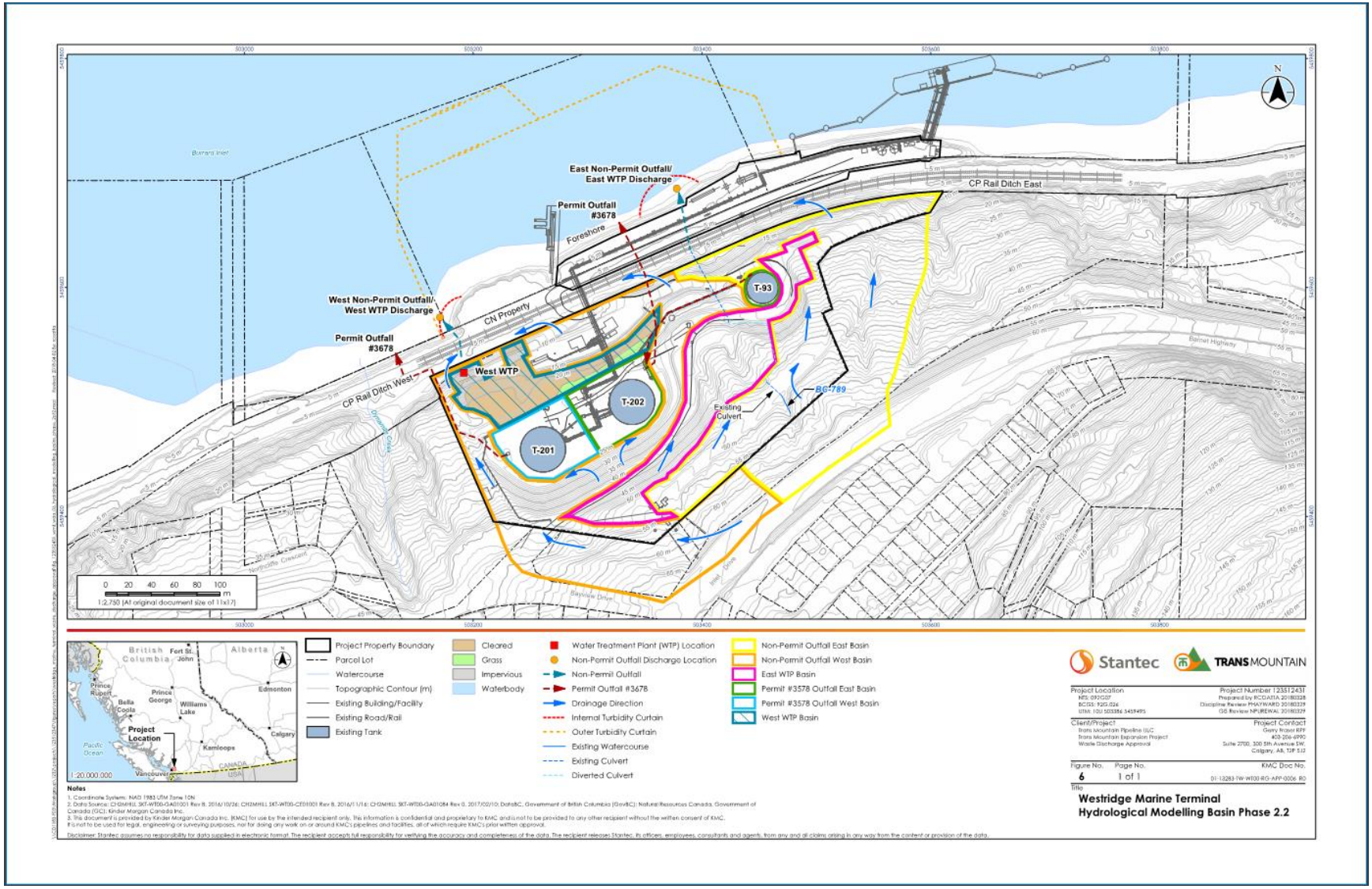

Figure 5-3. Overview of water treatment plant system drainage catchment- Phase 2.2

Figure 5-4. Example of water treatment plant system.

5.4 WATER QUALITY MONITORING

A Construction Water Quality Monitoring Plan (CWQMP) attached in Appendix A outlines how water quality monitoring will be undertaken to meet water quality criteria including the new Westridge Marine Terminal approval application limits.

Water quality of contact water will be monitored for permit compliance at the discharge point from the treatment plants and prior to discharge to Burrard Inlet. KLTP will submit water quality monitoring reports to Trans Mountain. For any results that indicate an exceedance of the approval permit limits, Trans Mountain will follow the regulatory agency notification and reporting requirements identified in the approval permit.

5.5 SEDIMENT CONTROL ACCESS/EGRESS

Mechanical or passive wheel wash systems may be employed within the Westridge Marine Terminal site if warranted to clean trucks and equipment tires of accumulated sediment prior to exiting the project boundaries. Wheel wash facilities require consideration of maintenance and dewatering requirements to remove accumulated sediments and to ensure that the ESC mitigation objectives are being met. Typically wheel wash facilities should ensure that wheels in contact with the wash facility should achieve at least four full rotations. Wash water will be treated at the onshore east WTP prior to discharge.

A passive rock mulch egress point within the construction area may also be established to assist in the cleaning of truck and equipment tires.

To assess the efficacy of the wheel wash systems, municipal roads will be assessed regularly for the presence of tracked material. A street sweeper will be used to remove any material that is tracked out on to the roads. Storm drain filters may also be used if necessary. Note that the Burnaby stormwater bylaws prohibit washing the streets as this would introduce sediment to the storm sewer system.

5.6 SOIL MANAGEMENT

The following mitigation measures will be followed for soil management:

- Topsoil will be salvaged during grubbing and stripping activities and stored for later use, wherever practicable.
- Soil and debris will be stockpiled in designated areas and not mixed with or buried by other materials.
- Soil stockpiles will be covered or seeded with an approved, certified weed-free seed mixture to establish grass cover and reduce the opportunities for erosion.

5.7 DUST MANAGEMENT

If required, dust control measures will be implemented to maintain air quality in the project area at or near ambient levels and to avoid significant deposition of airborne particulates offsite. The following mitigation measures will be applied to reduce fugitive dust during construction activities.

5.7.1 MATERIAL HANDLING

- Adjust drop heights to less than two metres where feasible to reduce dust when loading materials into vehicles and depositing within stockpile areas.
- Material loads that may emit dust when being hauled should be covered.
- Load trucks so that loads do not spill during movement and use load covers.

5.7.2 MATERIAL EXTRACTION

- Use water sprays as required to suppress dust, except where this would result in not meeting technical specifications of the material being extracted or processed.
- Minimize vertical drop distance of materials to transfer points to the extent feasible.
- Establishment of construction material stockpiles in areas least prone to impact from prevailing winds.
- Retain vegetative barriers, or install temporary barriers, where practical.

5.7.3 ROADS

- Follow posted speed limits. Reduced speed limits may be implemented if necessary to reduce the generation of fugitive dust emissions.
- Timely stabilization of exposed areas prone to wind erosion.
- Oil may not be used as a dust suppressant.
- For controlling dust in spring and summer, apply sprayed water to the existing roadway.
- Fine-grained material vehicle loads will be covered to reduce wind-blown dispersal.
- Clean-up of mud and dust from paved roads and access points.

5.8 EROSION AND SEDIMENT CONTROL CONTINGENCY MATERIALS

KLTP will have miscellaneous ESC materials readily available throughout the duration of the project as a contingency measure should conditions necessitate their use. The list of ESC materials was derived from the review of National Guide to Erosion and Sediment Control on Roadway Projects (TAC 2005) and Trans Mountain Pipeline ULC Facilities Environmental Protection Plan (Trans Mountain Pipeline ULC 2017a) and appended associated contingency plans (e.g., Soil Handling Contingency Plan, Wet/Thawed Soils Contingency Plan and Soil Erosion and Sediment Control Contingency Plan). Materials will include the following, at a minimum:

- sediment fence and extra wooden stakes (36”);
- straw bales;
- rope;
- non-woven geotextile;
- polyethylene sheeting/tarps;
- rolled erosion control matting;
- spring berms;
- storm drain filters
- burlap sandbags (unfilled is acceptable as long as material is available to fill sand bags as required);
- fibre rolls or wattles;
- Sediment bags with or without flocculant;
- regionally-appropriate reclamation seed mix; and
- a variety of pumps and hoses.

