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Trans Mountain Expansion Project – Westridge Marine Terminal Monitoring

In light of the current COVID-19 pandemic, Fisheries and Oceans Canada (DFO) and Musqueam Indian Band's (Musqueam's) Indigenous Advisory and Monitoring Committee Indigenous Monitor (IAMC IM) have not been conducting joint in-person monthly site inspections at the Westridge Marine Terminal (WMT), in Burrard Inlet, BC, since March 2020. Instead, DFO and several representatives from the IAMC (including the Musqueam IAMC IM) had two conference-call meetings per month with representatives from Trans Mountain Pipeline ULC (Trans Mountain), the Project Indigenous Monitor (Project IM) from Kwikwetlem First Nation (KFN), and Kiewit Ledcor Trans Mountain Partnership (KLTP). This monitoring report provides a summary of the meeting on August 31, 2020. Monthly in-person site visits are tentatively planned to resume in September, 2020.

Date	August 31, 2020	**Time of Call (Start):**	2:00 PM	**Time of Call End:**	3:30 PM
Format	Web-based conference call with Trans Mountain presenting photographs, documents and/or videos relevant to the expansion of the Westridge Marine Terminal.				
DFO participants	DFO - TMX Review and Engagement Team, Fish and Fish Habitat Protection Program: R.L. (A/ Senior Biologist), W.B. (A/ Team Lead) and K.J. (Biologist)				
IAMC participants	Musqueam Nation: J.H. (IAMC IM) and R.K. (Environmental Stewardship Technician) IAMC – Monitoring Subcommittee: C.T. (IAMC representative – Burrard Inlet and Lower Fraser River, from Tsleil-Waututh Nation), R.C. (IAMC representative – Alberta First Nations) and K.R. (Technical advisor to IAMC) Note: R.C. and K.R. joined at ~2:20 PM				
Other participants	Trans Mountain: K.M. (Regulatory Lead), T.A (Construction Manager), L.B. (Field Regulatory Advisor), S.D. (Lead Environmental Inspector), B.J. (Chief Environmental Inspector) and J.S.(Environmental Inspector) Kwikwetlem First Nation (KFN): M.J. (Project IM)				

Contractor/equipment on site at the time of the call	**Role**
DB Bremerton	Moored along the shoreline for works on cell 4 (obstruction removal).
Nearshore Barge	Moored along the shoreline for woks on Cells 1, Arc 1A and 2. Sheet-piles were driven by a vibratory or impact hammer. All works in this area were conducted in the dry prior to the least risk biological window (LRBW), which recommenced on August 16th. During the LRBW in-water pile driving occurred on cell 2.
Offshore barges (e.g. DB General)	Installing piles for Mooring Dolphin 1, 2 and 3 via vibratory and impact pile driving.

IAMC/ IAMC Indigenous Monitor Observations and Comments

JH asked if the water from the concrete spoils is going to the wastewater treatment facility on-site. TA explained the water is pumped to a containment bin and then is removed by a hydro vac and taken offsite to be disposed of at a treatment plant. SD added that the first few parts of a new wastewater treatment plant on the foreshore at the WMT are being installed currently.

CT asked if welding above water is observed by a regulator while the work is happening (i.e., how is compliance ensured)? WB explained that DFO's oversight relates to the *Fisheries Act* authorization and fish and fish habitat, in general. When considering welding over water, DFO considers the possibility of anything

entering the water. KM added that the primary regulator that has oversight of various forms of construction at the WMT (including welding) is the Canadian Energy Regulator (CER) and they undertake regular environmental and safety inspections, including a recent in-person inspection. KR offered to chat further with CT about this as he recently had a call with the CER.

JH asked if there have there been any fish school sightings. SD confirmed a juvenile salmon school was observed recently; however, herring schools have not been spotted since winter. SD reported that salmon did not exhibit a behavioural response to the acoustic deterrent, which was expected. Generally, herring are more sensitive to underwater noise than salmon, so they are more likely to be deterred by the acoustic deterrent. More information is provided in the report produced by JASCO.

CT was curious if there was a way to keep harbour seals away from the construction zone after SD explained they have been continuously interrupting pile driving offshore. KM and WB explained that the Marine Mammal Regulations, under the *Fisheries Act*, prohibit disturbance to marine mammals.

CT asked what the best way to share the information associated with the JASCO report from TM was. WB suggested discussing the contents of the report and the summary provided by SD during the debrief call with DFO.

