Liard West

Erosion and Sedimentation

Management Plan

Version 1

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1.0 INTRODUCTION

Paramount is the operator of the Liard West Project ("the Project"). The Project is situated in the NT, roughly 35 km north of the BC / NT border. From the Project area, Fort Nelson, BC is located approximately 200 km to the south, Trout Lake, NT is located roughly 150km to the east and Nahanni Butte, NT is located approximately 100km to the north. The hamlet of Fort Liard, NT is located within the Project area.

The Project encompasses all-season and winter access roads; well sites, pipelines, valve sites and gas dehydration facilities; a water disposal well at 0-80; a repeater site; camp, decking and staging sites; and various borrow pits and sumps. Six natural gas wells (Paramount *et al* K-29A, 2K-29, 3K-29, M-25, 2M-25 and F-25a) on three lease sites (K-29, M-25 and F-25) are tied-in to a 37.2km main pipeline that connects the K-29 lease site to a suspended pipeline at the abandoned/reclaimed BP Pointed Mountain plant site. The M-25 lease site is linked to the F-25 plant site via a 1.4 km pipeline lateral and the F-25 plant is linked to the main pipeline via a 3.3 km pipeline lateral. When active, produced water from wells on the K-29 and F-25 leases is transported via pipeline to an injection well located at 0-80.

All of the Project components have been built. The wells and pipelines at the Project are suspended, deactivated and/or decommissioned. Activity in the Project has been limited in recent times to suspension activities, maintenance of access and monitoring. Short term plans are to abandon the wellbores. Long term plans for the Project are currently undetermined and depend on future economic and political developments.

The Liard West project site has had issues with erosion due to topography and watercourses at different times in the project history. Reporting on the issues and corrective actions taken have been done under the National Energy Board, now Canadian Energy Regulator under the Annual Environmental Report (NEB File #2620-D-12-9). Since devolution the reports have been submitted to the Office of the Regulator of Oil and Gas Operations (OROGO). That reporting can be found at:

Paramount Resources Ltd. - POA-Paramount-Liard | Office of the Regulator of Oil and Gas Operations (gov.nt.ca)

On November 20, 2020, following the completion of the regulatory process, a renewal of water licence for the Project was issued. The Mackenzie Valley Land and Water Board (MVLWB) issued Water License MV2020L1-0006 to Paramount for the Project. Part F, condition 5 of the license requires the submission by Paramount to the MVLWB of an Erosion and Sedimentation Management Plan("ESMP"). The main objectives of the ESMP are to describe measures taken to prevent and mitigate or remediate erosion that could lead to the deposit of sediment into Waters and/or hinder revegetation of project components. As required, the ESMP incorporates the conditions found in Schedule 3, items a through d.

The overall objective of the ESMP is to ensure that Paramount can prevent, control, and/or mitigate the potential for sedimentation and erosion relating to Project. The ESMP builds off existing management, mitigation and monitoring activities undertaken by Paramount at the Project, which are in Paramount's project approvals, Waste Management Plan, Spill Contingency Plan and the soon to be developed Closure and Reclamation Plan.

Building on these existing documents, and taking into account the MVLWB's requirements in Schedule 3, items a through d, the ESMP is comprised of the following four main sections:

- Criteria for recognizing and understanding erosion and sedimentation potential
- Existing erosion prevention, control and mitigation measures
- Erosion and sedimentation monitoring
- Erosion prevention and mitigation performance
- Contingency plans (adaptive management)

2.0 SEDIMENT AND EROSION CONTROL

2.1 RECOGNITION AND UNDERSTANDING

This section outlines the criteria, or standards, used to assess areas at the Project that are sensitive to erosion and/or sedimentation. *Assessment* refers to the recognition of erosion, its relative severity, and the potential for sediment deposition into waterbodies or limit revegetation Section 2.3 below provides a summary of those erosion monitoring procedures and schedules. Recent outcomes of erosion monitoring (prevention and mitigation performance) are summarized in Section 2.4.

2.1.1 APPROACH

Erosion is the movement and loss of soil from one location to another by water, wind, gravity and/or other natural forces. The criteria used for recognizing and understanding erosion, and the potential for sedimentation in the Project Area, is largely descriptive and qualitative. To facilitate accurate and informed assessments of erosion and sedimentation potential at the project, Paramount will ensure the availability of information on erosion and sedimentation (including the ESMP), as well as ongoing training of all project field personnel in erosion issues. Guidance information includes background on the causes and effects of erosion, keys to identifying and evaluating risk to the environment, and knowledge concerning any built or innate mitigating factors. These include information to facilitate the assessment of the effectiveness of any erosion control works, such as regrade rills and gullies, rock rip rap on banks, silt fences and diversion ditches, and the presence and condition of natural vegetation.

The ESMP and related components of other documents are used to guide the recording and characterizing of erosion evidence. Professional knowledge and judgment is further applied to evaluate the risk that erosion or subsidence pose to water quality/revegetation, and to consequently develop recommendations for potential response actions (i.e., additional mitigation). In essence, exposed soil is an indication of the quantity of unstable soil likely to be available to contribute to runoff to surface waters, leading to sedimentation in the aquatic environment. The distance between a sediment source and fish habitat is an indication of the aquatic environment's sensitivity to sedimentation. Both exposed soil and distance between a sediment source and fish habitat are primary qualitative indicators of the potential for erosion to impact surface water quality. The basic assumptions regarding risk are:

(1) Exposed soil and risk to surface water quality are directly related,

(2) While distance between a sediment source and fish habitat and risk to surface water quality are inversely related.

2.1.2 CRITERIA

Water erosion can occur from runoff or from flowing water associated with streams, springs and seepages. Sedimentation refers to the deposition of un-dissolved sediments into water bodies. Both suspended and dissolved sediment can negatively affect water quality, which in turn can result in a variety of harmful impacts to fish

Erosion is typically the result of the removal of stabilizing vegetative cover and the exposure of mineral soils to the effects of gravity and flowing water. Excavations and ditches backfilled with frozen soil can result in settlement upon thawing. Depressions resulting from this settlement can in turn collect water that increases the potential for erosion. Construction and reclamation at water crossings can also lead to the potential for both erosion and sedimentation. Typical types of erosion in the southern Northwest Territories include sheet, rills, gulley, soil slide and trail braiding. These types of erosion are outlined below.

Numerous factors can influence erosion and potential sedimentation. Key factors inform the qualitative criteria that allows the professional evaluation of erosion and the potential risk of sedimentation into waterbodies or water courses. These factors include the relative amount of water observed, activity level (e.g., stable or active or expanding), slope (relatively flat or low slope versus moderate or high slopes), soil texture (e.g., organic, sand, silt, clay, etc.), relative extent of vegetative cover compared to exposed soil, surface roughness, and the proximity of areas affected by erosion to creeks, lakes or other waterbodies.

Paramount's approach for evaluating and potentially responding to erosion and sedimentation relies on qualitative criteria and the application of professional judgement. It is key to note that the annual summer or fall inspections of the Fort Liard West field conducted by Government of the Northwest Territories Department of Land Inspectors adopts a parallel, qualitative approach using professional judgement, and thus provides an effective and unbiased basis for comparison of results and recommendations.

The following section provides background material that is used in the field to help characterize and monitor erosion.

SHEET EROSION

Sheet erosion is caused by shallow water flowing over the land. Large areas, particularly long, steep slopes, with no vegetative cover are prime candidates for sheet erosion. Water moves as a relatively uniform sheet for only a metre or less before concentrating in surface irregularities. Therefore, sheet erosion quickly progresses to rills and gullies.

GULLEY EROSION

Gulley erosion develops as runoff concentrates in low spots and irregularities on the surface. This action cuts tiny channels, or rills, usually only several centimeters deep. With continued runoff, rills increase in size and become gullies. Gullies are considered too large to drive across.

SOIL SLIDE

Shallow soil slides occur on gentle slopes when the near surface material, saturated with water from the downward percolation of rainfall and/or seepage from the upslope ditch, is underlain by frozen ground or permafrost. The material moves on a plane, parallel to the ground surface, with very little settlement. The extensive cracking in the slope will allow significant amounts of water to enter the slope and further saturate the soils.

TRAIL BRAIDING

Standing water combined with multiple passes of wheeled vehicles can create “trail braiding” and “wallows”. Trail braiding is created by producing one set of tracks beside another as each old set of tracks becomes impassable. Wallows are holes caused by getting stuck and spinning wheels. This disturbance may negatively affect vegetative cover.

WATERCOURSE & CROSSINGS OF WATER BODIES

If watercourse crossings are poorly constructed and/or maintained, they may result in destruction or alteration of fish and aquatic habitats, alteration in channel morphology, increased stream sedimentation, bank erosion, constraints to fish passage and introduction of deleterious substances into the water.

Areas of Pipeline Trench Subsidence

Excavations and ditches backfilled with frozen soil often result in settlement upon thawing. Depressions resulting from this settlement can collect water, which increases potential for erosion. Criteria to be recorded include the length of pipeline trench that has experienced subsidence, whether or not there is water accumulation and the depth of cover over the pipe.

2.2 SITES OF POTENTIAL RISK

The Liard West project site has had issues with erosion due to topography and watercourses at different times in the project history. Paramount has a history of monitoring these locations through the annual reporting under NEB File #2620-D-12-9. Along with the identified sites Paramount and GNWT Inspectors monitor the environmental conditions of the other. Sites and locations listed in the table below are identified on the map in Appendix E.

PROJECT COMPONENTS	COMPONENT STATUS	SITE ACTIVITIES	RISKS AND RISK FACTORS	RISK LEVEL	MITIGATION, BMPS, MONITORING AND CORRECTIVE ACTION(S)
WELL SITES 0-80 F-25 AND F-25A M-25 K-29	Well sites are built and all well bores are suspended or abandoned.	Vegetation clearing, grading, and recontouring, abandonment activities	Clearing vegetation exposes soil to climatic conditions of precipitation and wind. Soil removal leads to recontouring and the requirement to fill. This can lead to slumping and settling issues	Medium	Ensuring proper slopes and grading on recontouring, roll back, mounding and revegetation. Monitoring annually for evidence of settling and/or runoff due to site grade. Ensure berms and other structures are effective. Corrective actions could include increased revegetation measures, supplementary recontouring, additional berms and erosion control blankets.
CAMP SITES BORROW PITS STAGING AREAS	Built	Vegetation clearing, soil removal, recontouring, revegetation	Clearing vegetation exposes soil to climatic conditions of precipitation and wind. Soil removal leads to recontouring and the requirement to fill. This can lead to slumping and settling issues	Medium	Ensuring proper slopes and grading on recontouring, roll back, mounding and revegetation. Monitoring annually for evidence of settling and/or runoff due to site grade. Corrective actions could include increased revegetation measures, supplementary recontouring and erosion control blankets.
ACCESS ROAD POINTS 1-10	Built	Vegetation clearing and water crossings	Vegetation clearing reduces the organic layer protecting the soil which may lead to braiding and or wallows. Crossings if improperly built can cause compaction, rutting or sedimentation. Stream erosion is the displacement and transportation of solids (soil, sand, gravel,	High	Use of clean snow and use during frozen conditions. No use of materials such as gravel, rock or loose woody materials. Maintain adequate thickness on road and crossings. Ensure bridges are in good working order, proper setbacks and properly anchored prior to use. Bi-Annual monitoring as part of project monitoring, rip rap and/or erosion control blankets to correct any issues. Removal of structures when not in use if required.

			mud, boulders, and other particles) by moving water. This type of erosion is natural and occurs in and adjacent to every stream		

2.3 PREVENTION AND MITIGATION MEASURES

Paramount actions to address erosion and sedimentation include prevention and mitigation, the latter defined as those means and methods by which potential negative effects on the environment can be reduced and/or managed to an acceptable risk or standard. Prevention and mitigation can include avoiding all or part of a potential effect through appropriate sighting and scheduling of project activities, by utilizing best management practices (BMPs) during all project phases, by repairing or restoring affected components of the environment and, where feasible and appropriate, by compensating important unmitigated effects with substitute or alterative resources.