6 WORK PHASES AND SITE-SPECIFIC EROSION AND SEDIMENT CONTROL

6.1 PHASE 1 – EARLY SITE WORKS

During Phase 1 of construction, activities are performed throughout the Westridge Marine Terminal. The activities include tree clearing and limited grubbing as required, perimeter fence installation, preliminary site preparation for the access road and tunnel portal, concrete box culvert installation, stream diversion and secant pile wall installation for the tunnel portal.

In summary, Phase 1 works will be undertaken outside the dyked tank farm and will not affect authorized discharges for maximum annual average, maximum daily discharge and total extractable hydrocarbon concentrations under the existing permit (Section 1, Permit# 3678).

Figure 6-1 illustrates the proposed works and ESC measures during Phase 1 of construction.

6.1.1 WORK SCOPE

- Tree Clearing and Limited Grubbing
    - Set out clearing perimeter for major work fronts including access road, tunnel portal, transmission line, fence corridor, and secant pile wall
    - Conduct danger tree assessments
    - Fall, buck, deck, and haul timber from clearing areas
    - Grub limited area for fence corridor and secant pile wall area only
    - Mulch and haul woody material
    - Salvage top soil/root zone material where applicable
    - Prepare WTP landing in northeast corner with cut and fill to construct a flat area
- Fence Installation
    - Repair/replace existing perimeter fence
    - Install secondary fence inside the perimeter fence
    - Install CCTV system and electrical underground wiring
- Box Culvert Installation
    - Excavate trench
    - Install concrete culvert

  - Backfill

- Diversion of Existing Stream around the Portal
  - Install new, 500 mm diameter CSP above ground (partially buried) from the outlet of the existing culvert at the southeast end of the porta area to the discharge manhole at the north end of the Portal Area
  - Connection of existing stream to newly diverted culvert

- Secant Pile Wall Installation
  - Drill, install rebar and pour primary piles
  - Drill, install rebar and pour secondary piles

6.1.2 ESC MEASURES

Erosion controls on environmentally sensitive areas will be installed as follows:

- Install perimeter ditch to divert offsite water to CP ditch, rock armour, and install check dams as required
- Set up silt fence around contact areas as well as on the downslope of undisturbed fields used for infiltration. The silt fence traps sediments and directs water toward infiltration.
- Install drainage ditches to direct contact water to green vegetated spaces for infiltration, rock armour, check dams as required
- Install sumps, pumps and perforated pipe connections to direct contact water to vegetated spaces
- Silt fencing and wattles will be set up on steep slopes to slow run off flow, catch sediments and promote infiltration.
- Apply mulch or cover to exposed areas where practicable
- Mulch produced during clearing and grubbing activities will be used as a temporary ESC measure on sloped areas.
- An undisturbed area south of the CP ditch will be used as an infiltration field to intercept and filter surface flow/stormwater from construction activities. Flow from the infiltration field will flow to the CP ditch.
- Monitor effectiveness of these measures, additional controls such as filter bags, wheel wash, or storm drain inserts may be required

6.1.3 ESC MEASURES SPECIFIC TO STREAM DIVERSION

- An Environmental Inspector and Resource Specialist will be onsite throughout active diversion work to ensure BMPs are being followed, monitor water quality and advise onsite construction staff.
- A temporary stormwater retention/treatment area will be established adjacent to the tunnel portal to capture construction water related to tunnel excavation.
- A silt fence will be installed along the secant pile wall area to capture and direct contact water to the water retention/treatment area.
- Trees within the watercourse area will be felled so as to land outside of the wetted perimeter of the stream. Grubbing within the riparian buffer zone will not occur until just prior to start of instream work.
- Works in the tunnel portal construction area will occur when the watercourse is dry, where practicable.
- The contractor will monitor weather forecasts during critical tie-in periods and plan the work during dry or low flow periods with low risk weather windows (i.e., no forecasted rainfall events).
- Machinery will be operated from the top of bank to avoid instream sedimentation and channel impacts prior to stream diversion.

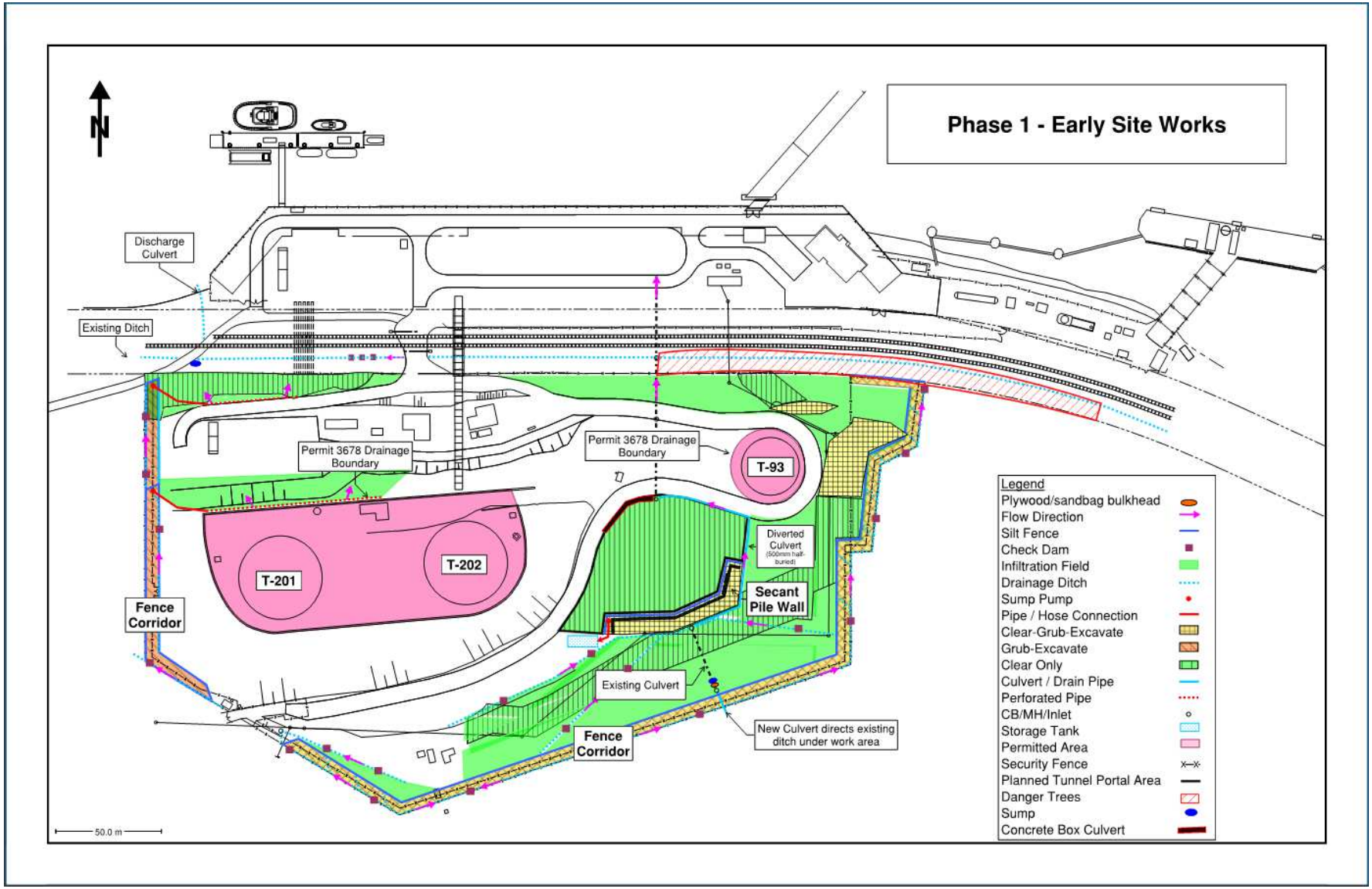

Figure 6-1. Phase 1 work plan and ESC measures

6.2 PHASE 2.1 – ROAD WIDENING AND TUNNEL PORTAL CONSTRUCTION

Phase 2.1 includes the excavation of the pad for the tunnel portal and works associated with widening of the access road.

Figure 6-2 illustrates the proposed works and ESC measures during Phase 2.1 of construction.