After the meeting, additional inquires regarding the on-site wastewater treatment plant, the fish acoustic deterrent system and vibratory pile driving were brought forward by RK. The inquires were further discussed during the CVA debrief call on September 15th.

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Summary of inspection discussions (use initials of participants)

Introductions

Agenda Review

In addition to the agenda review, KM noted that SD can provide an overview of the report "Fish Deflection System Sound Source Characterization" by JASCO, a TM subcontractor, at the end of the presentation.

WB noted further discussion of this report with IAMC representatives can occur during a CVA debrief/planning conference call.

Construction Update

SD provided an overview of the site layout at the WMT and described the construction works that have occurred since the July 9th compliance verification conference call, with a focus on most recent works. SD stated that there has been lots of work conducted offshore on the superstructure. SD also noted that as of the 16th of August we have entered the least risk biological window (August 16 – February 28); subsequently, nearshore works have recommenced.

SD showed a labelled aerial photo of the WMT construction site, which displayed the numbered foreshore cells and arcs. SD provided an overview of the construction works in the foreshore:

- Cell 1 and Arc 1A: installed sheets and backfilled during low tide in the dry.
- Cell 2: sheets installed via vibratory and impact pile driving during low tide in the dry prior to August 16th. Since the least risk biological timing window recommenced on August 16th, sheets have been fully installed.
- Cell 4: template installed and sheets are being threaded.
- Ongoing work on the derailment wall along eastern foreshore.
- Deep soil mixing and jet grouting works (ground improvement work) on the eastern foreshore are still ongoing behind and within completed foreshore cells.

SD showed a schematic overview of the WMT site and a photo showing offshore works. SD provided an overview of the construction works:

- Overall, lots of work is being conducted on both Berths 1 and 2.
- Mooring Dolphins 1, 2 and 3: vibratory and impact pile driving.
    - MD 1: welding completed.
    - MD 2: impact pile driving.
    - MD 3: vibrated down and ready to be impacted.
- Breasting Dolphin 5 and 6: dolphin jackets are set and crews are now welding shear lugs to connect to the piles inside the jackets.
- Loading Platform 1/2 and Trestle 7: concrete pours and pre-cast deck panels are set (only 1 deck panel left to install) – it now looks like a dock structure.
- Mooring Dolphins 4, 5 and 6: jackets that were previously installed are now welded and permanent platforms have been installed on top. Permanent catwalks have been installed between the dolphins. Trestle spans between the dolphins have also been worked on.
- Trestle Span 3 and 4: are being formed up with rebar in preparation for concrete pours in the pile caps.
- Trestle Span 6: concrete pile cap has been poured.

- Junction Platform: previously driven now have rebar inside them and falsework installed in preparation for pouring concrete caps.

SD described specific works and mitigation measures in the foreshore:

- Derailment wall: segment one has been poured (eastern most section). In segment 3 forms and rebar have been installed in order to pour the concrete footing.
    - Note all works on derailment wall are in isolation from the marine environment.

- Expanded eastern foreshore: ongoing deep soil mixing and jet grouting works.
    - WB: Have there been any changes to the mitigation measures in place regarding sediment and erosion control or have any issues been observed?
    - SD: Deep soil mixing occurs within the foreshore cells. TM has been monitoring the marine water quality outside of the cells when doing deep soil mixing closer to the ocean. There are grout spoil curing pits located in Arcs 8A and 9A. TM takes turbidity and pH readings outside of those arcs in the marine environment and they have not seen an increase in turbidity, pH or have identified any other issues as deep soil mixing works are not under pressure and the cells provide a barrier to the ocean. Other mitigations measures include berm and sediment fences and silos have been expanded from the eastern foreshore onto western foreshore – there have been no issues.