There are four general classes of prevention and mitigation pertaining to erosion and the risk of sedimentation:

1. Spatial considerations. These include the avoidance of sensitive habitats, areas prone to erosion, the buffering of waterbodies 100m (unless a crossing is required), and the avoidance of permafrost if feasible.
2. Temporal considerations. This refers to the scheduling of project activities outside of key, sensitive periods in the year. This can include, for example, conducting all construction and drilling programs during the winter period, and adherence to water crossing timing windows.
3. Fundamental Mitigation. These include the adoption of BMPs and industry procedures as they apply to the Project as a whole. These include the Federal Department of Fisheries and Oceans' (DFO's) *Standards and Codes of Practice* and the Government of the Northwest Territories' *(GNWT's) Environmental Guidelines for the Construction and Maintenance and Closure of Winter Roads in the Northwest Territories.*
4. Task-specific Mitigation. These include the adoption of task-specific mitigations, BMPs and industry procedures as they apply to specific tasks required for development and operation of the Project.

Fundamental and task-specific mitigations for preventing, controlling, and mitigating erosion and the risk of sedimentation are outlined below.

2.3.1 FUNDAMENTAL MITIGATION

Fundamental mitigation for erosion includes factors relating to clearing, grading, soil handling and direct erosion controls. With respect to clearing, the boundaries of areas

approved for clearing are marked to prevent unauthorized clearing. Clearing is minimized to the extent possible. Where and when possible, vegetation cannot be cleared or be semi-cleared, which refers to the falling of timber onto the clearing using heavy equipment outfitted with a cutter blade or a hydroaxe. This procedure helps minimize ground disturbance.

The removal of felled timber is done so using heavy equipment with the bottom edge of the blade elevated roughly 4cm above the ground surface to prevent disturbance. Felled timber is windrowed at the side of clearings with care taken to avoid obvious drainage courses. When possible, windrowed material eventually may be rolled back on the clearing to help minimize erosion from the disturbed area.

Waterbodies are protected through the adoption of 100m setback distances from creeks, rivers, wetlands, and other waterbodies, unless a crossing is required. Grading, if required, is undertaken away from watercourses to minimize introduction of soil and organic debris. No windrowed or fill material shall be placed in the watercourses during grading. Where a crossing may be required, and specifically an isolated water-crossing, Paramount will adopt guidance provided by Fisheries and Oceans Canada's Interim code of practice: temporary stream crossing. This code of practice, along with other pertinent federal code of practices, are included in Appendix B.

Direct erosion control measures can be applied on a site-specific basis as needed and can include the use of measures or techniques such as check dams, contouring, cross ditches, cross berms, ditch plugs, diversion berms, positive drainage, seeding, silt fence, slash rollback, and swales. Vegetation is also important in mitigating erosion. On disturbed areas, natural regeneration of vegetation is promoted except in areas that are susceptible to erosion (e.g., steep slopes). Direct control measures and ground covers that may be applied to eliminate or effectively reduce erosion are discussed and illustrated below (Section 2.2.1.1).

Soil can be directly protected by minimize grading where possible, particularly on steep slopes and near watercourses and wetlands. Grubbing is undertaken only where necessary (e.g., pipeline trenches, bell holes, sumps, etc.). A buffer (≥ 1m in width) is maintained between grubbing and adjacent, undisturbed areas. Grubbing is restricted in wet areas, to avoid the creation of bog holes, and near watercourse, to minimize the potential for introduction of sediment.

2.3.1.1 DIRECT CONTROL MEASURES AND GROUND COVER

To minimize erosion, direct erosion control measures such as diversion ditches and silt fences can be used. Erosion control measures must be chosen carefully, located and installed correctly and adequately maintained, to be effective. To determine effectiveness of erosion control measures, they must be monitored regularly. Ground covers are also used to eliminate or control erosion. These include maintaining rough surfaces, erosion control blankets, and ensuring re-vegetation of disturbed areas.

DIVERSION DITCHES

Diversion ditches reduce erosion potential by intercepting runoff and diverting it to a stable outlet at a non-erosive velocity (Price and Karesh, 2002). For example, cross ditches across ROW's (pipeline or road) are designed to move water off the ROW and prevent runoff form channeling down the pipeline ditch or access road. Diversion ditches should be constructed above, across or below a slope, with a supporting earthen ridge on the lower side. Signs that diversion ditches are not functioning properly include:

- Ponding of water on the ROW, or water running onto the ROW from adjacent area;
- Water entering the ROW and running down the ditch line; and
- A natural drainage blocked by the roach or windrowed soil (long soil pile) within the trench or on the ROW.

SILT FENCES

Silt fences reduce erosion potential by decreasing flowing water velocity and allowing sediment deposition at the structure. Silt fences are effective where sheet flow runoff is present, not where concentrated flow is present (*e.g.*, streams, ditches, waterways, *etc.*). To ensure silt fences function effectively, design criteria must be considered carefully.

Signs that silt fences are not functioning properly include:

- Silt fences that are a third full of silt;
- Silt fences that have water flowing around or underneath them; and
- Silt fences that are not upright.

ROUGH SURFACES

Rollback of wood slash over the trench line helps to stabilize the soil.

Rough surfaces, such as rollback and riprap reduce erosion potential by decreasing runoff velocities, trapping sediment, increasing infiltration of water into the soil and helping to establish vegetative cover (Price and Karesh, 2002). Rollback and riprap are typically associated with pipeline rights-of-way (ROW) decommissioned roads, and watercourses, respectively.

Riprap helps to stabilize stream banks.

EROSION CONTROL BLANKETS

Erosion control blankets reduce erosion potential by protecting the soil surface; allowing easy installation of seed; preventing erosion of seed; promoting seed germination and protecting young vegetation (Price and Karesh, 2002). Erosion control blankets are typically associated with areas where erosion hazards are high and natural revegetation/conventional seeding is likely to be too slow in providing adequate cover.

Signs that erosion control blankets are not functioning properly include:

- Movement of the matting or coming loose at the edges (eg. general displacement);
- Water flow/erosion under or around the matting; and
- Water levels higher than the matting.

VEGETATION

Permanent perennial vegetation reduces erosion potential by reducing runoff velocity; maintaining sheet flow; protecting soil surface from erosion and promoting infiltration of runoff into soil (Price and Karesh, 2002). Permanent perennial vegetation is typically associated with areas that are prone to erosion; where topsoil was not stripped and where natural vegetation regeneration is likely to be too slow in providing adequate cover. Permanent perennial vegetation should cover ≥ 70% of a disturbed area to be deemed satisfactory. Percent cover is estimated as the percentage of the ground surface covered when viewed from directly above; viewing the layer obliquely can result in an over-estimation.

2.3.2 TASK-SPECIFIC MITIGATION

Temporary Camps

Where possible, campsites are located on previously cleared land, or natural clearings, and on relatively level terrain 100m from any watercourses. Site stability at temporary campsites is assessed prior to use and after use. If unstable, appropriate corrective action is undertaken as soon as practical to stabilize the site, thereby minimizing erosion.

Access

Existing access is utilized for the Project. Adhere to Land Use Permit conditions #20-36. Proper maintenance and dust control is in place prior to use

Well Leases

Existing leases are used, leases are assessed prior to activity, Regraded and recontoured.as required. Further disturbance is minimized allowing the continuation of natural revegetation on the site.

Abandonment

When a well is abandoned, equipment is properly placed, and appropriate dust control and berms are in place.

Reclamation

Removal of established vegetation in forested areas, muskeg, highly erodible or drought-prone areas should always be evaluated prior to commencement of earthwork activities and alternatives will be considered where the planned reclamation activity may cause more damage than leaving stable naturally revegetated as is. Reclamation activities, including the use of heavy equipment may cause soil compaction, soil erosion, a change in the soil structure, and admixing by rutting can occur if activities are conducted under wet conditions and so reclamation earthworks will only occur under suitable soil moisture conditions. Highly erodible soils (i.e. sands) that are sensitive to disturbance and typically lack organic matter may be difficult to revegetate and are more vulnerable to disturbance (i.e. by equipment) and thus, have a higher erosion potential. Hilly and/or sloped areas are generally subject to more erosional forces.

Following reclamation earthworks erosion control measures will be implemented if erosion is determined to be greater than adjacent lands. This may include revegetation with acceptable species, erosion control blankets, fencing and/or strategically placing woody debris. If necessary, additional erosion control methods will be applied at various phases during the reclamation process.

2.4 EROSION MONITORING AND REPORTING

Erosion monitoring and reporting are essential for ensuring the effective implementation of erosion prevention, control and mitigation measures. Erosion monitoring and reporting at the Project are currently done twice a year in June and Septemeber. Key elements pertaining to erosion monitoring and reporting are provided below.

Erosion and sedimentation monitoring consists of site wide checks, scheduled monitoring at road and leases, and annual erosion monitoring.

The biannual site wide erosion monitoring survey is undertaken by a field representative and the ARO department reviews the results to monitor the integrity of existing erosion control works (if any), identify sites with high potential for erosion, and to identify any new erosion issues that may have developed throughout the year.

METHODS AND PARAMETERS

Personnel use those criteria outlined in Section 2.1 to monitor and characterize erosion and subsidence at the Project.

REPORTING

Where erosion is detected during scheduled monitoring of the Project it will be documented and reported to Paramount's ARO department. Based on the data, the ARO Department will recommend appropriate action, should it be required. Where concerns are urgent, the ARO Department is contacted immediately. If a significant deposit of sediment into a waterbody/watercourse occurs and was caused by Paramount's operations, Paramount will notify the appropriate government agencies and the MVLWB. Affected parties are notified

via the MVLWB online review system or notified by Paramount as per the Incident Notification Protocol that can be viewed in the project Spill Contingency Plan.

Under Schedule 1 Part k) as part of the Annual Licence Report Paramount will report to the MVLWB activities conducted in accordance with this plan once approved. Affected parties are notified via the MVLWB online review system when the Report is available for review.

Reporting Outcomes

Based off the reporting, the ARO department will prescribe an outcome where erosion/sedimentation have occurred or could occur:

Action Level	Observed site Condition	Corrective Actions	Next Steps
Moderate	Lack of vegetation, minor settling or ponding over a 2-year period	Continued or more frequent monitoring	Monitoring. Revegetation, mounding, and microsite creation
Medium	Persistent lack of vegetation over a 4-year period. Significant settling or ponding.	Revegetation, mounding and microsite creation in the near term after proper planning (next season)	Monitoring. Larger earthworks including filling and recontouring two or three years after initial corrective actions
Urgent	Sedimentation event into stream from a non-natural event	Notification of appropriate regulators. Erosion control blankets and rip rap	Engage with Regulators on any further corrective actions.