6.2.1 WORK SCOPE

- Access Road Widening
    - Grub work area adjacent to existing access road
    - Excavate upslope of access road to grade to allow for widening of road surface
    - Install retaining walls to secure cut slope
- Tunnel Portal Construction
    - Grub and strip tunnel portal area
    - Excavate portal area to final elevation and grade work area
    - Place gravel surface on tunnel portal area

6.2.2 ESC MEASURES

- Erosion and sediment control measures from the Phase 1 early site activities will remain in place
- Apply mulch or cover to exposed areas where practicable
- Install silt fences, check dams and drainage ditches along the south edge of access road widening and north edge of the tunnel portal construction area, rock armour as required
- Install a WTP in the northeast corner of the site. This WTP accepts runoff from the access road and tunnel portal construction areas. The water treatment consists of flocculation, settling, and sand filtration. Treated stormwater will be diverted directly to a sump in the CP rail ditch where it will infiltrate to ground
- Excavated material from the tunnel portal will be hauled offsite
- To confirm that the WTP is operating correctly, water quality monitoring will occur immediately on exit from the east WTP as required.
    - Internal WTP monitoring of water quality is measured in regular short intervals (every 15 minutes). See Appendix A for details on monitoring.

- Clean water from the stream will continue to be diverted via the culvert diversion into the non-permitted outfall.
- A turbidity curtain will be installed around the foreshore as part of the mitigation measures to contain sediment from the riprap removal and foreshore wall construction operations. (Figure 6-4). An inner turbidity curtain will also contain any turbid stormwater that discharges behind the curtain through the outfalls from the Phase 2.1 works.
- Water quality monitoring for permit compliance will take place at the end of the discharge pipe from the WTP. In addition, water quality monitoring will take place adjacent to the culvert stand pipe in the CP ditch if treated stormwater is discharging into the standpipe. However, if the treated stormwater fully infiltrates to ground and does not discharge into the culvert standpipe, no monitoring of stormwater will take place.
- A Construction Water Quality Monitoring Plan (CWQMP) for the Westridge Marine Terminal has been developed in consultation with BC MoE (Appendix A).

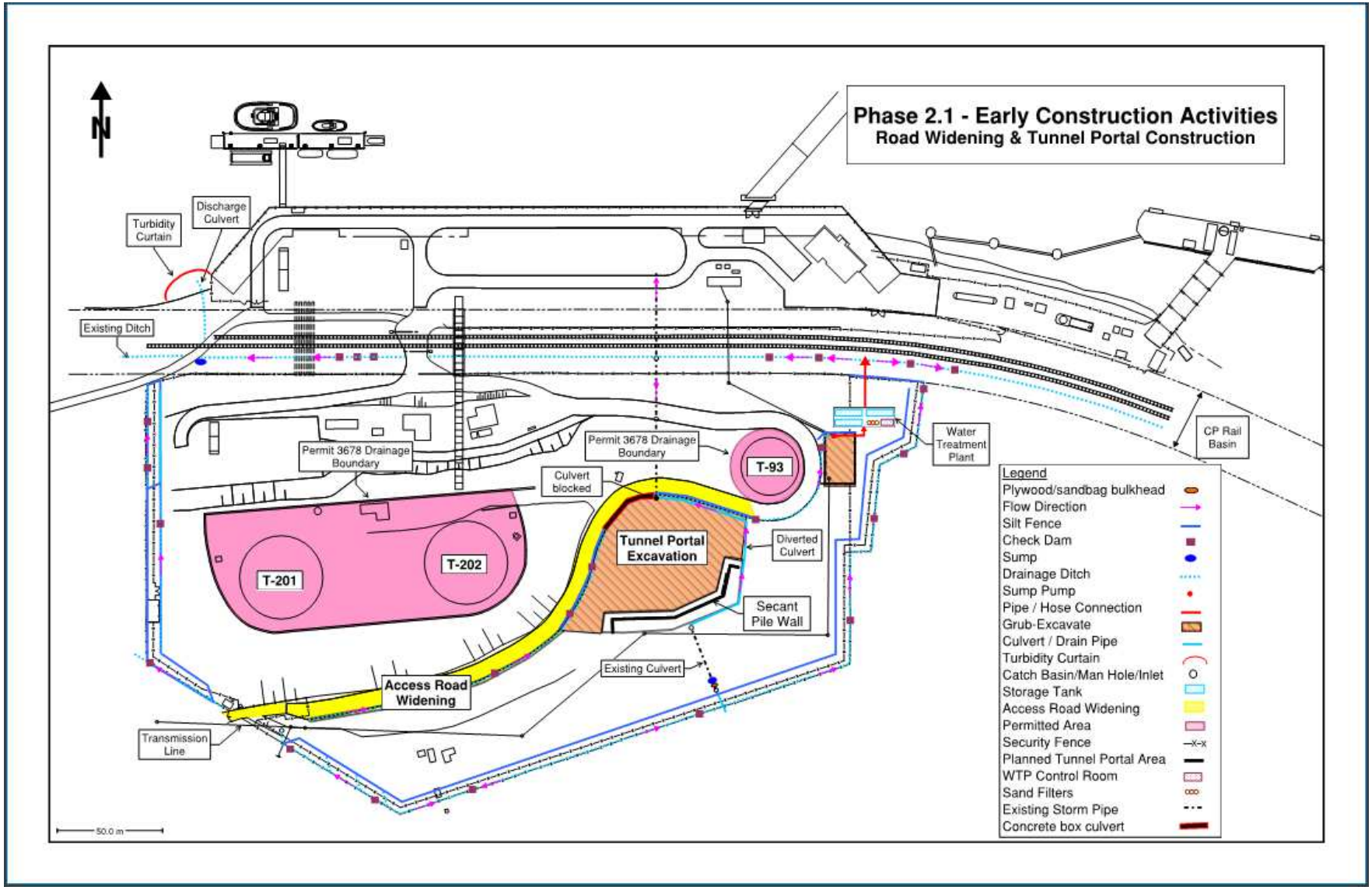

Figure 6-2. Phase 2.1 work plan and ESC measures.

6.3 PHASE 2.2 – PIPE EXCAVATIONS

This area will be excavated in Phase 2.2 for the pipe rack and bore pit in the northwestern portion of the site.

Figure 6-3 illustrates the proposed works and ESC measures during Phase 2.2 of the construction.

6.3.1 WORK SCOPE

- Pipe Rack Excavation
    - Grub and strip pipe rack area
    - Excavate pipe rack to final elevation and grade work area
    - Remove abandoned underground piping
    - Install retaining walls to secure cut slope
- Pipe Bore Pit Excavation
    - Grub and strip pipe bore pit area
    - Excavate pipe bore pit
    - Prepare area for guided horizontal auger boring

6.3.2 ESC MEASURES

- Installation of a WTP in the northwest corner of the site. The WTP will consist of flocculation, settling, and sand filtration. A "T" junction piping system with evenly spaced 30-50 mm diameter holes will be used to dissipate the water output from the water treatment plants. The treated water will be discharge to the top of the ditch bank where it will make its way to the CP Rail ditch and to Burrard Inlet.
- Installation of silt fences, check dams and drainage ditches along the western edge of the site and the northern edge of the pipe excavations to capture runoff
- Stormwater runoff will be captured by the drainage ditches adjacent to excavations and redirected to the west WTP. A sump pump will pull run-off from the pipe bore pit excavation to the west WTP.
-
- A turbidity curtain will be installed around the foreshore as part of the mitigation measures to contain sediment from the riprap removal and foreshore wall construction operations (Figure 6-4). An inner turbidity curtain will also contain any turbid stormwater that discharges behind the curtain through the outfalls form the Phase 2.2 works.

- Apply mulch or cover to exposed areas where practicable.
- To confirm that the WTP is operating correctly, water quality monitoring will occur immediately on exit from the west WTP as required.
    - Internal WTP monitoring of water quality is measured in regular short intervals (every 15 minutes). See Appendix A for details on monitoring.
- Construction water quality monitoring for permit compliance will take place at the end of the WTP discharge pipe. In addition, quality monitoring will take place at the sump area prior to the treated stormwater being discharged through the culvert and into Burrard Inlet.
- A Construction Water Quality Monitoring Plan for the project has been developed in consultation with BC MoE (Appendix A).