- Barge loading of grout spoils is now occurring. Proper grout management ensures no material enters the ocean.
    - When deep soil mixing is occurring, a pit is pre-dug next to it so that excess grout flows into the pit and then the liquid grout material is excavated into bins. The loader collects and then dumps the liquid grout material into the spoil pits. A berm of grout is left around the periphery of the pit to enhance containment. Grout material hardens over 24 to 48 hours. A new conveyor has been installed along the western foreshore. The cured grout spoils are excavated out of the pits, transferred over to the hopper and then are conveyed on a belt out to the barge that is contained below on all four sides (this started last week). TM is currently using a plastic sheet to ensure no hardened grout ends up falling off the belt into the marine environment.
    - KLTP, a subcontractor, is in the process of designing a more permanent structure (like a rigid sloped slide) that will be fixed to the bottom of the conveyor should there be any loss of material off of the conveyor so that it will slide back towards the barge.
    - TA: One of the biggest concerns is making sure that when it rains that water or moisture coming off the conveyor is properly contained before reaching any water surface.
    - SD: TM will have pumps and containment on the barge so that when it rains they can capture water as it could have a high pH even though the spoils are cured.

- Cell 1, Arc 1A and part of cell 2 were installed during low tide in dry conditions (prior to the least risk biological window).

- Cell 2: crews finished threading sheet piles and closed the cell. Sheet piles were installed by vibratory and impact pile driving.
    - Since pile driving was in-water, a fish and invertebrate salvage was necessary.
    - Fish and invertebrate salvage occurred under a fish salvage permit in cell 2 after it was closed during low tide using minnow and crab traps.

- A red rock crab, a bay pipefish, a few hermit crabs and a few shore crabs were captured and transported to Barnet Marine Park where they were released.

- Cell 4: installed H-piles and pin piles and set the template prior to threading some of the sheet piles.
  - Rock obstructions were removed using a clamshell bucket and the rock was placed on the beach.
  - Once all the piles are threaded, a fish salvage will be undertaken inside of the cell.
  - Sheets may be impacted if the sheets meet hard substrate.
  - Monitoring of water quality is conducted outside of the turbidity curtain (same procedure as used for the removal of riprap). All water monitoring has been compliant so far.
  - WB: when you are removing an obstruction it is treated as if it were part of the previous riprap wall?
  - SD: Yes. Mitigation requirements are the same. Any work has to be done within the authorized footprint (i.e., within the footprint of the cells or arcs or backshore of it). Any material removed must be placed within the project authorized work area. TM followed the same water quality monitoring plan as for riprap removal. A lot of obstruction removal was completed during low tide, so the turbidity generated was low.

- Can see that the turbidity curtain, which encompasses the whole work area, is working well (visible on slide).

<u>SD described specific works and mitigation measures in the offshore:</u>

- Overview: Trestle Span 6 (poured and ready for girders), Junction Platform 1 (falsework is installed for upcoming pours), Mooring Dolphins 4, 5, and 6 (have gangways across them), Trestle 7 and the Loading Platform (decking work), and Mooring Dolphins 1, 2 and 3 (impact pile driving).

- WB: what diameter are the piles that are being vibratory or impact pile driven?
  - SD: Resumed pile driving on the Mooring Dolphin piles last week and the piles are the larger ones (1.981 m in diameter).

- Loading Platform 1/2: concrete caps poured, girders placed across and decking is being built on top of it.
- Trestle 7: pre-cast concrete deck panels are placed, formwork along the edges has been installed in preparation for pouring a concrete deck on top of the panels.

- Mooring Dolphin 6: jacket is welded and is completed (i.e., jacket is placed on top of the four piles, shear lugs are welded, and a permanent platform has been welded on top of the jacket).
- Mooring Dolphin 4: extends over to MD 5 via a permanent gangway.
- Junction platform 1: all piles have been installed, the deck is fully built out and falsework has been installed so that concrete caps can be poured.

- RL: Is impacting occurring offshore?
- SD: Vibratory and impact pile driving is occurring for offshore piles.

- SD: following fish mortality events, one idea was to see if piles could be driven deeper with just vibratory pile driving to reduce the distance over which the piles need to be impacted. A

subcontractor, KLTP, worked with Ape who manufactures hammers. They built a custom large vibratory hammer (Tandem APE-600). With this new hammer they can drive piles 5 to 7 m deeper into the till (big improvement in depth), but impacting is still needed to drive the piles to refusal.

- TA: Approximately two to four hours of impacting is required to reach engineer design depth.
- KM: This has been a good mitigation measure so that TM spends less time impact pile driving as vibratory pile driving creates less noise.
- RL: when was this new hammer first used?
- SD: The new hammer was first tested on mooring dolphin piles in early July.