2.5 EROSION PREVENTION AND MITIGATION PERFORMANCE

Results of annual inspection by both Paramount and the GNWT provide insight into the nature and scope of existing and foreseeable erosion issues at the Project. In 2022, reporting indicated some natural erosion issues, and indicators such as rutting, subsidence and water ponding were generally deemed to be minor or non-existent; no follow-up actions were required. These recent results are characteristic of results from previous years. The Project is extremely well revegetated.

2.6 CONTINGENCY PLANS (ADAPTIVE MANAGEMENT)

Contingency planning involves the setting in place general procedures and actions to be able to respond to unanticipated events. With respect to erosion and the potential for sedimentation, contingency planning necessitates the need for adaptive management. Adaptive management refers to the planned and systematic process for continuously improving environmental management practices by learning about their outcomes. Adaptive management provides flexibility to identify and implement new mitigation measures or to modify existing ones during the life of the project (CEAA 2011). For the Project, the main objective of the ESMP is that best management practices, mitigations and industry procedures lead to overall low risk of impacts on water. Should future monitoring results

lead to questions or uncertainties about the effectiveness of certain mitigation measures or management approaches, alternative measures and approaches will be assessed and considered. Where possible, consideration will be given to demonstrating a range of potential technically and economically feasible options with which to adapt and manage the project.

2.6.1 Climate Change

For the Liard West project area climate change is expected to potentially shorten winter activity timings and lengthen vegetation growth seasons. This may lead to more activities taking place in summer months increasing potential for erosion on the sites due to use by heavy equipment during years where abandonments and decommissioning activities take place in summer months. Given the state of the project (built and suspended) climate change is considered to have a potential neutral effect on Liard West. Potential negative outcomes are more activities may occur in summer months without the cover of snow and ice, changes to natural drainages and changes to watercourses (volume and intensity). The potential negative aspects are offset by potentially reduced reclamation timelines from when Liard West was assessed and built. The potential lengthening of growing seasons should lead to shorter revegetation timelines and decreasing the length of monitoring time in the project Closure and Reclamation Plan (to be submitted).

2.6.2 Foreseeable Scenarios

For the Liard West project, the defined future is either closure or redevelopment in the future. Near term the wells will be abandoned to comply with the OROGO *Well Suspension and Abandonment Guidelines and Interpretation Notes,* this activity is currently scheduled for the summer of 2023. Paramount will complete pre-activity monitoring and scouting and address any sedimentation and erosion activities with the project area at that time. Subsequent to the summer of 2023 activities, Paramount will monitor the site biannually and address any issues on a case-by-case basi. Response outcomes will be directed by the contents of this document, specifically section 2.4 and supplemented by the project Closure and Reclamation Plan (to be submitted). All of the response actions are considered low risk as they are all potential corrective actions or closure activities within the scope of the project assessment processes and regulatory approvals.

2.7 ANNUAL UPDATE

As required in Part F, Condition 4 and Schedule 3 of the MVLWB Type B Water Licence License, Paramount will review the ESMP annually and modify the plan as necessary, or at the direction of the MVLWB, to reflect changes in operation and technology. Any proposed changes shall be submitted to the MVLWB for approval.

3.0 REFERENCES

Department of Fisheries and Oceans. (2021). https://www.dfo-mpo.gc.ca/pnw-ppe/practice-practique-eng.html accessed May 7, 2021.

Government of British Columbia. 2010. Field Manual for Describing Terrestrial Ecosystems. B.C. Ministry of Environment, Lands, and Parks and B.C. Ministry of Forests. Available online at: https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/conservation-data-centre/field_manual_describing_terrestrial_ecosystems_2nd.pdf

Price, J.C. and R. Karesh. 2002. Tennessee Erosion And Sediment Control Handbook A Guide For Protection Of State Waters Through The Use Of Best Management Practices During Land Disturbing Activities (Second Edition) Tennessee Department Of Environment And Conservation. 148 pp + apps.

APPENDICES

Appendix A MVLWB Type B License MV2020L1-0006, Schedule 3 and Schedule 1 k)

Schedule 3: Erosion and Sedimentation Management Plan

1.The Erosion and Sedimentation Management Plan referred to in Part F, Condition 5 shall include, but not be limited to, the following information:

a) Information regarding erosion, sedimentation, and permafrost degradation potential and management, including:

I. A summary, with appropriate maps or diagrams of the Project site, identifying areas susceptible to erosion, sedimentation, and/or permafrost degradation;

II. A description of the process and criteria for assessing the risk of erosion, sedimentation, and/or permafrost degradation;

III. A description of the best management practices that will be employed for different levels of assessed risk; and

IV. A description of Water management during the Project.

V. A description of how climate change has been considered, including any linkages to other plans required under this Licence; and

VI. Any other information required to describe how erosion and sediment release into the Receiving Environment, and permafrost degradation will be minimized.

b) Information regarding monitoring, including;

I. Details of the monitoring, including rationale, that will be undertaken with respect to the effectiveness and maintenance of erosion and sediment management practices, including;

a. Monitoring locations, parameters, frequencies, methods, and types of instrumentation; and

b. A map to scale, with monitoring locations.

II. Linkages to other monitoring programs required under this Licence; and

III. Any other information about monitoring that will be performed to meet the objectives in Part F, Condition 1.

c) Information regarding responses to monitoring results, including:

I. A description of how the Licensee will link the results of monitoring to those corrective actions necessary to ensure that the objectives listed in Part F, Condition 1 are met. This description shall include:

a. Definitions, with rationale, for Action Levels applicable to the performance of erosion and sedimentation control measures; and

b. For each Action Level, a description of how exceedances of the Action Level will be assessed and generally, which types of actions will be taken for the Action Levels exceeded.

d) Information regarding contingency planning, including:

I. A description of reasonably foreseeable scenarios; and

II. For each scenario identified in (d)(i) above:

a. A description of response action options; and

b. A risk-based analysis of response action options, identifying preferred options and alternate options.

Schedule 1: Annual Water Licence Report

k) A summary of activities conducted in accordance with the approved Erosion and Sedimentation Management Plan, referred to in Part F, Condition 5 of this Licence, including:

i. A summary of approved updates or changes to the process or facilities required for the management of erosion and sedimentation;

ii. A description of any erosion susceptible areas encountered;

iii. A summary of activities undertaken to prevent or mitigate erosion;

iv. A report of the performance of mitigations applied to each area;

v. A summary and interpretation of monitoring results, including any Action Level exceedances; and

vi. A description of actions taken in response to any Action Level exceedances

Appendix B DFO Standards and Codes of Practice

Interim code of practice: beaver dam removal

1.0 About this code of practice

This code of practice outlines national best practices for the removal of beaver dams. Beaver dams need to be removed or breached periodically to protect, maintain or construct infrastructure or to avoid the flooding of private or public land. Dam removal is normally accomplished using hand tools, or mechanical equipment such as backhoes. Be aware that the removal of a beaver dam may not necessarily prevent future beaver activity in the area.

Potential impacts to fish and fish habitat from the removal of beaver dams could include, but are not limited to, direct damage to substrates, release of accumulated sediments, loss of riparian habitat and stranding of fish. It is therefore important to exercise caution when proceeding with dam removal due to the possibility of downstream flooding and damage and the re-entry of dam material into the water body.

This code of practice allows for the removal of a beaver dam which is impounding water that may cause imminent threat of damage to nearby infrastructure, or is obstructing fish passage.

A project review by DFO is not required when the conditions and measures set out in this code of practice **and** all applicable measures to protect fish and fish habitat are applied.

This code does not remove or replace the obligation to comply with all applicable statutory and regulatory requirements of the *Fisheries Act*, *Species at Risk Act*, or other federal, provincial, or municipal legislation and policies.

2.0 You can use this code of practice if

- There are no shellfish listed under the *Species at Risk Act*, or critical habitat or residences of endangered or threatened aquatic species present in the work zone or the vicinity of the works, undertakings and activities. Consult the aquatic species at risk maps to determine where at-risk populations occur in Canada and where their critical habitat is located.
- The removal activities are limited to removing or breaching the beaver dam itself and do not involve channel or shoreline modification straightening, ditching, etc..
- Explosives are not used to remove the dam.
- You follow the measures in this code of practice and all other applicable Measures to Protect Fish and Fish Habitat.

Request a project near water review when the works, undertakings and activities do not meet all of the criteria listed in this section.

3.0 Measures to protect fish and fish habitat

3.1 Protection of fish

- Plan in-water works, undertakings and activities to respect timing windows to protect fish and fish habitat.
    - Limit the duration of in-water works, undertakings and activities so that it does not diminish the ability of fish to carry out one or more of their life processes (e.g. , spawning, rearing, feeding, migrating).

3.2 Protection of the riparian zone

- Use existing trails, roads, access points or cut lines wherever possible.
- Avoid tree, shrub removal whenever possible.
- Use methods to prevent substrate compaction (e.g., swamp mats, pads).
- Avoid stockpiling of material on stream banks and in riparian zones.
- Do not grade streambanks or approaches.
- Limit access to shorelines and banks or areas adjacent to water bodies.
- Construct roads, access points and approaches perpendicular to the watercourse or water body.
- Prune or top the vegetation instead of grubbing/uprooting.
- Limit grubbing on watercourse banks to the area required for the footprint of the works, undertakings and activities.
- Remove vegetation species selectively and in phases.
- Re-vegetate the disturbed areas with native species suitable for the site.
- Restore stream banks and riparian vegetation affected by the works, undertakings and activities to their natural state (substrate granularity, profile, vegetation, etc.).

3.3 Protection of aquatic habitat

- Operate machinery in a manner that minimizes disturbance to the banks of the watercourse.

- Conduct in-water works, undertakings and activities during periods of low flow or at low tide.
- Maintain an appropriate depth and flow (i.e., base flow and seasonal flow of water) for the protection of fish habitat.
- Replace/restore any other disturbed habitat features and remediate any areas impacted by the works, undertakings and activities.

3.4 Protection of fish habitat from sedimentation

- Install effective erosion and sediment control measures prior to beginning works, undertakings and activities.
    - Develop and implement an erosion and sediment control plan to prevent the introduction of sediment into any water body during all phases of the works, undertakings and activities.
    - Schedule work to avoid wet, windy and rainy periods (and heed weather advisories) that may result in high flow volumes and/ or increase erosion and sedimentation.
    - Regularly inspect and maintain the erosion and sediment control measures and structures during all phases of the works, undertakings and activities.
    - Regularly monitor the watercourse for signs of sedimentation during all phases of the works, undertakings and activities and take corrective action if required.
    - Use biodegradable erosion and sediment control materials whenever possible.
    - Operate machinery on land in stable dry areas.
    - Keep the erosion and sediment control measures in place until all disturbed ground has been permanently stabilized.
    - Remove all sediment control materials once the site has been stabilized.