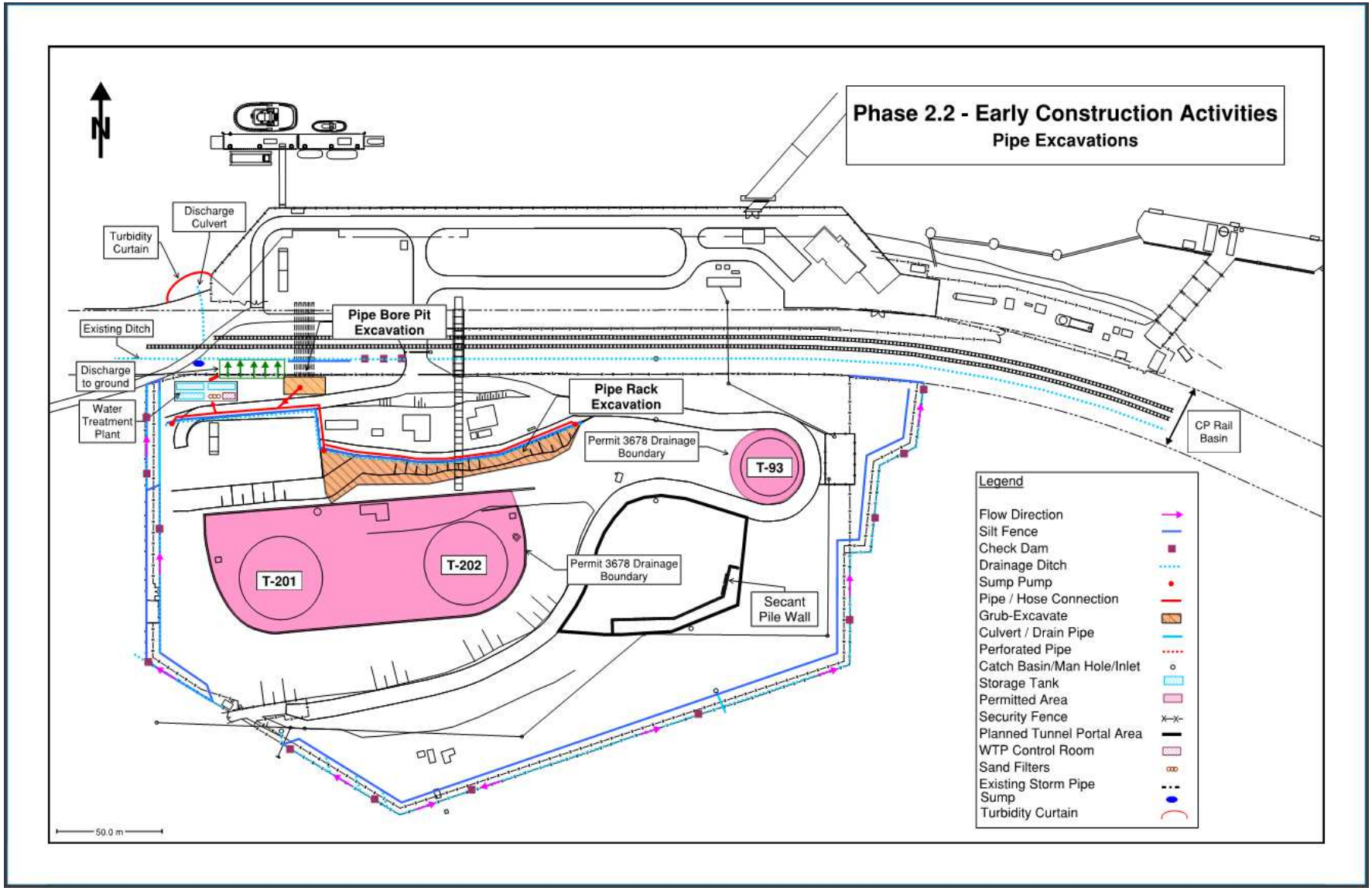

Figure 6-3 Phase 2.2 work plan and ESC measures

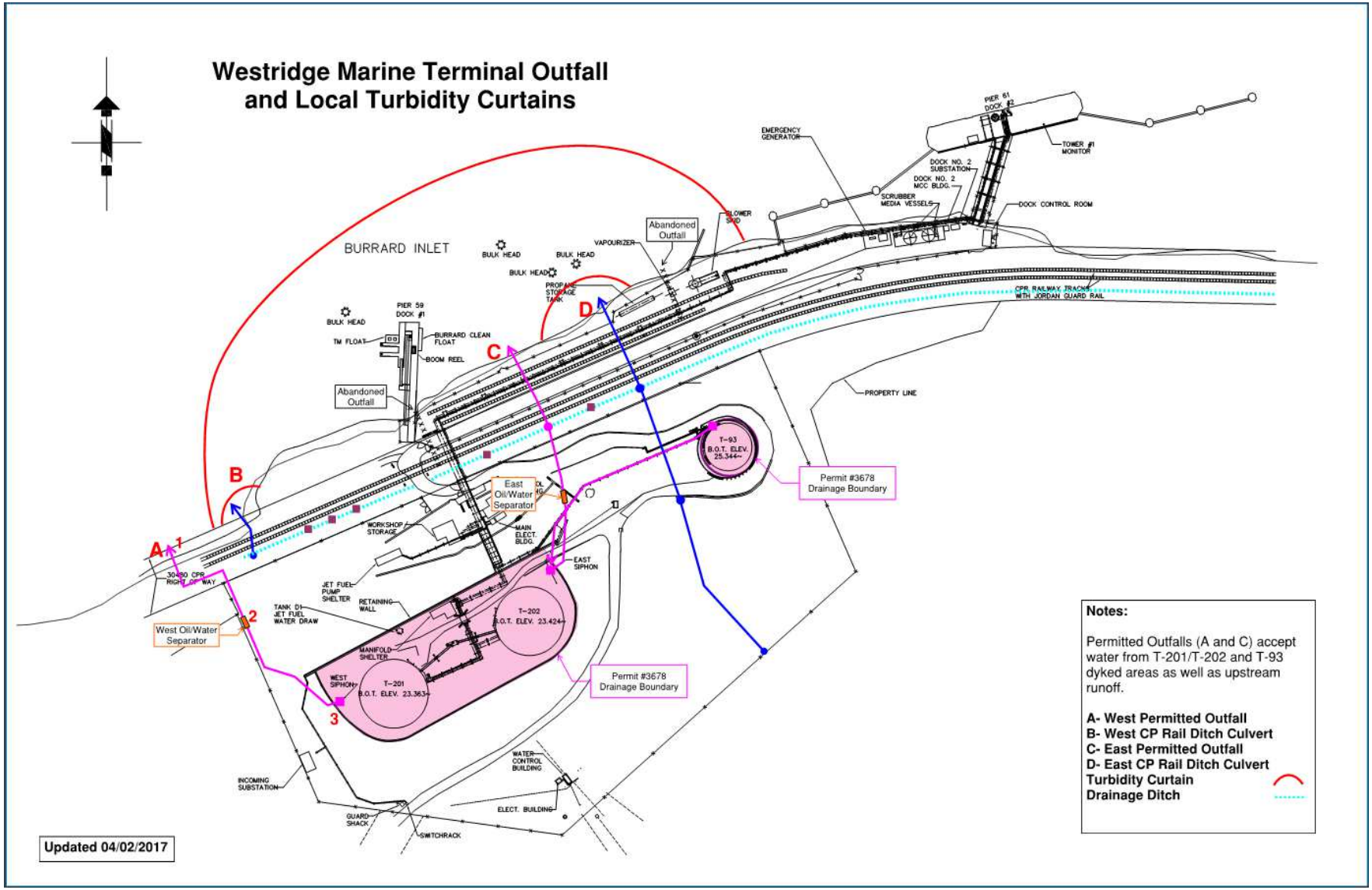

Figure 6-4. Turbidity curtain placement location.

7 ROLES AND RESPONSIBILITIES

This section outlines specific roles and responsibilities of the proposed key members of the Trans Mountain and KLTP construction teams with regards to implementing the ESCP and being in compliance with all applicable regulatory requirements. This structure is based on the Facilities EPP (Trans Mountain Pipeline ULC 2017a) and the Compliance Management Plan (Trans Mountain Pipeline ULC 2017d).

7.1 TRANS MOUNTAIN ENVIRONMENTAL TEAM

7.1.1 TRANS MOUNTAIN ENVIRONMENTAL MANAGER (EM)

The EM is retained by Trans Mountain Pipeline ULC and is responsible for:

- all environmental matters on the project inclusive of the activities outlined in the TMEP Project Description;
- directing the development and implementation of the environmental components of the project, including ensuring that environmental conditions are integrated into project documents and enforced during construction; and
- liaison where required, regulatory agencies and ensuring with environmental reporting requirements are met.