- KR: I know fish mortalities associated with driving the larger piles was a problem. Is the new vibratory hammer being brought in because past mitigation measures were insufficient (e.g. secondary bubble curtain and acoustic deterrent system)?
    - SD: When TM had the fish mortality incidents and then a two month pause on impact pile driving, TM looked at alternative options to mitigate risk (e.g. second bubble curtain, an acoustic deterrent system, and a larger vibratory hammer). TM started using the new hammer in early July and started using the acoustic deterrent on April 7th. No fish mortality events have occurred since; however, TM was driving the smaller piles in April, May and June. TM is driving the larger piles now.

- SD: TM has had difficulties testing the secondary bubble curtain as harbour seals are almost constantly within the 150 m exclusion zone. This has led to four days without pile driving due to their presence.

- Mooring Dolphin 1: welders are splicing the piles, coating them and then the weld shelter and templates are taken off. Piles will then be vibratory and impact driven.
    - TM is deploying fish acoustic deterrents prior to impact driving (a TM contractor is deploying the deterrents).
    - Two acoustic deterrents are deployed at 1/3 and 2/3 depth. TM has had difficulties knowing when to deploy the deterrents as pile driving has been continuously interrupted by the presence of harbour seals. It doesn't seem as though the deterrents have any impact on the seals.
    - SD tried to a play video with the acoustic deterrents on, but it was not audible. The video will be posted to the FIRMEX site.

- RL: Have the ramp up procedures changed at all?
- SD: No. The acoustic deterrent is run for ~30 minutes, then the sledgehammer is used to strike the pile, then the bubble curtain is run for 1 minute (previously 3 minutes) and finally there is a 6 minute ramp up for the impact hammer before it is run at a high drive speed.

- SD: TM has only been able to drive two piles in the last two weeks due to presence of harbour seals (Mooring Dolphin 2A and Mooring Dolphin 2D).
    - MD2- pile D: peak noise level was ~204.7 dB with the bubble curtains running.
    - MD2- pile A: peak noise level was ~202.8 dB.

- SD: Acoustic deterrents must be raised out of the water before commencing impacting.
- WB: Are acoustic deterrents removed prior to starting the bubble curtain as well?

- SD: Yes, they are usually raised out of the water before the bubble curtain is fired up as it creates a lot of wash and pushes them around. TM does not want them to hit the barge while they are being pulled out.
- RL: How long does it take to pull the acoustic deterrents out of the water?
- SD: 10 minutes. The 150 m exclusion zones need to be free of harbour seals for 30 minutes before commencing impact pile driving. The acoustic deterrents run for 10 to 15 minutes prior to the end of the 30 minutes of no seal sightings. Seals have halted this process a lot recently.
- TM hopes to resume impact pile driving with the second bubble curtain installed. This is dependent on the amount of seal sightings.

Further Questions:

- WB: Have any other marine mammals been observed recently?
  - SD: Only harbour seals recently.

- KR: Is it typical to observe this many seals at this time of year?
  - SD: Harbour seals are very abundant within Burrard Inlet. TM did not observe as many in the late spring or early summer.

- KR: Is there any advanced warning given for fish salvages conducted at Westridge Marine Terminal? Is it possible to give DFO or IAMC advanced warning?
  - TA: We can try, TM completes the salvage immediately after the cells are closed. Closing the cells can take up to a week and the salvage needs to happen the next day.
  - KR: In lieu of the issues that occurred last time during the fish salvage, building trust and sharing how the activities are being done is important. IAMC monitors may wish to observe the fish salvage. Short notice is difficult, but some notice would be nice.
  - KM: The condition of fish salvage permit requires TM to notify DFO's regional office prior to conducting the fish salvage.

- KR: There was a water quality issue with cement pouring. Since concrete pours are ongoing, have there been any changes to practices to avoid spills?
  - SD/TA: TM had two spills during concrete pours. TM has worked with KLTP to put in place a solid box containment as secondary containment. The tube for pouring the cement has been changed so that pourer knows when the cement is coming up, and there have been changes to the pour rate. The air pocket was bubbling, which has been corrected. There have been no issues since.

- KR: Is the IM for TM on the call?
  - MJ: Yes.

- SD provided a high-level summary of the JASCO report "Fish Deflection System Sound Source Characterization":

  At the request of DFO, TM and DFO had a meeting, as questions regarding the nature of the noise that is produced by the underwater acoustic fish deterrent system were raised.