- Dispose of and stabilize all excavated material above the ordinary high water mark or top of bank of nearby water bodies and ensure sediment entry to the watercourse is prevented.

3.5 Protection of fish and fish habitat from deleterious substances (including suspended sediment)

- Develop and immediately implement a response plan to prevent deleterious substances from entering a water body.
  - Stop works, undertakings and activities in the event of a spill of a deleterious substance.
  - Immediately report any spills (e.g., sewage, oil, fuel or other deleterious material), whether near or directly into a water body.
  - Keep an emergency spill kit on site during all phases of the works, undertakings and activities.
  - Contain any water with deleterious substances.
  - Ensure clean-up measures are suitably applied so as not to result in further alteration of the bed and/or banks of the watercourse.
  - Clean-up and appropriately dispose of water contaminated with deleterious substances.
  - Maintain all machinery on site in a clean condition and free of fluid leaks.
  - Wash, refuel and service machinery and store fuel and other materials for the machinery in such a way as to prevent any deleterious substances from entering the water.
  - Dispose of all waste materials (e.g., construction, demolition, commercial logging) above the ordinary high-water mark of nearby water bodies to prevent entry into the watercourse.

3.6 Additional measures for beaver dam removal

- Remove beavers prior to undertaking the removal of the beaver dam. Their removal must be undertaken in compliance with all relevant Acts and Regulations.
- When a series of dams is to be removed, this should be done from downstream to upstream in order to avoid severe flooding and damage to fish habitat.
- Removing a beaver dam by non-mechanical methods (by hand) is preferred over using industrial equipment.
- When dewatering beaver impoundments:
    - Remove the dam gradually to prevent sediment at the bottom of the pond from being released downstream.
    - Ensure the width of the breach opening of the beaver dam does not exceed the width of the original stream channel.
    - As the water levels drop in the upstream pond, increase the size of the opening to drain the pond to the desired water level.
    - The original watercourse bed and bank material and/or the beaver lodge(s) may not be removed or disturbed.
- Relocate any fish that become trapped in isolated pools or stranded in newly flooded areas to the main channel of the watercourse.
    - Relocate any fish as per applicable permits for capturing and relocating fish.

4.0 Notification

When making use of this code of practice, please submit a Notification Form (PDF, 50 KB) to your regional DFO office to help us improve this fish and fish habitat protection guidance over time.

It is your *Duty to Notify* DFO if you have caused, or are about to cause, the unauthorized death of fish by means other than fishing and/or the harmful alteration, disruption or destruction of fish habitat. Such notifications should be directed to the Fish and Fish Habitat Protection Program.

5.0 Contact us

If you have questions regarding this code of practice contact the Fish and Fish Habitat Protection Program located in your region.

6.0 Glossary

Deleterious substance

Any substance that, if added to any water, would degrade or alter or form part of a process of degradation or alteration of the quality of that water so that it is rendered or is likely to be rendered deleterious to fish or fish habitat or to the human use of fish that frequent that water.

Ordinary high-water mark

The usual or average level to which a body of water rises at its highest point and remains for sufficient time to change the characteristics of the land. In flowing waters (e.g., rivers, streams) this refers to the "active channel/bank-full level" which is often the 1:2 year flood flow return level. In inland lakes, wetlands or marine environments it refers to those parts of the water body, bed and banks that are frequently flooded by water so as to leave a mark on the land and where the natural vegetation changes from predominately aquatic vegetation to terrestrial vegetation (excepting water tolerant species). For reservoirs this refers to normal high operating levels (i.e. full supply level).

Riparian zone

Area adjacent to streams, lakes, and wetlands that support a unique mixture of water tolerant vegetation from trees and shrubs to aquatic and herbaceous plants.

Date modified:

2020-07-08

Interim code of practice: culvert maintenance

1 About this code of practice

This code of practice outlines national best practices for culvert maintenance. Culvert maintenance is undertaken to extend the life of the structure and to ensure that it functions as designed (this includes baffled culverts). For the purpose of this code, culvert maintenance includes the manual or mechanical removal of accumulated debris (e.g. logs, sediment, boulders, garbage, ice build-up) that prevents the efficient passage of water and fish through the structure. Culvert maintenance may also include the reinforcement of eroding inlets and outlets but does not include the replacement of damaged or destroyed bevel ends.

This code of practice provides useful information on the measures to follow to ensure that fish and fish habitat are protected. This code applies to routine culvert maintenance only and does not apply to culvert replacement or extension, installation of liners, trash rack installation or beaver dam removal.

Some potential impacts to fish and fish habitat from culvert maintenance could include but are not limited to: the sedimentation of aquatic habitat; changes in food supply; changes in flow regime and fish passage; changes to the riparian zone; and the accumulation of deleterious substances.

A project review by DFO is not required when the conditions and measures set out in this code of practice **and** all applicable Measures to Protect Fish and Fish Habitat are applied.

This code does not remove or replace the obligation to comply with all applicable statutory and regulatory requirements of the *Fisheries Act*, or other federal, provincial, or municipal legislation and policies.

2 You can use the code of practice if:

- There are no shellfish listed under the *Species at Risk Act*, or critical habitat or residences of endangered or threatened aquatic species present in the work zone or the vicinity of the works, undertakings and activities. Consult our aquatic species at risk maps to determine where at-risk populations occur in Canada and where their critical habitat is located.
- The work does not include realigning the watercourse, installing a culvert liner or support struts, replacing damaged or destroyed bevel ends or extending/replacing the existing culvert.
- The work does not include any dredging, infilling, (e.g., filling scour pools) or excavation of the channel upstream or downstream of the culvert.
- There is no use of explosives.
- There is no temporary or permanent increase in the existing footprint below the ordinary high water mark (see definition below).
- You follow the measures in this code of practice and all other applicable Measures to Protect Fish and Fish Habitat.

Request a project near water review when the works, undertakings and activities do not meet all of the criteria listed in this section.

3 Measures to protect fish and fish habitat

3.1 Protection of fish

- Plan in water works, undertakings or activities to respect timing windows to protect fish and fish habitat.
- Conduct in-water works, undertakings and activities during periods of low flow.
- Limit the duration of in-water works, undertakings and activities so that it does not diminish the ability of fish to carry out one or more of their life processes (e.g. spawning, rearing, feeding, migrating).
- Employ fish exclusion netting (up and downstream) to isolate the work site if fish are observed in the vicinity of the works, undertakings and activities.
- Maintain an appropriate depth and flow (i.e. base flow and seasonal flow of water) for the protection of fish.

3.2 Protection of fish passage

- Maintain fish passage during the works, undertakings and activities.
    - Avoid changing flow or water level.
    - Avoid obstructing and interfering with the movement and migration of fish.

3.3 Protection of the riparian zone

- Limit access to shorelines and banks or areas adjacent to water bodies.
- Prune or top the vegetation instead of grubbing/uprooting.
- Limit grubbing on watercourse banks to the area required for the footprint of works, undertakings and activities.
- Construct roads, access points and approaches perpendicular to the watercourse or water body.

- Remove vegetation or species selectively and in phases.
- Re-vegetate the disturbed areas with native species suitable for the site.
- Restore the stream banks and riparian vegetation affected by the works, undertakings and activities to their natural state (substrate granularity, profile, vegetation, etc.).

3.4 Protection of fish habitat from sedimentation

- Use only clean materials (e.g., rock, coarse gravel, wood, steal, snow) for works, undertakings and activities.
- Install effective erosion and sediment control measures prior to beginning works, undertakings and activities in order to stabilize all erodible and exposed areas.
    - Develop and implement an erosion and sediment control plan to avoid the introduction of sediment into any water body during all phases of the works, undertakings and activities.
    - Schedule work to avoid wet, windy and rainy periods and heed weather advisories.
    - Regularly inspect and maintain the erosion and sediment control measures and structures during all phases of the works, undertakings and activities.
    - Regularly monitor the watercourse for signs of sedimentation during all phases of the works, undertakings and activities and take corrective action if required.
    - Use biodegradable erosion and sediment control materials whenever possible.
    - Keep the erosion and sediment control measures in place until all disturbed ground has been permanently stabilized.

- Remove all sediment control materials once site has been stabilized.
- Dispose of, and stabilize, all excavated material above the ordinary high water mark or top of bank of nearby waterbodies and ensure sediment re-entry to the watercourse is prevented.

3.5 Protection of fish and fish habitat from deleterious substances (including suspended sediment)

- Develop and immediately implement a response plan to prevent deleterious substances from entering a water body.
  - Stop works, undertakings and activities in the event of a spill of a deleterious substance.
  - Immediately report any spills (e.g., sewage, oil, fuel or other deleterious material), whether near or directly into a water body.
  - Keep an emergency spill kit on site during all phases of the works, undertakings and activities.
  - Contain any water with deleterious substances.
  - Ensure clean-up measures are suitably applied so as not to result in further alteration of the bed and/or banks of the watercourse.
  - Clean-up and appropriately dispose of water contaminated with deleterious substances.
  - Maintain all machinery on site in a clean condition and free of fluid leaks.
  - Wash, refuel and service machinery and store fuel and other materials for the machinery in such a way as to prevent any deleterious substances from entering the water.
  - Dispose of all waste materials (e.g., construction, demolition, commercial logging) above the ordinary high water mark to prevent entry into the water body.

3.6 Additional measures for culvert maintenance

- Limit the removal of accumulated material and debris (e.g., branches, stumps, other woody materials, garbage, etc.) to the area within the culvert and immediately upstream and downstream of the culvert.
    - Remove accumulated materials and debris slowly to allow clean water to pass, to prevent downstream flooding and to reduce the amount of sediment-laden water going downstream.
    - If maintenance activities reduce the water level within the culvert, take appropriate measures to restore previous streambed elevation/conditions.
- If replacement rock reinforcement/armouring is required to stabilize eroding inlets and outlets, the following measures should be implemented:
    - Place appropriately-sized, clean rocks into the eroding area.
    - Do not obtain rocks from below the ordinary high water mark of any water body.
    - Ensure that acid generating rock is not used.
    - Avoid the use of rock that fractures and breaks down quickly when exposed to the elements.
    - Install rock at a similar slope to maintain a uniform stream bank and natural stream alignment.

4 Notification

When making use of this code of practice, please submit a Notification Form (PDF, 50 KB) to your regional DFO office to help us improve this fish and fish habitat protection guidance over time.

> You must download and save this PDF form to your computer before filling it out.
> How to download and open a PDF form

It is your *Duty to Notify* DFO if you have caused, or are about to cause, the unauthorized death of fish by means other than fishing and/or the harmful alteration, disruption or destruction of fish habitat. Such notifications should be directed to the Fish and Fish Habitat Protection Program.

5 Contact us

If you have questions regarding this code of practice contact the Fish and Fish Habitat Protection Program located in your region.

6 Glossary

Ordinary high water mark

The usual or average level to which a body of water rises at its highest point and remains for sufficient time to change the characteristics of the land. In flowing waters (e.g., rivers, streams) this refers to the "active channel/bank-full level" which is often the 1:2 year flood flow return level. In inland lakes, wetlands or marine environments it refers to those parts of the water body, bed and banks that are frequently flooded by water so as to leave a mark on the land and where the natural vegetation changes from predominately aquatic vegetation to terrestrial vegetation (excepting water tolerant species). For reservoirs this refers to normal high operating levels (i.e. full supply level).