7.1.2 TRANS MOUNTAIN CHIEF ENVIRONMENTAL INPECTOR (CHIEF EI)

The Chief EI retained by Trans Mountain Pipeline ULC, has the following responsibilities and involvement:

- oversees the EI Team across the entire project;
- keeps abreast of all environmental reports, incident reports, contractor environmental action plans, and corrective action plans for the project; and
- communicates with the Lead EI and Contractor Environmental Manager (CEM) regularly, and as necessary over the course of the project.

7.1.3 TRANS MOUNTAIN LEAD ENVIRONMENTAL INSPECTOR (LEAD EI)

The Construction Monitoring and Inspection (CM&I) Lead EI is retained by Trans Mountain Pipeline ULC and has is responsible for:

- oversight of mitigation measures implemented in the field to verify it is timely, effective, and appropriate and in line with environmental objectives and requirements; and
- keeping abreast of all environmental reports, incident reports, contractor environmental action plans, and corrective action plans for their assigned area of construction (i.e. construction spread).

7.1.4 TRANS MOUNTAIN ENVIRONMENTAL INPECTION TEAM (EI TEAM)

The EI Team is comprised of CM&I Environmental Inspectors retained by Trans Mountain Pipeline ULC who will monitor construction activities to ensure mitigation and contingency plans are being implemented to minimize environmental disturbance and that activities comply with environmental requirements and conditions. They will also:

- review and approve contractor construction plans for compliance with applicable environmental objectives; and
- where necessary, the EIs will consult with the onsite Construction Manager to support halt work orders where non-compliant conditions exist and assist with discussions on how corrective solutions may be applied.

7.2 KLTP CONTRACTOR ENVIRONMENTAL TEAM

7.2.1 KLTP CONSTRACTOR ENVIRONMENTAL MANAGER (CEM)

The Construction Environmental Manager (CEM) is responsible for; ensuring compliance to all Project environmental requirements; confirming and tracking that all regulatory and contractual requirements are implemented; reviewing environmental plans prepared by the Contractor Environmental Coordinators (CEC) and ensure they are approved by the CM&I Environmental Inspector (EI); initiating and implementing environmental corrective and preventative action plans as required; liaising with CM&I for scoping and scheduling the needs of the CM&I Resource Specialists (i.e., those that are not defined in the Contractor's Scope of Work).

The qualification requirements of the CEM include the designation as a certified Environmental Qualified Professional by a recognized professional organization. The CEM shall have experience on major projects that are comparable in scope, complexity and nature to the Project in; the development and management plans to address environmental requirements; leading a multidisciplinary environmental team; implementing and environmental management system; knowledgeable in legislation and regulation applicable to the Project; and working with regulatory agencies.

7.2.2 KLTP CONTRACTOR ENVIRONMENTAL COORDINATORS (CEC)

Contractor Environmental Coordinators (CECs) are responsible for; ensuring that environmental requirements are understood by applicable Contractor personnel (e.g., toolbox talks, environmental orientation, etc.); confirming that environmental requirements are met during all phases of construction; preparing specific environmental action plans for approval by the EI; and working closely with the EI team and CM&I team to manage environmental compliance. The CEC is also responsible for communicating to the CM&I the need for CM&I Resource Specialists. CECs will report directly to the CEM.

The qualification requirements of the CEC's include an appropriate educational background, hands on experience maintaining and implementing environmental programs on construction projects, and the ability to work with and train staff on environmental compliance.

7.2.3 RESOURCE SPECIALISTS (SUBCONTRACTORS)

The Resource Specialist(s) will be a QEP and can be hired by the Prime Contractor or Trans Mountain Pipeline ULC as needed, to support the ESCP. They may provide planning guidance, review of mitigation measures, advice or signoff as necessary. They are independent to the project and have the appropriate training and/or experience related to erosion and sediment control.

8 ENVIRONMENTAL MONITORING

Environmental monitoring is a key step in environmental process and risk management for the project. Not only is environmental monitoring used to review, observe and report on environmental impacts resulting from construction activities, it is also a critical tool in assessing potential risk during pre-construction planning and forms part of the feedback component of adaptive management. To reduce environmental risk, environmental monitoring needs to anticipate potential impacts, be commensurate with the area sensitivity, and be designed to assess the mitigation/avoidance strategies are achieving the goals and objectives set out in the EPPs and regulatory agency approvals are addressed during all project phases.

8.1 ENVIRONMENTAL RISK VS MONITORING EFFORT

Monitoring for this project will be based on the construction activities, time of year and potential for impacts:

- Monitoring related to ESC and water quality will increase during wet periods (i.e., September through March).
- The onsite monitoring frequency will be full time (daily) when water has the potential to discharge from site.
- Monitoring the turbidity curtain isolating the Marine Area after high tides, winds/waves. Risk factors will need to be established after the curtain has been installed and performance assessed.
- During other lower risk period of activities, onsite monitoring will only be required weekly.

8.2 TYPES OF MONITORING

The following monitoring is specific to the requirements of the ESCP and include but are not limited to:

8.2.1 PHASES 1 AND 2 ESC PERFORMANCE

Monitoring of ESC performance will be completed by KLTP and Trans Mountain environmental personnel.

- ESC measures will be inspected regularly and whenever water is discharging from the site.
- Should treated contact water move off site, turbidity levels will be monitored prior to discharge as per the CWQMP (Appendix A). If levels exceed allowable limits water will be pumped back to infiltration vegetation or the WTP systems.
- Daily inspection of the turbidity curtain as outlined in Section 6.0 of the Marine Water Quality Management Plan (Trans Mountain Pipeline ULC 2017c):

- Inspection of silt fencing, silt curtains, gravel berms, check dams and bale structures for status and /or necessary repair;
- Inspection of ESC measures during storm events;
- Site review for visible signs of erosion and sediment movement (e.g., riling, slumping, channelizing, flooding, concavity, etc.) or possible risk of erosion, including along the water edge for sign of turbidity runoff;
- Inspection of drains, ditches, culverts, swales, and catch basins for status and/or necessary repair;
- Inspection of truck wheel wash functionality and proper drainage (if installed);
- Inspection of public roads for loose soils and ensure sweeping as required;
- Assess dust suppression requirements as per Section 5.7.
- Water retention areas and catch basins are cleaned out by vacuum truck when accumulated sediments reach 250 mm (City of Burnaby 2016a); and
- Inspection and status of exposed slopes, stockpiles and spoils.

8.2.2 CONTINUOUS IMPROVEMENT

Each day the CEC reports will be reviewed by the KLTP Construction Team for areas of improvement and potential risk. Furthermore, feedback from other agency reporting will also circle back to the construction team as it relates to erosion and sediment control (e.g., monthly NEB reporting)

8.2.3 WATER QUALITY MONITORING AND RESPONSE

As noted above, water quality monitoring will be done at regular planned intervals and during storm events in accordance with the CWQMP (Appendix A). The results of the water quality monitoring will be reviewed daily by the CEC and Trans Mountain EI Team. If TSS is increasing and at risk of exceeding compliance levels, the following actions will be taken by the CEC before thresholds are exceeded:

- Site inspection to determine source of sediment;
- Develop site specific response plan to reduce sediment source, and
- Liaison with the Construction Team.

8.2.3.1 Water Quality Non-compliance

The release of water that does not meet water quality criteria is considered an environmental incident and will result in the immediate stop of discharge. Incident reporting as outlined in Section 8.3 will be implemented. An investigation of the root cause of the discharge along with the impacts on the receiving environmental will be conducted by the CEC reporting to the CEM and Trans Mountain EI Team.

Stop Work

The following actions will be applied to reduce erosion during periods of heavy or prolonged rainfall or rapid snowmelt:

- Work will shut down if rainfall exceeds the 24-hour rainfall intensity of 50 mm (BCTS 2010) or if snowmelt on wet or thawing soils causes water quality results to show exceedance of acceptable values.
- Work may be temporarily shut down under lower rainfall intensities at the direction of the CEC or the Trans Mountain EI Team.

The purpose of shutting down during periods of heavy or prolonged rainfall or rapid snowmelt will be to limit sediment generation and to focus efforts on maintaining the integrity of water and sediment management measures.