  TM/JASCO deployed both deterrent devices and measured underwater noise at a range of distances out to 1 km. JASCO collected the data and created a report to illustrate noise properties and how it would be perceived by hearing abilities of killer whales, harbour seals, herring and salmon. The report considered injury and disturbance thresholds. The report describes the sound

produced by the acoustic deterrent system as a non-impulsive 50–500 Hz linear frequency modulated signal, at a repetition rate of 4 Hz. The acoustic deterrent does not exceed any injury threshold for the four species considered. For behavioural disturbance criteria (there are several caveats given that thresholds for behaviour disturbance are not well established) Killer whales and salmon may be able to perceive the sound, but it is outside their range of best hearing. At close range it is likely to deter herring and seals and can affect their behavior. TM is happy about that, because they want it to deter herring. It likely would not deter them at range (i.e., 40-50 m out from the source). TM has not observed harbour seals leaving the exclusion zone when the acoustic deterrent system is on.

- WB: may SD provide a summary of the marine mammal monitoring conducted at the exclusion zones prior to impact pile driving?
    - SD: TM has two exclusion zones: one at 150 m for harbour seals and the other at 1 km for all other marine mammals. These are monitored for 30 minutes before impact pile driving can start. If works are in progress and they see a seal within the 150 m exclusion zone then work stops and work does not recommence until the species is absent from the applicable exclusion zone.

- WB: DFO plans to resume in person CVA’s during September.

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GENERAL AND MISCELLANEOUS MITIGATION MEASURES

Measures specified within the Westridge Marine Terminal Fisheries Act Authorization Conditions:

Schedule			
2.2.6 All nearshore in-water Project construction activities (within a 50-m horizontal distance seaward of the higher high water large tide level) at the Westridge Marine Terminal shall only be carried out during a work timing window from August 16 to March 15 each year.			
Discussed: ☒ Yes ☐ No	Issue(s) identified: ☐ Yes ☒ No	Issue(s) unresolved: ☐ Yes ☐ No	Not applicable ☐
Comments			
TM acknowledged that all work completed prior to August 16th is outside the timing window (i.e., works on the foreshore cells were being completed at low tide in the dry and in-water works were only being conducted offshore beyond 50 m of the higher high water large tide). TM acknowledged that any in-water pile driving within 50 m of the higher high-water large tide only occurred after August 16th.			
Action Items			
None.			
Monitoring			
3.1 A qualified environmental professional must be on-site during the carrying on of in-water works, undertakings and activities, and shall monitor the works, undertakings or activities on a systematic and on-going basis to ensure that standards and avoidance measures to avoid impacts to fish and fish habitat are effective, and that unauthorized impacts to fish and fish habitat are avoided.			
Discussed: ☒ Yes ☐ No	Issue(s) identified: ☐ Yes ☒ No	Issue(s) unresolved: ☐ Yes ☐ No	Not applicable ☐
Comments			
The Lead Environmental Inspector spoke throughout the meeting about their experiences at the WMT during construction since the last compliance verification call on July 9th. Qualified environmental professionals are conducting monitoring of construction activities at the WMT.			
Action Items			
None.			
Marine Mammal Observations			
2.2.7 In-water construction activities must cease if any marine mammal is observed adjacent to or within the project area such that there is risk of direct physical harm to the marine mammal. Construction activities may only resume once the marine mammal has been confirmed to have left the immediate area or has not been sighted for 30 minutes.			
Discussed: ☒ Yes ☐ No	Issue(s) identified: ☐ Yes ☒ No	Issue(s) unresolved: ☐ Yes ☐ No	Not applicable ☐
Comments			
Trans Mountain noted that there had been multiple delays to pile driving recently due to the presence of one or more harbour seals in the seal-specific 150 m exclusion zone prior to the commencement of pile driving.			
Action Items			
None.			
Temporary Structures and Decommissioning of Existing Structures			
The application for a *Fisheries Act* authorization states that a floating debris boom will be secured around the work area to collect drifting debris during demolition of the existing utility dock (page 3.1).			
Discussed: ☐ Yes ☒ No	Issue(s) identified: ☐ Yes ☐ No	Issue(s) unresolved: ☐ Yes ☐ No	Not applicable ☒