Riparian zone

Area adjacent to streams, lakes, and wetlands that support a unique mixture of water tolerant vegetation from trees and shrubs to aquatic and herbaceous plants.

Date modified:

2020-07-06

Interim code of practice: End-of-pipe fish protection screens for small water intakes in freshwater

1 About this code of practice

This code of practice provides national guidance on the design, installation and maintenance of small end-of-pipe water intake fish screens to prevent entrainment and impingement of fish. Entrainment occurs when a fish is drawn into a water intake and cannot escape. Impingement occurs when a fish is held in contact with the intake screen and is unable to free itself.

The end-of-pipe fish screen code of practice describes best practices to follow when designing, installing, maintaining and cleaning low volume water intakes that have the potential to impact fish. This code of practice is for small-scale water intakes (e.g. irrigation, construction, municipal and private water supplies, mining exploration) where the water intake flow rate is up to 0.150 m^3/s, or 150 litres per second (L/s). Impacts related to fish habitat and changes in flow conditions are not covered by this code of practice.

When working in water, it is important to have a good understanding of local conditions. For example, water velocity, flow, depth, the type of fish species present and their abundance and swimming abilities are all important factors to consider when designing, installing, maintaining and

cleaning small end-of-pipe water intake fish screens. This code of practice provides necessary information and guidance on the measures to follow to ensure maximum protection of fish. The sizing and design specifications of fixed screens in this code are exclusively for fish that have a minimum fork length of 25 mm. Entrainment and impingement impacts on eggs and larval fish can be minimized by following the measures below.

A project review is not required when the conditions and measures set out in this code of practice **and** all applicable measures to protect fish and fish habitat are applied.

This code does not remove or replace the obligation to comply with all applicable statutory and regulatory requirements in place by other sections of the *Fisheries Act*, or other federal, provincial, or municipal legislation and policies associated with water extraction.

2 You can use this code of practice if:

- There are no aquatic species at risk present in the work zone or the **affected area**. Consult our aquatic species at risk maps to determine where at-risk populations occur in Canada and where their critical habitat is located
- The water withdrawal is for small-scale water intakes, where the water intake flow rate is up to 0.150 m^3 /s, or 150 litres per second (L/s)
- You incorporate the measures in this code of practice and all other applicable measures to protect fish and fish habitat

Request a project near water review when the works, undertakings or activities do not meet all the criteria listed in this section.

3 Measures to protect fish and fish habitat for end-of-pipe fish screens

1 Fish screen design

Three criteria need to be considered when designing a fish screen for water intakes:

- Effective screen area
- Screen material
- Screen shape

1.1 Effective screen area

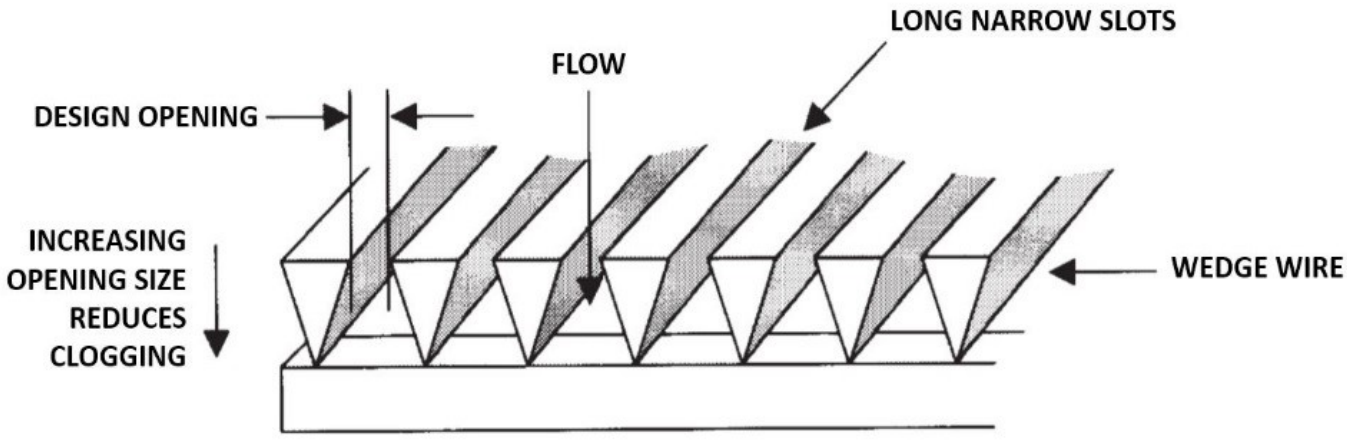
Larger screens reduce the approach velocity so fish are more likely to outswim the flow entering the intake. The screen area needed depends on the amount of water being withdrawn and the species of fishes that frequent the intake location. The total submerged screen area available for the free flow of water is referred to as the effective screean area.

- Use the End-of-Pipe Screen Size Tool to determine the effective screen area for your project
    - to protect fish from impingement or entrainment, the approach velocity (i.e., the water velocity into, or perpendicular to, the face of an intake screen) should not exceed the values set for each species
    - you should apply a precautionary approach when a species is absent or unknown by using the ‘All/Unknown' option in the species selection list. This selection will determine the effective screen area for the weakest swimming fishes

1.2 Screen material

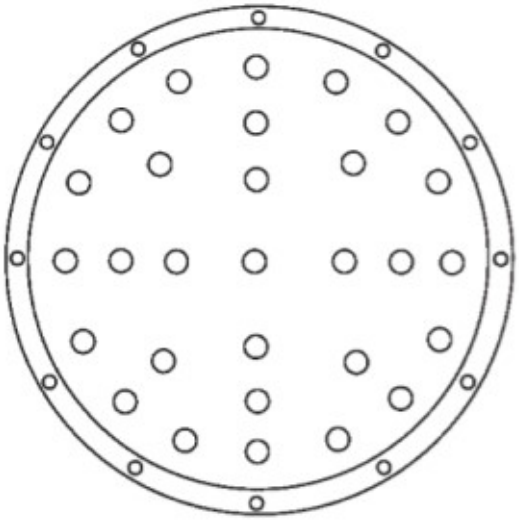
For a fish screen to prevent entrainment, the openings must be small enough so a fish cannot pass through. The narrowest dimension of any opening on the screen, regardless of opening shape, is referred to as the design **opening** (Figure 1). The maximum design opening for a fish of 25 mm fork length is estimated at 2.54 mm.

- Ensure the design opening of the screen material does not exceed 2.54 mm
- Ensure there are no protrusions on the screen surface of support structures that could injure fish
- Use welded wedge wire screens (Figure 2), whenever possible
- Ensure screen material is resistant to corrosion and UV light (i.e., brass, bronze, aluminum, monel metal, galvanized or stainless steel, plastics)
- Use material that minimizes clogging

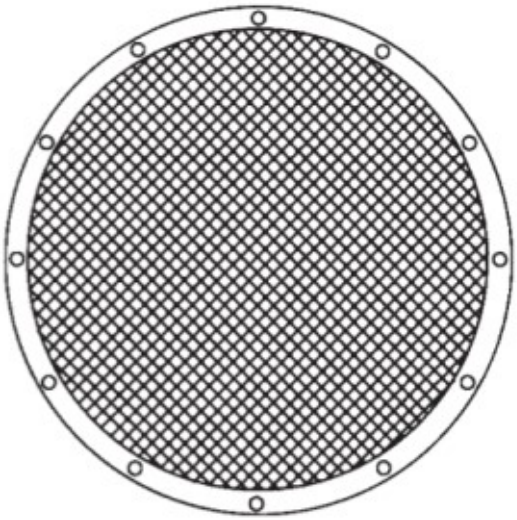


▶ Figure 1

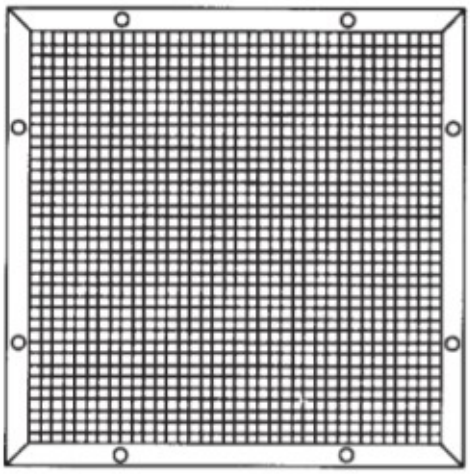
PERFORATED PLATE (PUNCHED)