ESC Failure

An ESC failure may include but is not limited to a slump, extensive wasting or repeat failure of the sediment control system. Incident reporting as outlined in Section 8.3 will be implemented. An investigation of the root cause of the failure along with the impacts on the receiving environmental will be conducted by the CEC reporting to the CEM.

8.3 ENVIRONMENTAL NON-COMPLIANCE REPORTING

As outlined in the Westridge Marine Terminal EPP (Trans Mountain Pipeline ULC 2018) and Compliance Management Plan (Trans Mountain Pipeline ULC 2017d), a potential non-compliance may be identified by anyone at any time. Non-compliances must be reported to supervisory level personnel. The CEM must be notified and will contact the Construction Manager or designate and, in consultation with the Trans Mountain Environmental Team, determine if the non-compliance is in violation with legal requirements and whether corrective action is required.

An environmental incident is defined in the Compliance Management Plan as "any unplanned release that exceeds a reportable quantity, the quantity is unknown, or the release enters or threatens to enter a body of water will be reported to applicable government authority" (Trans Mountain Pipeline ULC 2017d). The same document also provides a detailed form for reporting incidents.

If immediate measures or corrective action is required, the Construction Team will make a determination to either modify the work practice or shut the activity down until conditions improve.

All environmental non-compliances, including those related to erosion and sediment control will be documented, including photographs. The CEC and the construction personnel will be responsible for

documenting all environmental non-compliances as they occur and providing the information in their reports to the Trans Mountain Environmental Team.

9 ENVIRONMENTAL EDUCATION

Environmental education and awareness of all project personnel form the cornerstone of a strong environmental program. The KLTP environmental and construction teams will provide standardized ESC orientation for its workers, including subcontractors, designed to:

- Increase employee awareness and appreciation of the environment and the natural resources likely to be affected during construction activities including legislated requirements;
- Familiarize workers with the negative impacts their actions can have on the environment and how these can best be avoided or minimized; and
- Convey mitigation and protection expectations such as monitoring, inspection and reporting requirements.

The education program is intended to facilitate worker understanding of the environmental context of the project and is fully detailed in the EPPs and the Compliance Management Plan (Trans Mountain Pipeline ULC 2017d). Training is intended to increase environmental accountability of individual workers respecting protection of the environment therefore environmental training is mandatory for all personnel. The level of training will be commensurate of a worker's responsibility and role, but all workers on site including visitors will have some level of training, building upon the minimum site orientation.

Records will be kept for all training that summarize the objective or purpose of the training, the type of material covered, attendance, as well as minutes/notes where appropriate.

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APPENDIX A. CONSTRUCTION WATER QUALITY MONITORING PLAN

TRANSMOUNTAIN

Westridge Marine Terminal

Construction Water Quality Monitoring Plan

Prepared For
Trans Mountain Pipeline ULC

Prepared By
Kiewit-Ledcor TMEP Partnership (KLTP)

Sign-Off Sheet

This document entitled Burnaby Terminal Construction Phase 1 Water Quality Monitoring Plan was prepared by Kiewit-Ledcor TMEP Partnership ("KLTP") on behalf of Trans Mountain Pipeline ULC (the "Client"). As per the Province of British Columbia a Qualified Environmental Professional (QEP) is an "*applied scientist or technologist who is registered and in good standing with an appropriate BC professional organization constituted under an Act. The QEP must be acting under that association's code of ethics, and subject to the organization's disciplinary action*." A QEP can be a professional Biologist, Agrologist, Forester, Geoscientist, Engineer, or Technologist.

Prepared by: _____

(signature)

J. Andrew Allan, R.P.Bio., P.Biol.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

The Westridge Marine Terminal (WMT) is the western coastal loading and shipping facility for the Trans Mountain Pipeline. It is an existing facility that has been in operation for over 50 years, providing distribution of refined and crude oil products.

As part of the Trans Mountain Expansion Project (TMEP), the TMEP proponent, Trans Mountain Pipeline ULC (TMP) plans to expand the Westridge Marine Terminal to include a new dock complex, access road, substation and transmission line, product lines, as well as a utility dock, decommissioning of the existing berth and the construction of a tunnel to convey two new 30 inch delivery lines from the Burnaby Terminal under the Burnaby Mountain.

On behalf of TMP, Kiewit-Ledcor TMEP Partnership (KLTP) has prepared a water quality monitoring plan for the construction activities at the WMT. Water discharged from the construction site into ditches or stormwater drainage systems, will be monitored to confirm that levels of total suspended solids (TSS) meet environmental performance indicators during construction. Water that does not meet performance indicators, will be contained and treated prior to discharge or collected, transported and disposed offsite at an approved facility. Water quality monitoring frequency, parameters and treatment requirements will follow the permitted and approved plans and environmental regulatory authorizations and orders.

2. SITE DESCRIPTION

Figure 1 provides an overview of the drainage at the WMT that will be maintained through Phase 1 of construction. At the WMT site, a ditch running parallel to the south side of the CP Rail line (and parallel to the existing shoreline), collects surface stormwater run-off from a number of drainages within and outside of the WMT site boundary.

No outlet culvert exists for the CP Rail ditch east of the foreshore access road. Any water that is collected in this portion of the ditch flows subsurface into the rail ballast. A standpipe (approximately 30 cm high) is located in the middle of the ditch. Should water accumulate in the ditch at a depth greater than 30 cm, the standpipe would over top releasing the ditch water into the existing outfall. Field observations of the east CP Rail ditch during heavy rainfall events have indicated that surface water in this ditch flows subsurface into the rail ballast. Water that collects in the ditch west of the foreshore access road flows west to a culvert under the CP Rail line. The lower terminal road runoff makes it way overland across the foreshore access road to the west end of the CP Rail ditch.

An existing culvert carries off-site stormwater collected from south of the terminal directly north under the terminal. A catch basin mid-way within the terminal directs the upper terminal road runoff into this culvert. Treated surface water collected within the WMT dyked tank farm's secondary containment facilities is isolated from the CP Rail ditch and discharged to Burrard Inlet through separate permitted outfalls.