2.2.5 Temporary structures installed below the high-water mark shall be decommissioned and removed when they are no longer being used for construction purposes.			
Discussed: ☐ Yes ☒ No	Issue(s) identified: ☐ Yes ☐ No	Issue(s) unresolved: ☐ Yes ☐ No	Not applicable ☒
Comments			
No structures are currently being decommissioned.			
Action Items			
None.			
Pump Intake Screening			
2.2.2 Water intakes of any pumps shall be designed and screened in accordance with specifications outlined in the Addendum, Fisheries and Oceans Canada's *Freshwater Intake End-of-Pipe Fish Screen Guidelines* (Fisheries and Oceans Canada 1995), and Fisheries and Oceans Canada's *Guidelines for Minimizing Entrainment and Impingement of Aquatic Organisms at Marine Intakes in British Columbia* (Fisheries and Oceans Canada 1991).			
Discussed: ☐ Yes ☒ No	Issue(s) identified: ☐ Yes ☐ No	Issue(s) unresolved: ☐ Yes ☐ No	Not applicable ☒
Comments			
Screens for known water intakes have been discussed during previous site inspections. No issues were reported.			
Action Items			
None.			
Fish Salvage			
2.2.3 Fish salvage and relocation shall be conducted, as appropriate, prior to the start of construction activities so as to avoid and minimize adverse impacts to fish.			
Discussed: ☒ Yes ☐ No	Issue(s) identified: ☐ Yes ☒ No	Issue(s) unresolved: ☐ Yes ☐ No	Not applicable ☐
Comments			
A fish salvage was conducted in foreshore cell 2 in August. Minnow and crab traps were used. Captured fish and invertebrates were released at Barnet Marine park. No issues were reported.			
Action Items			
None.			
Integrity of Habitat Offsets			
4.7 The Proponent shall not carry on any works, undertakings or activities that will adversely disturb or impact the offsetting measures.			
Discussed: ☐ Yes ☒ No	Issue(s) identified: ☐ Yes ☐ No	Issue(s) unresolved: ☐ Yes ☐ No	Not applicable ☒
Comments			
Offsetting measures have yet to be installed.			
Action Items			
None.			

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MITIGATION MEASURES SPECIFIC TO PILE DRIVING

Measures specified within the Westridge Marine Terminal Fisheries Act Authorization Conditions:

Underwater Sound Pressure Level Reduction			
2.2.8 A vibratory hammer will be used for pile driving where practical and feasible, and all in-water pile driving activities will be monitored via hydrophone to ensure underwater peak pressures do not result in adverse impacts to fish.			
Discussed: ☒ Yes ☐ No	Issue(s) identified: ☐ Yes ☒ No	Issue(s) unresolved: ☐ Yes ☐ No	Not applicable ☐
2.2.9.1 To avoid death of fish, mitigation measures (e.g., bubble curtain around the full wetted length of the pile, fish exclusion, etc.) must be implemented.			
Discussed: ☒ Yes ☐ No	Issue(s) identified: ☐ Yes ☒ No	Issue(s) unresolved: ☐ Yes ☐ No	Not applicable ☐
Comments			
Mitigation measures for pile driving were discussed, including the current ramp-up sequence (running the acoustic deterrent, striking the pile with the sledgehammer, running the bubble curtain and initiating the impact hammer ramp-up), the testing of a secondary bubble curtain and the use of a new vibratory hammer. The new hammer is able to vibrate piles deeper into the substrate, lessening the duration of impact pile driving.			
Action Items			
None.			
Underwater Sound Pressure Level Monitoring			
2.2.9.2 Monitoring via underwater noise recordings must be conducted continuously and within 10 meters of the pile being driven to verify that underwater sounds do not exceed the 30 kPa (209.5 dB re: 1 µPa) threshold for injury to finfish.			
Discussed: ☒ Yes ☐ No	Issue(s) identified: ☐ Yes ☒ No	Issue(s) unresolved: ☐ Yes ☐ No	Not applicable ☐
2.2.9.3. Outside of the least risk window for Burrard Inlet (August 16 – February 28), a more conservative underwater sound threshold of 22.5 kPa (207 dB re: 1 µPa) will be adhered to, and monitored, to prevent injury to finfish. If sound levels exceed this threshold, or a fish kill is observed despite mitigation measures being in place, pile driving activities are to cease immediately and mitigation methods are to be reviewed and modified in consultation with DFO.			
Discussed: ☒ Yes ☐ No	Issue(s) identified: ☐ Yes ☒ No	Issue(s) unresolved: ☐ Yes ☐ No	Not applicable ☐
2.2.9.4 If underwater noise recordings indicate that sound levels are likely to exceed the applicable threshold defined in conditions 2.2.9.2 or 2.2.9.3, the Proponent will take appropriate action with the goal of preventing the exceedance from occurring. These actions may include adjusting the force of the hammer, adjusting the mitigation measures already in place to increase their effectiveness, or implementing additional mitigation measures.			
Discussed: ☒ Yes ☐ No	Issue(s) identified: ☐ Yes ☒ No	Issue(s) unresolved: ☐ Yes ☐ No	Not applicable ☐
2.2.9.5 Upon commencement of pile driving, or recommencement after a delay of 30 minutes or more, pile installation shall ramp-up by starting with less frequent impact strikes of lower force. This ramp-up period is designed to enable any fish that may be in the area time to leave the area prior to the generation of peak pressure and noise levels for pile installation.			
Discussed: ☒ Yes ☐ No	Issue(s) identified: ☐ Yes ☒ No	Issue(s) unresolved: ☐ Yes ☐ No	Not applicable ☐
Comments			