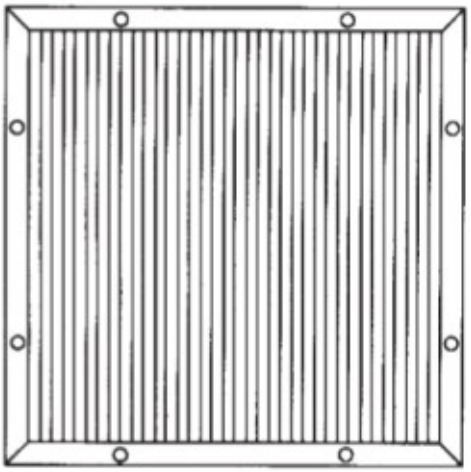
CIRCULAR MESH SCREEN



SQUARE MESH SCREEN

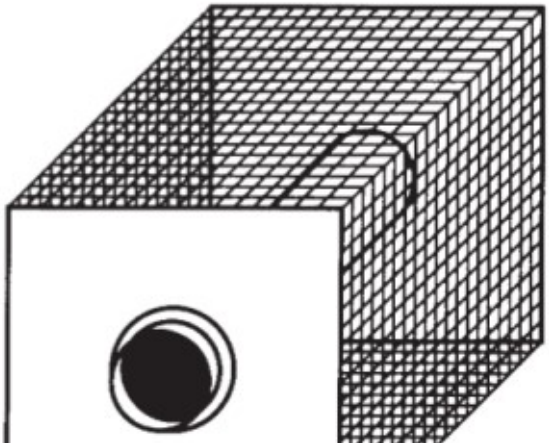


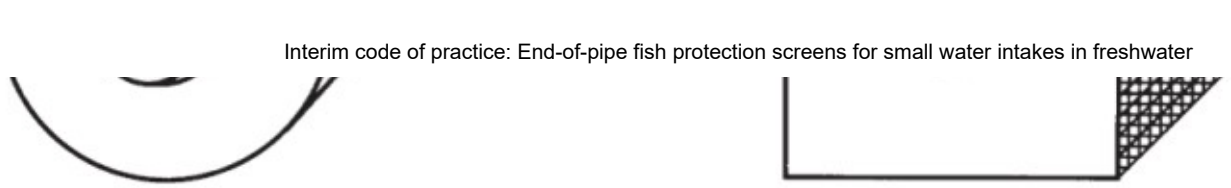
SQUARE WEDGE WIRE SCREEN



DRUM OR CYLINDER WITH PERFORATED PIPE

BOX-TYPE WITH MESH SCREEN



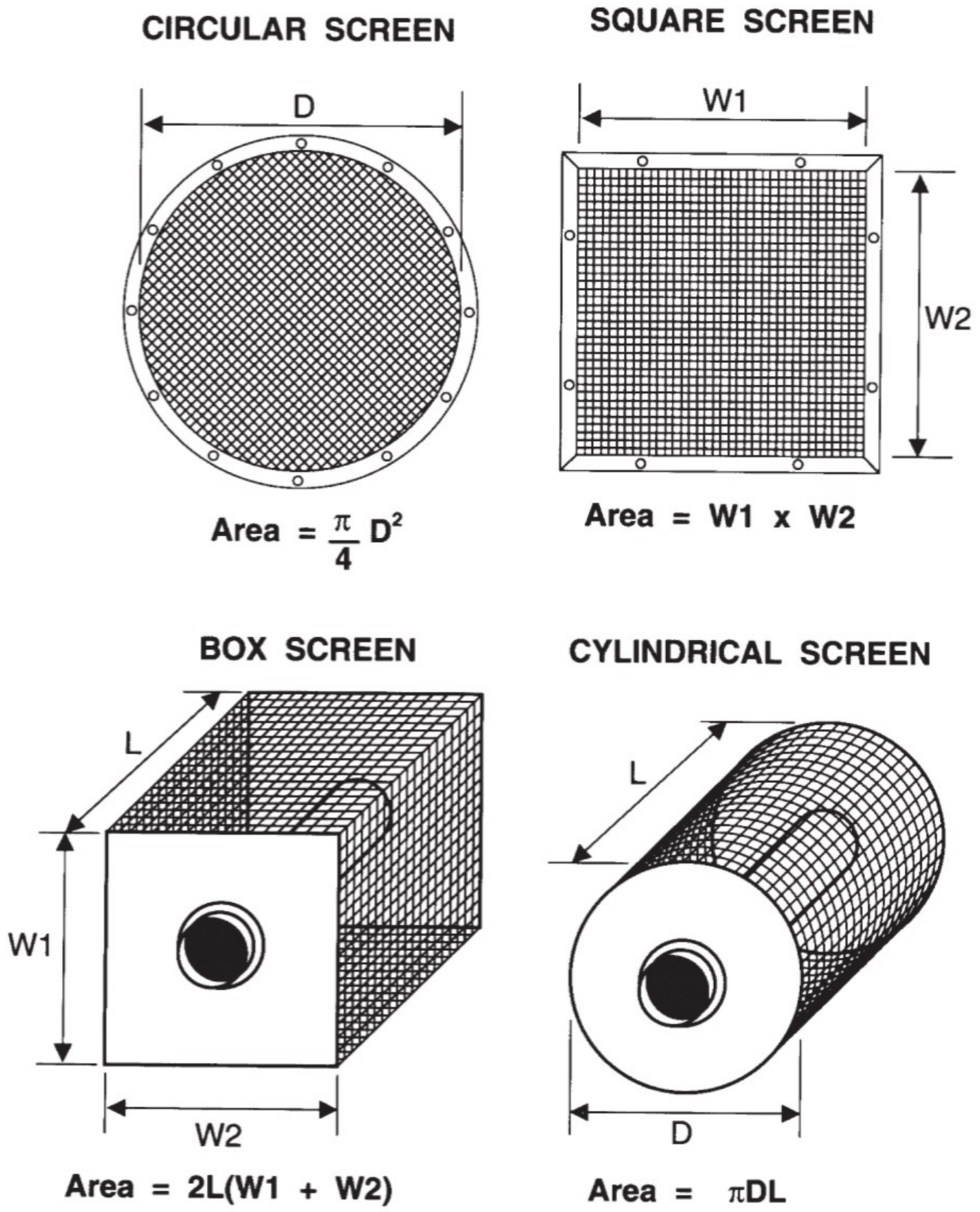


▶ Figure 2

1.3 Screen shape

Use a manifold on designs where the flow would be uneven across the surface of the screen (e.g.: cylindrical or box type) (Figure 3).

- Ensure the manifold is equal distance from the outer screen
- Cap the end of the manifold with a solid material


CIRCULAR SCREEN
D
Area = π/4 D²
SQUARE SCREEN
W1
W2
Area = W1 x W2
BOX SCREEN
L
W1
W2
Area = 2L(W1 + W2)
CYLINDRICAL SCREEN
L
D
Area = πDL

▶ Figure 3

2 Fish screen installation

Consider the following best practices when installing a fish screen:

- Plan in water work, undertaking or activity to respect timing windows to protect fish including their eggs, juveniles, spawning adults and/or the organisms upon which they feed and migrate
- Place screens away from natural or man-made structures that may attract fish that are migrating, spawning, or in rearing habitat
- Place screens in waters with low concentrations of fish throughout the year
- Orient the screen so any natural water flow passes across the surface of the screen material
- Place screens a minimum of 30 cm above the bottom of the watercourse to prevent the entrainment of sediment and benthos that dwell in the substrate
- Ensure all openings for guides and seals are smaller than the opening width of the screen material (2.54 mm) so fish cannot pass through
- Ensure there is enough structural support to prevent sagging or collapsing of the screen panel
- Account for the areas blocked by supports while meeting the effective screen area recommended in this code of practice
- Protect large screens with trash racks fabricated of bar (150 mm spacing is typical) or grating in areas where there is debris loading (i.e. woody material, leaves or algae mats)
- Check the approach velocity directly in front of the screen to ensure it does not exceed the designed approach velocity at any location
- Avoid withdrawing water from the littoral zone when possible
- When possible, avoid withdrawing water, or reduce the rate of water withdrawal, during critical timing windows to diminish the likelihood of entraining eggs and larval fish

3 Screen maintenance and cleaning

Debris or damage to screens can cause uneven intake flow across the screen surface. Uneven flow may result in higher intake velocities on some sections of the screen, increasing the likelihood of impinged fish. You can verify the pump's approach velocity to assess the need for screen cleaning using a flow meter. Keeping fish screens clean maintains their effectiveness for supplying water and protecting fish.

- Properly maintain cleaning apparatuses, seals and screens
- Turn off intake pump prior to the removal of the screen for cleaning and/ or maintenance

4 Project notification

Please submit a Notification Form to your regional DFO (Fisheries and Oceans Canada) office to help us improve this fish and fish habitat protection guidance over time.

> You must download and save this PDF form to your computer before filling it out.
> How to download and open a PDF form

Notification form

(PDF (Portable Document Format), 41 KB (KiloByte))

5 Contact us

If you have questions regarding this Code of Practice contact the Fish and Fish Habitat Protection Program located in your region.

6 Glossary

Affected area

Area within which potential impacts from works, undertakings or activities are likely to occur.

Approach velocity

The water velocity measured directly in front of the intake screen.

Benthos

Organisms that live on or in the bottom sediments of a body of water.

Design opening

The narrowest dimension of any opening on the screen, regardless of opening shape.

Effective screen area

The area of the open spaces available for the free flow of water, including screen material but excluding major support structures.

Entrainment

Occurs when a fish is drawn into a water intake and cannot escape.

Fork length

The straight line distance measured from the tip of the nose to the fork of the tail of a fish.

Impingement

Occurs when an entrapped fish is held in contact with the intake screen and is unable to free itself.

Intake flow rate

The amount of water withdrawn over time.

Littoral zone

The shallow water near shore. The depth of the littoral zone varies but is generally 2-5 meters deep in most freshwater systems.

Date modified:

2020-02-06

Interim code of practice: Routine maintenance dredging

1 About this code of practice

This code of practice outlines national best practices for routine maintenance dredging. Routine maintenance dredging occurs at least once every 10 years and involves the mechanical removal of accumulated sediment from the bed of a waterbody with clamshell buckets, draglines, backhoes or suction dredges. Routine dredging helps to maintain the design depths of navigation channels, harbours, marinas, boat launches, docking sites and port facilities that contribute to tourism, recreation and the transportation of goods.

Some potential impacts to fish habitat from routine maintenance dredging could include but are not limited to: sedimentation of aquatic habitat, change of aquatic habitat and vegetation, change in riparian zones and accumulation of deleterious substances.

This code of practice provides useful information on the measures to follow to ensure that fish and fish habitat are protected. This code applies to routine maintenance dredging only and does not apply to new dredging projects or to the expansion of a previously dredged area.

A project review by DFO is not required when the conditions and measures set out in this code of practice **and** all applicable measures to protect fish and fish habitat are applied.

This code does not remove or replace the obligation to comply with all applicable statutory and regulatory requirements of the *Fisheries Act*, or other federal, provincial, or municipal legislation and policies.

2 You can use this code of practice if:

- there are no SARA-listed shellfish, or critical habitat or residences of freshwater endangered or threatened aquatic species present in the work zone or the **affected area** except where exempted in the recovery strategy for that species. Consult our aquatic species at risk maps to determine where at-risk populations occur in Canada and where their critical habitat is located
- you performed analysis on the polychlorinated biphenyls (PCB) content of the substrate to be dredged, within the last 5 years and you were not required to apply mitigation measures over and above best management practices for dredging
- you are dredging in an area that has been dredged within the past 10 years
- your project does not include propeller wash dredging
- you are not temporarily or permanently increasing the existing footprint of the dredge and disposal areas
- you dispose of dredged material and stabilize it on land following provincial legislation or you dispose of dredged material in an approved Marine Disposal and Dumping Site
- you incorporate the applicable measures in this code of practice and all other applicable measures to Protect Fish and Fish Habitat

Consult our Projects near water review webpage when the works, undertakings or activities do not meet all the criteria listed in section 2.

3 Measures to protect fish and fish habitat for routine maintenance dredging

1 Timing windows

- Plan in water works, undertakings or activities to respect timing windows to protect fish including their eggs, juveniles, spawning adults and/or the organisms upon which they feed and migrate
- Conduct in-water work, undertaking and activity during periods of low flow
- Limit the duration of in-water work, undertaking and activity so that it does not diminish the ability of fish to carry out one or more of their life processes (e.g. spawning, rearing, feeding, migrating)

2 Dredging

- Limit impacts of fish habitat components to those approved for the work, undertaking or activity
    - Limit the amount of dredged material removed for depth require for navigation
- For water-based operations, avoid placing vertical spuds or other anchors into sensitive fish habitat areas outside the footprint of the dredge area (e.g. eelgrass or kelp beds, saltmarshes, shellfish harvesting areas and known spawning areas)

3 Limit impacts on riparian vegetation

Limit impacts on riparian vegetation to those approved for the work, undertaking or activity.

- Limit access to banks or areas adjacent to waterbodies
- Prune or top the vegetation instead of grubbing/uprooting
- Limit grubbing on watercourse banks to the area required for the footprint of work, undertaking or activity
- Construct access points and approaches perpendicular to the watercourse or waterbody
- Remove vegetation or species selectively and in phases
- Re-vegetate the disturbed areas with native species suitable for the site

4 Limit impacts on habitat components

- Salvage, reinstate or match habitat structure (e.g., large wood debris, boulders, instream aquatic vegetation/substrate) to its initial state
- Restore stream geomorphology (i.e., restore the bed and banks, gradient and contour of the waterbody) to its initial state
- Replace/restore any other disturbed habitat features and remediate any areas impacted by the work, undertaking or activity

5 Ensure proper sediment control

Develop and implement a sediment control plan that minimizes sedimentation of the waterbody during all phases of the work, undertaking or activity.