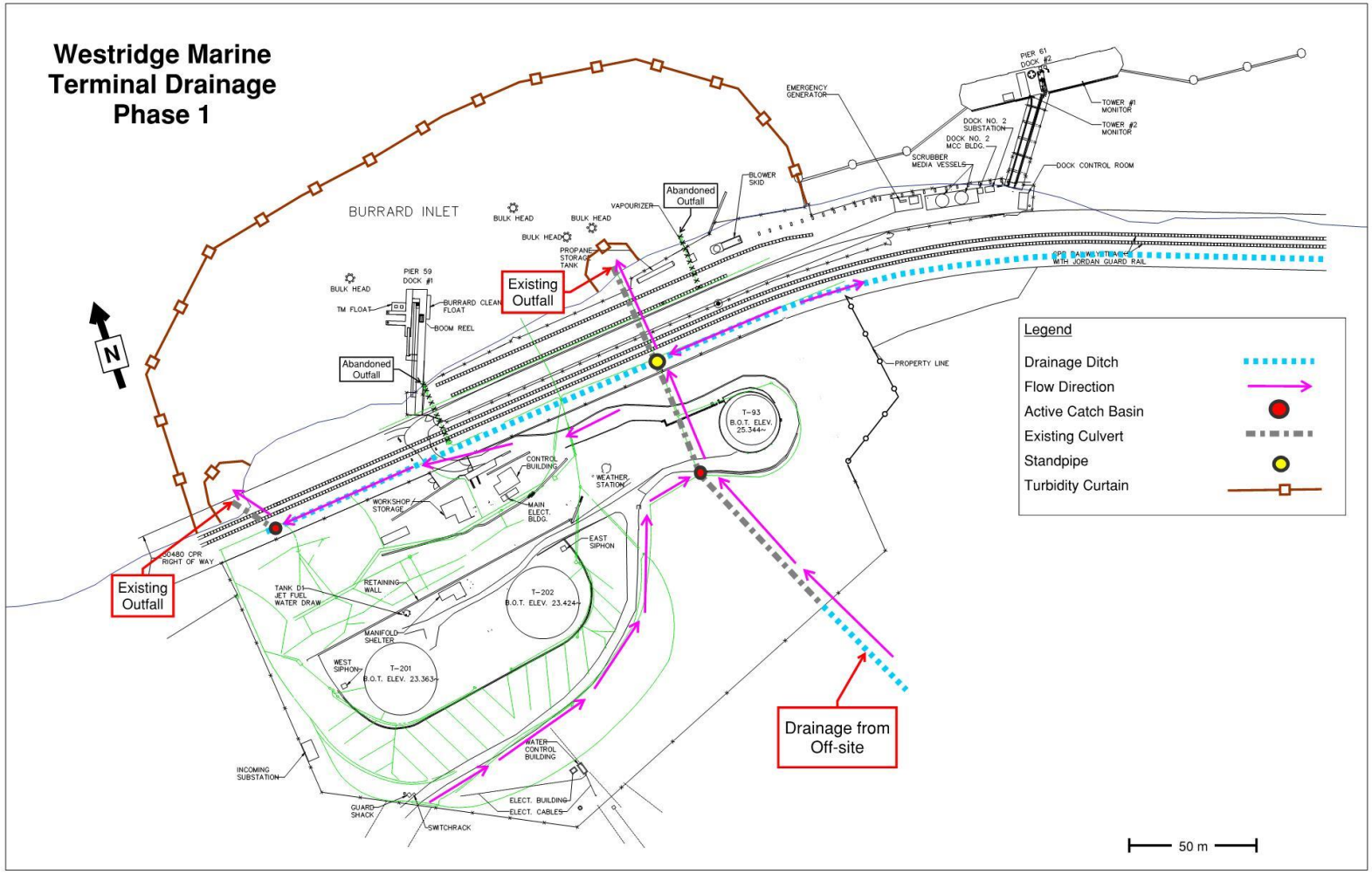

Figure 1 **Westridge Marine Terminal Drainage Phase 1.**

3. WATER MANAGEMENT AND MONITORING STRATEGY

Trans Mountain Pipeline ULC has applied for an Approval from the BC Ministry of Environment and Climate Change Strategy under the *Environmental Management Act* (the Approval) to permit stormwater discharges from the WMT site outside of the existing dyked tank farm. Stormwater discharge for Phase 2 construction will be monitored to confirm that targeted water quality parameters are compliant with the limits set in the Approval. It should be noted that the location of the larger, primary turbidity curtain may be adjusted depending on the locations of construction activities that may result in sedimentation. The locations of the two smaller, inner turbidity curtains at the outlets of the outfalls will remain throughout construction. KLTP will also use the results of the monitoring plan for continuous improvement of the ESC measures and on-site water management practices.

Effects of construction activities on water quality will be monitored at individual sites by comparing the water quality of construction contact water to the new Westridge Approval application limits. The new Westridge Approval and associated water quality limits will be provided in Appendix A of this report. Construction contacted water quality will be monitored for Approval compliance at the outlets of the water treatment plants (WTPs). The locations of two compliance sampling locations are indicated in Figure 2 as C1 (west WTP outlet) and C2 (east WTP outlet).

Water draining from the construction site will be controlled through erosion and sediment control measures into ditches, stormwater drainage systems and WTPs for treatment. Surface water from the construction area that meets TSS Approval limits including treated water will be diverted to the CP Rail ditches and then either infiltrate into ground or into a sump which will discharge into Burrard Inlet. Water that does not meet Approval limits will be contained and redirected through the WTPs and monitored to confirm compliant water quality, prior to discharge to the CP Rail ditches.

The application for the Approval has also requested that total extractable hydrocarbon (TEH) limits be included in the new Approval. Water quality samples for TEH will be opportunistic and only when stormwater may be contaminated with hydrocarbons. On site clean-up efforts will be used for all hydrocarbon contaminated stormwater. Should these efforts not be successful, the hydrocarbon contaminated water will be shipped off site to a third party facility approved to accept hydrocarbon contaminated water that exceeds Approval limits.

4. SAMPLING LOCATIONS AND FREQUENCY

Figure 2 shows the proposed site-specific water quality sampling locations as well as the locations of the WTPs that will be used during Phase 2 construction. It should be noted that the catch basin in the middle of the site will be blocked during Phase 2 should water quality sampling indicate turbidity exceedances allowing the construction contact water to flow to a new sump and then directed to the east WTP.

Six water quality sampling locations have been identified for WMT during construction. Stations C1 and C2 as Approval compliance sampling locations. To ensure the WTPs are operating as intended, water quality sampling stations will be located prior to stormwater entering the WTPs (C6 east WTP and C5 west WTP). Stormwater at C6 will only be directed to the east WTP if water quality sampling indicate elevated turbidity. If turbidity levels are acceptable at C6, the stormwater will be allowed to flow into the middle catch basin and into Burrard Inlet. Table 1 summarizes the sampling locations.

Water quality sampling sites C3 and C4 are locations prior to potential discharge to existing outfalls. These sites will be able to capture influences to the ditch water quality other than from the WTPs. Water

quality samples at these sites will only be taken in flowing water that has the potential to exit the outfall into Burrard Inlet.

The WTPs include an in situ turbidity monitor that automatically logs turbidity levels at 15 minute intervals during operation. The sampling station downstream of the water treatment system will verify the NTU levels reported by the plant data logger. The water treatment plant will only be brought on-line should the water quality, measured as turbidity, approach Approval limits. An explanation of the relationship between TSS and NTU and the KLTP field monitoring approach is provided in Section 5.

Table 1 Water Quality Monitoring Plan Sampling Locations.

Location ID	Description
C1	Approval compliance location – Outlet of west WTP
C2	Approval compliance location – Outlet of east WTP
C3	CP Rail ditch west of foreshore access road prior to discharge into the existing outfall
C4	CP Rail ditch east of foreshore access road and standpipe
C5	Upstream of west WTP.
C6	Upstream of middle catch basin and east WTP.

Samples for the analysis of water quality parameters (TSS, TEH, and pH) will be collected monthly at two compliance points (C1 and C2).

During construction, the frequency of water quality sampling to confirm that ESC measures in place are functioning as intended will depend on the weather conditions (i.e., predicted and actual prevailing rainfall and storm conditions) and construction activities. This will allow for the adaptive management of construction activities, mitigation measures and the treatment plants (e.g., discharge rate) to protect water quality in Burrard Inlet. Sampling will be more frequent during storm conditions (minimum daily) and will be monitored hourly. The key is to be sampling at a frequency that will allow adjustments in construction activities, erosion and sediment controls and WTPs use to ensure Approval compliance for stormwater entering Burrard Inlet.