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TM demonstrated that they are monitoring underwater noise during vibratory and impact pile driving and that levels have remained below the threshold specified in the authorization.
Action Items
None.

Marine Mammal Monitoring

2.2.9.6 Prior to commencement of pile driving, or recommencement after a delay of 30 minutes or more, visual monitoring must be conducted to determine if marine mammals are present within an exclusion zone of 1 km (except for harbor seals, which will have an exclusion zone of 150 m).

Discussed: ☒ Yes ☐ No	Issue(s) identified: ☐ Yes ☒ No	Issue(s) unresolved: ☐ Yes ☐ No	Not applicable ☐

2.2.9.7 Work may only commence if marine mammals and harbor seals are not observed in their respective exclusion zones for 30 minutes.

Discussed: ☒ Yes ☐ No	Issue(s) identified: ☐ Yes ☒ No	Issue(s) unresolved: ☐ Yes ☐ No	Not applicable ☐

2.2.9.8 Exclusion zones must be monitored continuously during impact pile driving. If a marine mammal or marine mammals are observed within their respective exclusion zone, pile driving activities must cease until all marine mammals leave their respective exclusion zone or they have not been sighted for 30 minutes within their respective exclusion zone.

Discussed: ☒ Yes ☐ No	Issue(s) identified: ☐ Yes ☒ No	Issue(s) unresolved: ☐ Yes ☐ No	Not applicable ☐

2.2.9.9 If underwater noise recordings reveal that the threshold of 160 dB is exceeded at the 1 km exclusion zone boundary, the exclusion zone radius must be widened to a new outer limit, where sound recordings demonstrate that the 160 dB threshold is not exceeded. Conditions 2.2.9.6 to 2.2.9.8 will need to be complied with within this new exclusion zone.

Discussed: ☒ Yes ☐ No	Issue(s) identified: ☐ Yes ☒ No	Issue(s) unresolved: ☐ Yes ☐ No	Not applicable ☐

2.2.9.10 Pile driving may only be carried out during daylight hours to enable effective visual monitoring of marine mammal exclusion zones.

Discussed: ☒ Yes ☐ No	Issue(s) identified: ☐ Yes ☒ No	Issue(s) unresolved: ☐ Yes ☐ No	Not applicable ☐

Comments
TM is carrying out marine mammal monitoring. Harbour seals were observed within the seal-specific 150 m exclusion zone prior to the commencement of pile driving, resulting in multiple work stoppages.
Action Items
None.

Measures specified within the Westridge Marine Terminal Environmental Protection Plan:

Fish Salvage

35. Immediately following the installation of each sheet pile cell, and prior to excavation and infilling of that cell, conduct a salvage of commercial, recreational and Aboriginal (CRA) fishery species via crab and fish trapping/netting and seines (where appropriate). Release captured CRA fishery species in a suitable habitat at least 500 m away from marine construction activities.