- Operate machinery on land in stable dry areas, or from barges or on ice
- Use methods to prevent substrate compaction (e.g., swamp mats, pads)

- Where applicable, put in place site isolation measures (e.g., silt boom or silt curtain) to contain suspended sediment generated by dredging activities
- Schedule work to avoid wet, windy and rainy periods (and heed weather advisories)
- Inspect and regularly maintain erosion and sediment control measures and structures during all phases of the project
- Use biodegradable erosion and sediment control materials whenever possible
- Remove all exposed non-biodegradable erosion and sediment control materials once site is stabilized
- Monitor the watercourse to observe signs of sedimentation during all phases of the work, undertaking or activity and take corrective action

6 Deleterious substances

Develop a response plan that is to be implemented immediately in the event of a release or spill of a deleterious substance and keep an emergency spill kit on site.

- Stop work, contain sediment-laden water or other deleterious substances and prevent their further migration into the watercourse
- Report any spills of sewage, oil, fuel or other deleterious material, whether near or directly into a water body
- Maintain all machinery on site in a clean condition and free of fluid leaks to prevent any deleterious substances from entering the water
- Wash, refuel and service machinery and store fuel and other materials for the machinery in such a way as to prevent any deleterious substances from entering the water

4 Project notification

Please submit a Notification Form (PDF, 50 KB) to your regional DFO office to help us improve this fish and fish habitat protection guidance over time.

> You must download and save this PDF form to your computer before filling it out.
> How to download and open a PDF form

5 Contact us

If you have questions regarding this code of practice contact the Fish and Fish Habitat Protection Program located in your region.

6 Glossary

Affected area

Area within which potential impacts from works, undertakings or activities are likely to occur.

Navigation channels

Channels in the sea, lake or river bed that are wide and deep enough to accommodate vessels passing through to, or accessing a harbour, marina, boat launch or a port facility.

Date modified:

2020-10-22

Interim code of practice: temporary stream crossings

1 About this code of practice

This code of practice outlines national best practices for temporary stream crossings. For the purpose of this code of practice these may include fords, temporary clear span bridges (including Bailey bridges or log stringer bridges) and temporary winter crossings (i.e. ice bridges and snow fills). Temporary watercourse crossings are required to access infrastructure and property for construction and maintenance activities. They are employed for short term access across a watercourse by construction vehicles when an existing crossing is not available or practical to use. They are not intended for prolonged use (e.g., forest or mining haul roads).

The use of temporary bridges or dry fording is preferred over fording in flowing water due to the lower risk of fish injury and mortality, damaging the bed and banks of the watercourse, and sedimentation of downstream fish habitat.

Ice bridges and snow fills provide cost-effective access to remote areas when rivers and streams are frozen. Since the ground is frozen, ice bridges and snow fills can be built with minimal disturbance to the bed and banks of the watercourse.

There are however risks to fish and fish habitat associated with temporary stream crossings. These include the potential for: direct harm to stream banks and beds; release of sediments or other deleterious substances (e.g., fuel and lubricants); loss or damage of riparian vegetation; disruption of the sensitive life stages of fish; and injury and death of fish during wet fording. In the case of ice bridges and snow fills, blockage of fish passage during spring break up may also occur.

A project review by DFO is not required when the conditions and measures set out in this code of practice **and** all applicable Measures to Protect Fish and Fish Habitat are applied.

This code does not remove or replace the obligation to comply with all applicable statutory and regulatory requirements of the *Fisheries Act*, or other federal, provincial, or municipal legislation and policy.

2 You can use this code of practice if:

- There are no shellfish listed under the *Species at Risk Act*, or critical habitat or residences of endangered or threatened aquatic species present in the work zone or thevicinity of the works, undertakings and activities. Consult our aquatic species at risk maps to determine where at-risk populations occur in Canada and where their critical habitat is located.
- There is no temporary or permanent increase in existing footprint below the ordinary high water mark (see definition below) if the riparian area is identified as part of the critical habitat of an aquatic listed species at risk.
- The work does not include realigning the watercourse, dredging, placing fill, grading or excavating the bed or banks of the watercourse.
- The crossing does not involve installation of a temporary culvert.

- You follow the measures in this code of practice and all other applicable Measures to Protect Fish and Fish Habitat.

2.1 Temporary bridges

- Installation of a temporary bridge does not include pile driving.
- The temporary bridge is no greater than one lane wide with no part of the structure placed within the wetted portion of the watercourse.
- The work does not include the placement of abutments, footings or armouring (e.g., rock and concrete) below the ordinary high water mark.
- The channel width at the crossing is no greater than 5 meters from ordinary high water mark to ordinary high water mark.

2.2 Fords

- Fording consists of a one-time crossing (over and back) in flowing waters, or a seasonally dry streambed ford.
- The channel width at the crossing is no greater than 5 meters from ordinary high water mark to ordinary high water mark.

2.3 Winter crossings

- Snow fills are constructed of clean snow, and will not restrict water flow at any time.
- Snow fills will not result in erosion and sedimentation of the stream or alteration (e.g., compaction or rutting) of the bed and bank substrates.
- Materials such as gravel, rock and loose woody materials are NOT used in the construction of ice bridges.

Request a project near water review when the works, undertakings and activities do not meet all of the criteria listed in this section.

3 Measures to protect fish and fish habitat

3.1 Protection of fish

- Plan in water works, undertakings and activities to respect timing windows to protect fish and fish habitat.
- Limit the duration of in-water works, undertakings and activities so that it does not diminish the ability of fish to carry out one or more of their life processes (e.g., spawning, rearing, feeding, migrating).
- Maintain an appropriate depth and flow (i.e. base flow and seasonal flow of water) for the protection of fish.

3.2 Protection of fish passage

- Maintain fish passage during all phases of works, undertakings and activities.
    - Avoid changing flow or water levels.
    - Avoid obstructing and interfering with the movement and migration of fish.

3.3 Protection of the riparian zone

- Use existing trails, roads access points or cut lines wherever possible.
- Avoid tree/shrub removal whenever possible.
- Avoid stockpiling of material on stream banks and riparian zones.
- Do not grade stream banks or approaches.
- Use methods to prevent substrate compaction (e.g., swamp mats, pads).
- Limit access to banks or areas adjacent to water bodies.
- Construct roads, access points and approaches perpendicular to the watercourse or water body.

- Prune or top the vegetation instead of grubbing/uprooting wherever possible.
- Limit grubbing on watercourse banks to the area required for the footprint of the works, undertakings and activities.
- Remove vegetation or species selectively and in phases.
- Restore stream banks and riparian vegetation affected by the works, undertakings and activities to their natural state (substrate granularity, profile, vegetation, etc.).
- Re-vegetate the disturbed banks and adjacent areas) with native species suitable for the site.

3.4 Protection of aquatic habitat

- Avoid disturbing or removing aquatic vegetation, natural wood debris, rocks, sand or other materials from the banks, shoreline or the bed of the water body.
- Ensure there is no temporary or permanent increase in existing footprint below the ordinary high water mark.
- Operate machinery in a manner that minimizes disturbance to the watercourse bed and banks.
- Maintain an appropriate depth and flow (i.e., base flow and seasonal flow of water) for the protection of fish habitat.
- Conduct in-water works, undertakings and activities during periods of low flow, or at low tide.

3.5 Protection of fish habitat from sedimentation

- Use only clean materials (e.g., rock, coarse gravel, wood, steel, snow) for works, undertakings and activities.
- Install effective erosion and sediment control measures prior to beginning works, undertakings and activities in order to stabilize all

erodible and exposed areas.

- Develop and implement an erosion and sediment control plan to avoid the introduction of sediment into any water body during all phases of the works, undertakings and activities.
- Schedule work to avoid wet, windy and rainy periods (and heed weather advisories) that may result in high flow volumes and /or increase erosion and sedimentation.
- Operate machinery on land in stable dry areas.
- Regularly inspect and maintain the erosion and sediment control measures and structures during all phases of the project.
- Regularly monitor the watercourse for signs of sedimentation during all phases of the works, undertakings and activities and take corrective action if required.
- Use biodegradable erosion and sediment control materials whenever possible.
- Keep the erosion and sediment control measures in place until all disturbed ground has been permanently stabilized.
- Remove all sediment control materials once site has been stabilized.
- Dispose of, and stabilize, all excavated material above the ordinary high water mark or top of bank of nearby waterbodies and ensure sediment re-entry to the watercourse is prevented.

3.6 Protection of fish and fish habitat from deleterious substances (including suspended sediments)

- Develop and immediately implement a response plan to prevent deleterious substances from entering a water body.
  - Stop works undertakings and activities in the event of a spill of a deleterious substance.

- Immediately report any spills (e.g., sewage, oil, fuel or other deleterious material), whether near or directly into a water body.
- Keep an emergency spill kit on site during all phases the works, undertakings and activities.
- Contain any water with deleterious substances.
- Ensure clean-up measures are suitably applied so as not to result in further alteration of the bed and/or banks of the watercourse.
- Clean-up and appropriately dispose of water contaminated with deleterious substances.
- Maintain all machinery on site in a clean condition and free of fluid leaks.
- Wash, refuel and service machinery and store fuel and other materials for the machinery in such a way as to prevent any deleterious substances from entering the water.
- Dispose of all waste materials (e.g., construction, demolition, commercial logging) above the ordinary high water mark to prevent entry into the water body.

3.7 Additional measures for temporary crossings - general

- Locate temporary crossing site where streambanks are stable and where approaches have low slopes.
- Locate temporary crossing site where the stream is straight, unobstructed and well defined.
- Locate temporary crossing at a right angle to the stream.
- Ensure approach grades are kept to a minimum for at least 15m on each side of the crossing.

3.8 Additional measures for fords

- Locate fording site where stream substrate is stable or is a bedrock outcrop.
- Limit machinery fording of the watercourse to a one-time event (over and back).
- Conduct fording during periods of low flow.
- Stabilize approaches with non-erodible materials such as brush mats, corduroy or clean stone.
- Restore approaches and banks of the watercourse to its natural state.
- Do not skid or drag anything across ford.
- Do not use ford if the water depth is greater than the axle height of the vehicle.
- Do not manipulate material in the wetted portion of the watercourse while fording the watercourse.

3.9 Additional measures for winter crossings (ice bridges and snow fills)

- Construct snow bridges on large watercourses that have sufficient stream flow and water depth to prevent the ice bridge from coming into contact with the stream bed or restricting the water movement beneath the ice.
- Use only clean water, ice or snow to construct winter crossing.
- Construct approaches using clean compacted snow and ice to a sufficient depth to protect the banks of the watercourse.
- Do not exceed 10% of the instantaneous flow if withdrawing any water, in order to maintain existing fish habitat and flow under the ice.
- Screen intake pipes to prevent entrainment or impingement of fish.
    - Use the interim code of practice for end-of-pipe fish protection screens for small water intakes in freshwater.

- Where logs are used to stabilize the approaches of an ice bridge or snow fill:
    - Do not leave logs or woody debris within the water body or on the banks or shoreline where they can wash back into the water body.
    - Ensure that the logs are clean and securely bound together so they can be easily removed either before or immediately following spring freshet.
- Maintain natural, under ice water flow where it occurs.
- Place notch in center of the ice bridge to encourage proper melting and reduce flooding, to ensure that fish passage is maintained.
- Remove compacted snow from the snow fills prior to the spring freshet.