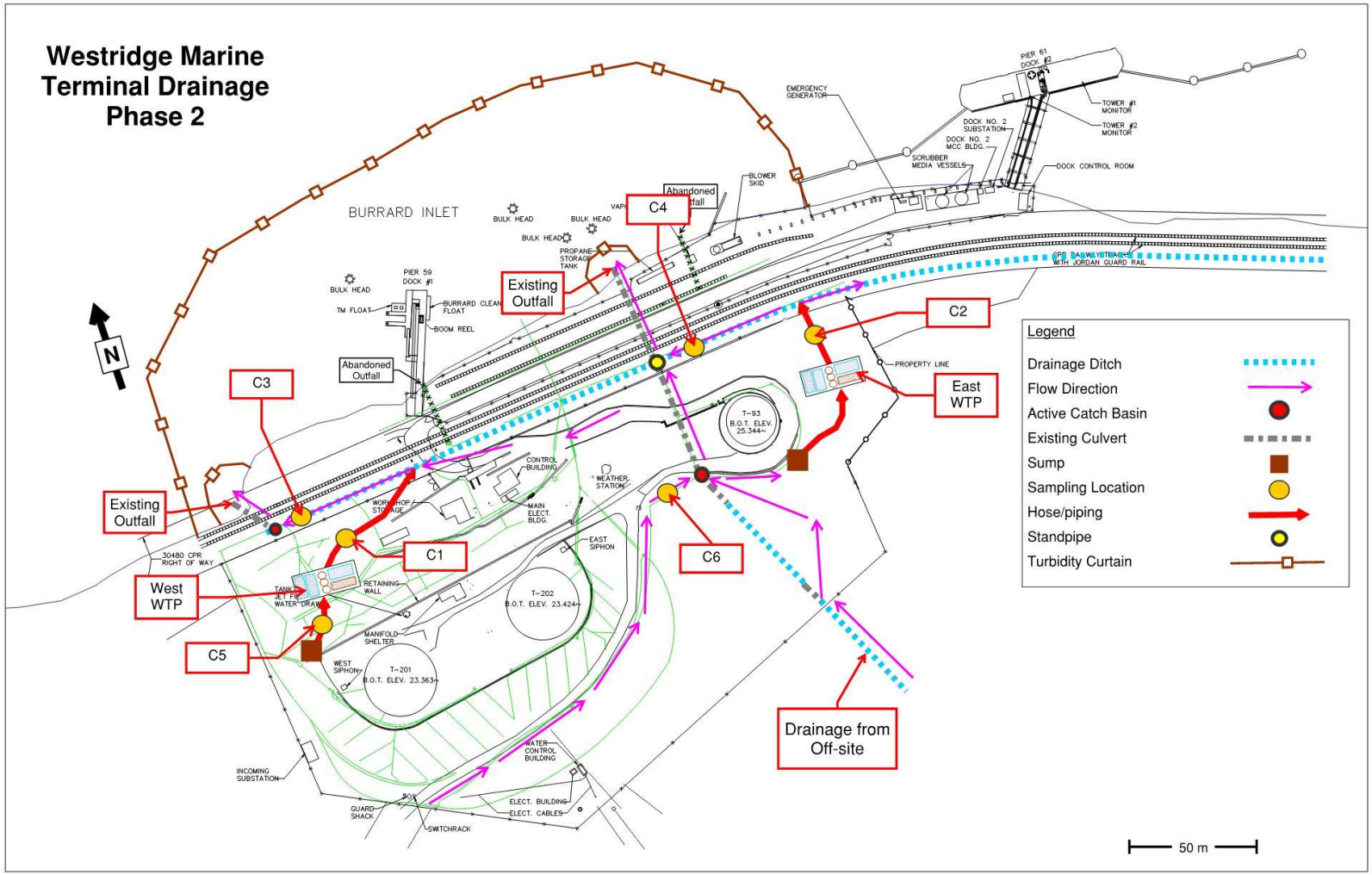

Figure 2 **Westridge Marine Terminal Drainage and Water Quality Sampling Locations for Phase 2.**

5. ANALYSIS AND SAMPLING METHODS

Initially, all grab water samples will be sent to an environmental lab accredited by the Canadian Association for Laboratory Accreditation (CALA) to be analyzed for: total suspended solids (TSS), total extractable hydrocarbons (TEH), pH, and turbidity. All grab samples will be field analyzed for pH using a pocket pH tester, such as the Myron Ultrapen PT2.

All water quality sampling activities will follow the procedures described in the British Columbia Field Sampling Manual for Continuous Monitoring and the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment, and Biological Samples (B.C. Ministry of Water, Land and Air Protection, 2013). Additional water quality sample handling and labeling procedures are detailed in Section 6. Quality Assurance/Quality Control (QA/QC) procedures are detailed in Sections 7 and 8.

Estimates of TSS concentrations in water requires that water samples are sent to a laboratory for analysis; in contrast, turbidity can be measured in real-time in the field, allowing for rapid modification of ESC measures in the event of elevated TSS. Use of field turbidity monitoring as a surrogate for TSS will require development of a site-specific relationship between TSS and turbidity, potentially at each sampling location. This relationship is determined by taking samples over the range of TSS concentrations that occur during a sediment event and analyzing for both TSS and turbidity. A statistical regression relationship can be established between TSS and turbidity. This relationship can be used to predict TSS concentrations based on field turbidity measurements. Once a relationship has been established at each sampling location, the TSS of the water quality sample will be estimated using a handheld turbidity meter, such as the Hoskin LaMotte 2020we Portable Turbidity Meter, and grab samples will be sent to the laboratory to be analyzed for TEH.

The WTPs include an *in situ* turbidity (NTU) monitor that automatically logs NTU levels at 15 minute intervals. The sampling station at the discharge of the water treatment systems will verify the NTU levels reported by the plant data logger. The WTP *in-situ* turbidity monitor will be read and recorded when a grab sample is taken for laboratory analysis and the results will be compared when the laboratory reports are received.

6. SAMPLE HANDLING AND LABELING

This program is consistent with the Environmental Data Quality Assurance Regulation and guidance provided in the *British Columbia Field Sampling Manual for Continuous Monitoring and the Collection of Air, Air Emissions, Water, Wastewater, Soil, Sediment, and Biological Samples* (BC MWLAP 2013) and the *British Columbia Laboratory Methods Manual for the Analysis of Water, Wastewater, Sediment, Biological Materials and Discrete Ambient Air* (BC MOE 2015).

KLTPs general sample handling and labeling procedure includes:

- All samples are handled using disposable nitrile gloves that are discarded between samples.
- All samples are labeled immediately after sampling.
- All water samples are submitted without headspace in the sample container.
- In the field, all samples are stored in coolers supplied with ice packs. The samples are stored in a refrigerated storage facility at the end of each day or when possible. Samples will be submitted to the laboratory as soon as possible and within the specified analysis holding time.
- The sampling containers and required preservatives are provided by the laboratory for the sample parameter requested.

- Field duplicates are independent samples collected as close as possible to the same point in space and time to assess the precision of the entire sampling and analytical process.
- Field duplicates are generally submitted at a rate of approximately 10% to assess the reproducibility of analytical results and sampling method.
- The chain of custody including sampling information and shipment information is recorded on a form supplied by the laboratory.
- Samples for rush analysis are announced to the laboratory ahead of time.

7. QUALITY ASSURANCE/QUALITY CONTROL

KLTP's QA/QC sampling program generally adheres to the requirements stated in the British Columbia Field Sampling Manual of 2013 and standard industry practices. The program includes:

- The analytical laboratory personnel are involved in study planning and data interpretation.
- Only laboratories accredited by the Canadian Association for Laboratory Accreditation (CALA) and are listed in the Ministry's Directory of Qualified Laboratories will be utilized. All laboratories are must be accredited to ISO 17025 standards for that test method(s).
- The Environmental Coordinator and field staff are responsible to ensure that the sampling and post-sampling process follows documented protocols.
- All samples are labeled with unambiguous identification of sample identification, date, and name of sampler.
- Field personnel will record all details relevant to the sampling in a field notebook. Unusual conditions and variations from usual sampling techniques especially require thorough documentation.
- All field records (e.g., field notes, chain of custody forms, analytical reports, communications, reports) are kept in a central filing place.
- All instruments and equipment are regularly maintained and calibrated per the manufacturer's manual. All maintenance and calibration logs are kept on file.
- Field duplicate samples are collected at a rate of approximately 10% per matrix, per parameter to assess the entire sampling and analytical process. Duplicates are preferably collected as replicated samples.
- The relative percent difference (RPD) is calculated for all duplicated samples.
- Sample collection equipment is regularly decontaminated in the field to avoid contaminating samples.
- Equipment cleanliness and performance is checked by running equipment blanks. An equipment blank is a sample of de-ionized water from the lab that has been allowed to contact the sampling equipment.
- Any travel blanks will be prepared by the laboratory using de-ionized water, and are shipped with the other sample bottles to and from the field. These travel blank bottles are not to be opened in the field. Blank samples are submitted at a rate of approximately 10% per matrix, per parameter. Corrective measures must be taken if the blanks are outside acceptable ranges.

8. LABORATORY QA/QC PROGRAM

KLTP requires that the environmental lab used for sample analysis has a well defined QA/QC program. This program must include:

- Clearly defined QA/QC objectives and QA/QC documentation. These include method blanks, laboratory replicates, surrogate spike recovery, blank spike recoveries and matrix spike recovery.
- The laboratory analytical report includes QA/QC documentation and is reviewed and compared to the quality objectives set by the laboratory.
- The analytical results of the field duplicates are compared and evaluated for reproducibility.

9. REPORTING AND COMPLIANCE

Water quality monitoring reports will be submitted to TMP on a monthly basis in an electronic format. The reports will detail the results of the construction monitoring program and will include all laboratory reports. If applicable, each report will include a statement outlining the number of exceedances of permitted levels that occurred during the reporting period, as well as the date(s) of exceedances and an explanation as to the cause of the exceedance and description of measures taken to prevent reoccurrence. If no exceedances occurred over the reporting period, a statement to that effect will be included in the report. Any results that indicate an exceedance of the Approval limits, TMP will follow the regulatory agency notification and reporting requirements identified in the Approval.

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APPENDIX A

(Place holder for new Approval once acquired)