Discussed: ☒ Yes	Issue(s) identified: ☐ Yes	Issue(s) unresolved: ☐ Yes	Not applicable ☐

☐ No	☒ No	☐ No	
Comments			
Fish salvage occurred within foreshore cell 2 after all sheet piles were threaded. The fish salvage used minnow and crab traps. All fish and invertebrates captured were released at Barnet Marine park. No issues were reported.			
Action Items			
None.			
Turbidity Monitoring			
43. Should visual monitoring during in-water pile installation indicate concern regarding turbidity levels, the Environmental Inspector will arrange for in situ sampling of turbidity (nephelometric turbidity units). Should turbidity levels exceed specified thresholds, pile driving will temporarily be halted.			
Discussed: ☒ Yes ☐ No	Issue(s) identified: ☐ Yes ☒ No	Issue(s) unresolved: ☐ Yes ☐ No	Not applicable ☐
Comments			
No water quality issues were reported during in-water pile installation. Turbidity curtains are in place and water quality monitoring has recorded no exceedance in water quality guidelines for turbidity outside of the turbidity curtain.			
Action Items			
None.			

MITIGATION MEASURES SPECIFIC TO FORESHORE CONSTRUCTION

Riparian Planting and Material Handling			
Westridge Marine Terminal Fisheries Act Authorization Conditions			
2.2.4 Disturbed riparian areas shall be replanted as appropriate, with native non-invasive species of vegetation.			
Discussed: ☐ Yes ☒ No	Issue(s) identified: ☐ Yes ☐ No	Issue(s) unresolved: ☐ Yes ☐ No	Not applicable ☒
Westridge Marine Terminal Environmental Protection Plan Commitments			
30. Unless otherwise approved by DFO, retain all excavated [marine] material and dispose at a land-based facility in accordance with applicable regulations.			
Discussed: ☐ Yes ☒ No	Issue(s) identified: ☐ Yes ☐ No	Issue(s) unresolved: ☐ Yes ☐ No	Not applicable ☒
Comments			
Not applicable.			
Action Items			
None.			

Water Quality Maintenance and Monitoring			
Westridge Marine Terminal Fisheries Act Authorization Conditions			
2.2.1 Effective sediment and erosion control measures (e.g., a turbidity curtain, etc.) shall be implemented before starting construction and shall be maintained during construction activities, as appropriate, to avoid the deposit and dispersion of sediment into the marine environment.			
Discussed: ☒ Yes	Issue(s) ☐ Yes	Issue(s) ☐ Yes	Not applicable ☐

☐ No	identified: ☒ No	unresolved: ☐ No	
2.2.10 A turbidity curtain must be used to isolate the work area during the excavation of riprap in order to contain marine sediment suspended in the water column and limit the extent of sediment dispersion. During severe weather conditions that may reduce the effectiveness of, or impede the visual monitoring of, the turbidity curtain (e.g., > 70 km/h winds, or dense fog), works, undertakings or activities that may increase suspended sediment concentrations within the turbidity curtain or adversely affect the integrity of the turbidity curtain, must be suspended.			
Discussed: ☒ Yes ☐ No	Issue(s) identified: ☐ Yes ☒ No	Issue(s) unresolved: ☐ Yes ☐ No	Not applicable ☐
Westridge Marine Terminal Environmental Protection Plan Commitments			
29. During in-water excavation or rip rap, conduct water quality monitoring (WQM) as per the Water Quality Management Plan during Rip Rap Removal (Appendix H of this EPP). Conduct WQM to assess the effectiveness of the turbidity curtain and modify turbidity curtain deployment, if required.			
Discussed: ☒ Yes ☐ No	Issue(s) identified: ☐ Yes ☒ No	Issue(s) unresolved: ☐ Yes ☐ No	Not applicable ☐
Westridge Marine Terminal Sediment and Erosion Control Plan Commitments			
The in-water sediment curtain will remain intact during Foreshore construction activities to ensure sediment laden water is not discharged into Burrard inlet.			
Discussed: ☒ Yes ☐ No	Issue(s) identified: ☐ Yes ☒ No	Issue(s) unresolved: ☐ Yes ☐ No	Not applicable ☐
Comments			
While conducting works on foreshore cell 4, a vibratory hammer probed for rock obstructions prior to threading sheet piles. Rock obstructions were removed using a clamshell bucket and the rock was placed on the shore. These rock obstructions were treated as if they were part of the previous riprap shore and required the same mitigation measures. Any material removed was placed within the project authorized work area. Monitoring of water quality was conducted outside of the turbidity curtain using the same procedure as used for the removal of riprap. Most of the obstruction removal was completed during low tide so the turbidity generated was fairly low and remained within the turbidity curtain, with no water quality issues reported. The turbidity curtain, which encompasses the whole work area, is reported to be working well.			
Action Items			
None.			

Additional comments or action items
None.