3.10 Additional measures for temporary clear span bridges

- Ensure the single-span bridge structure, including approaches, abutments, footings, and armoring is built entirely above the ordinary high water mark.
- Design the bridge so that storm water runoff from the bridge deck, side slopes and approaches directly run off into a retention pond or vegetated area to prevent sediment and other deleterious substances from entering the watercourse.
- Design temporary bridges to accommodate any expected high flows of the watercourse during the construction period.
- Remove bridge crossing prior to the spring freshet, unless the crossing has been constructed above the annual spring high water level.

4 Notification

When making use of this code of practice, please submit a Notification Form (PDF, 50 KB) to your regional DFO office to help us improve this fish and fish habitat protection guidance over time.

> You must download and save this PDF form to your computer before filling it out.
> How to download and open a PDF form

It is your *Duty to Notify* DFO if you have caused, or are about to cause, the unauthorized death of fish by means other than fishing and/or the harmful alteration, disruption or destruction of fish habitat. Such notifications should be directed to the Fish and Fish Habitat Protection Program.

5 Contact us

If you have questions regarding this code of practice contact the Fish and Fish Habitat Protection Program located in your region.

6 Glossary

Ford

A shallow, stable crossing location that does not require alteration of the bed or bank of the watercourse.

Ordinary high water mark

The usual or average level to which a body of water rises at its highest point and remains for sufficient time so as to change the characteristics of the land. In flowing waters (e.g., rivers, streams) this refers to the "active channel/bank-full level" which is often the 1:2 year flood flow return level. In inland lakes, wetlands or marine environments it refers to those parts of the water-body bed and banks that are frequently flooded by water so as to leave a mark on the land and where the natural vegetation changes from

predominately aquatic vegetation to terrestrial vegetation (excepting water tolerant species). For reservoirs this refers to normal high operating levels (i.e. full supply level).

Riparian zone

Area adjacent to streams, lakes, and wetlands that support a unique mixture of water tolerant vegetation from trees and shrubs to aquatic and herbaceous plants.

Temporary clear span bridge

Small scale bridge structures (e.g., Bailey bridge or log stringer bridge) that completely span the watercourse, do not alter the stream bed or bank, and are a maximum of one lane wide. The bridge structure (including bridge approaches, abutments, footings, and armouring is built entirely above the ordinary high water mark.

Winter crossings - Ice bridges and snow fills

These are two methods used for temporary winter access in remote areas. Ice bridges are constructed on large watercourses that have sufficient stream flow and water depth to prevent the ice bridge from coming into contact with the stream bed or restricting water movement beneath the ice. Snow fills are temporary stream crossings constructed by filling a stream channel with clean compacted snow, and are typically used for crossing smaller watercourses.

Date modified:

2020-07-02

Appendix C: GNWT Department of Lands 2022 Inspection Report

Department of Lands
Dehcho Region
P.O. Box 150
Fort Simpson, NT X0E 0N0

Telephone: 867-695-2626 ext. 206
Fax: 867-695-2615

September 2, 2022

Paramount Resources Ltd
Suite 2800, 421 7th Ave SW
Calgary, AB T2P 4K9

Attention: Terrence Hughes

File Number	**MV2020A0009**
Type of Operation	**OIL AND GAS DRILLING - WELLSITE**
Location	**F-25, F-25A, K-29, M-25, O-80, Quarry**

Dear Terence Hughes,

An inspection of the above noted operation was conducted on August 24th, 2022 by Resource Management Officer II Andrew Lirette and Manager, Resource Management Danielle Rogers.

Enclosed is a copy of the Environmental Inspection Report.

If you have any questions, please contact me at 867-695-2626 ext. 206.

Sincerely,

Andrew Lirette

Andrew Lirette
Resource Management Officer II
Department of Lands
Dehcho Region

CC: Andrew Wheeler – Regulatory Specialist, MVLWB
Kyle Christiansen - Regional Superintendent, Department of Lands, Dehcho Region
Danielle Rogers - Manager, Resource Management, Department of Lands, Dehcho Region

ENVIRONMENTAL INSPECTION REPORT

Permittee:	Paramount Resources Ltd	**Permit Expiry Date:**	November 19, 2025
Land Use Permit No.	MV2020A0009	**Previous Inspection:**	August 23, 2021
Quarrying Permit No.	21/0002	**Inspection Date:**	August 24, 2022
Contractor:		**Subcontractor:**	
Location(s) Inspected:	F-25, F-25A, K-29, M-25, O-80, Quarry		
Current Stage of Operation:	Abandonment and Reclamation		
Program Modifications Approved:	N/A		

Condition of Operation "A" - Acceptable "U" - Unacceptable "N/A" - Not Applicable "N/I" - Not Inspected

	Operating Condition	Aspect Inspected				
		Well Sites and Quarry				
	Location as Permitted	A				
	Time as Permitted	A				
	Equipment as Approved (Type & Size)	A				
	Methods & Techniques	A				
	Facilities	A				
	Erosion (Control or Prevention)	A				
	Chemicals	A				
	Wildlife and Fisheries Habitat (Protection)	A				
	Wastes	A				
	Fuel Storage	A				
	Brush Disposal	A				
	Restoration of Lands	A				
	Permits	A				

Explanatory Remarks –

Inspectors from the Department of Lands conducted an inspection of Land Use Permit MV2020A0009 on August 24th, 2022 via helicopter. The inspection consisted of well sites F-25/F-25A, K-29, M-25, O-80, and the Quarry located across from the barge landing.

F-25/F-25A: All infrastructure was in good condition and the fenced off sump was almost dried up. The wellhead was still present. Vegetation is growing nicely throughout the site and there were no signs of erosion.

K-29: There was another helicopter at the site during the inspection. All infrastructure was in good condition and the wellheads, along with other miscellaneous materials, were still on site. Vegetation growth was present in some areas, but there were also a lot of bare spots. No erosion was observed.

ENVIRONMENTAL INSPECTION REPORT

M-25: Infrastructure and the sump berm were both in good condition. The wellheads were still in the ground. The site had vegetation growing on most of it, however, there were a few small bare spots. No erosion was observed.

O-80: Infrastructure was in good condition except for the missing wind sock. Vegetation growth was present in most of the area, with less occurring on the access road and turn around area. No signs of erosion were identified.

Quarry (2021QP0002): Woody vegetation growth was occurring on pit benches, and smaller vegetation was growing on pit floor. Material has not yet been quarried under this quarry permit. No signs of erosion were observed.

Inspectors have no concerns and will continue to monitor.

ENVIRONMENTAL INSPECTION REPORT

Inspection Images:

Figure 1

F-25

Figure 2

F-25

ENVIRONMENTAL INSPECTION REPORT

Figure 3

F-25 Sump

Figure 4

F-25A

ENVIRONMENTAL INSPECTION REPORT

Figure 5

F-25A Incinerator

Figure 6

F-25A

ENVIRONMENTAL INSPECTION REPORT

Figure 7

F-25A

Figure 8

F-25A

Figure 9

K-29

Figure 10

K-29

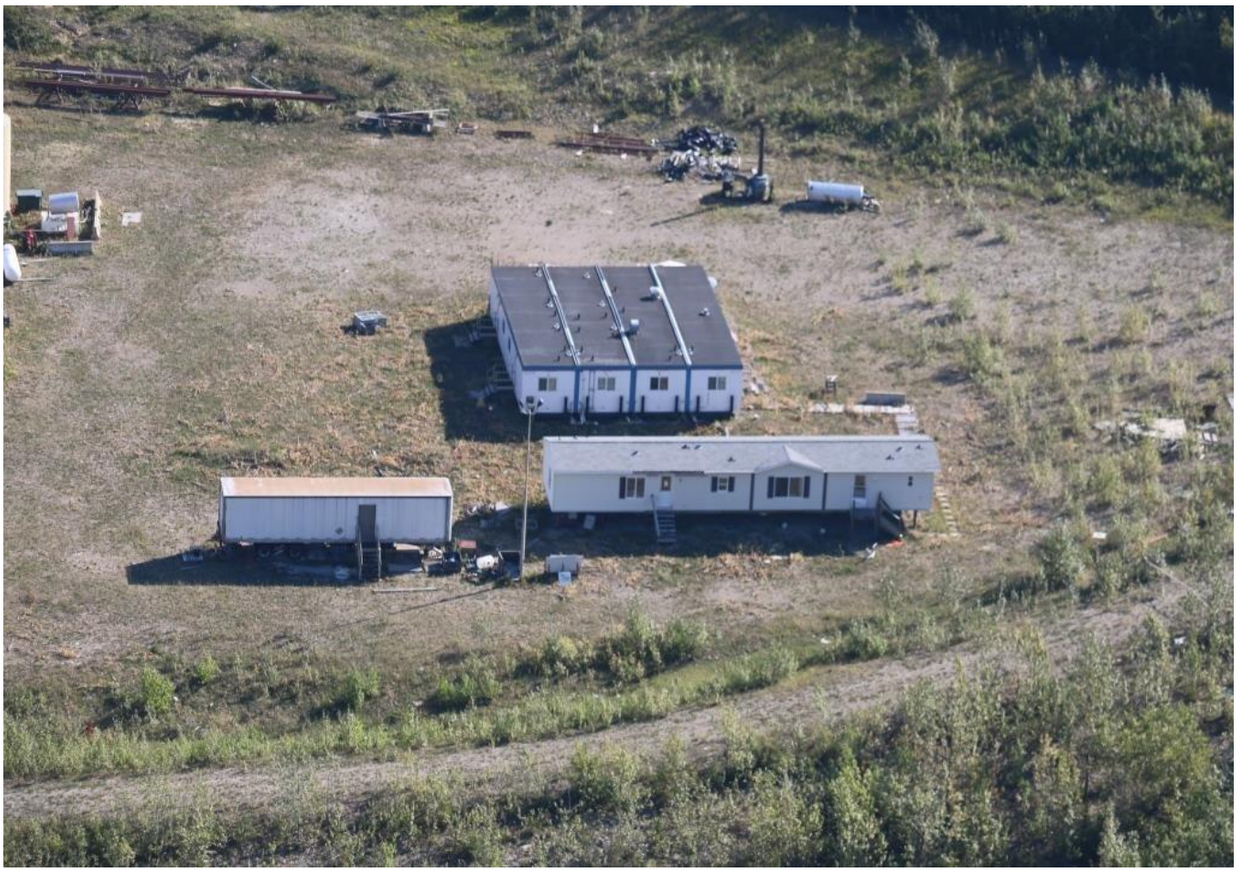


Figure 11

Other Helicopter at K-29

Figure 12

M-25

ENVIRONMENTAL INSPECTION REPORT

Figure 13

M-25 and Sump

Figure 14

M-25

Figure 15

O-80

Figure 16

O-80

Figure 17

O-80

Figure 18

Quarry

Appendix D: Paramount Erosion Monitoring Form

Liard East
Annual Erosion Report

Email completed reports to ARO Rep (@paramountres.com)
Keep a copy for your own records.

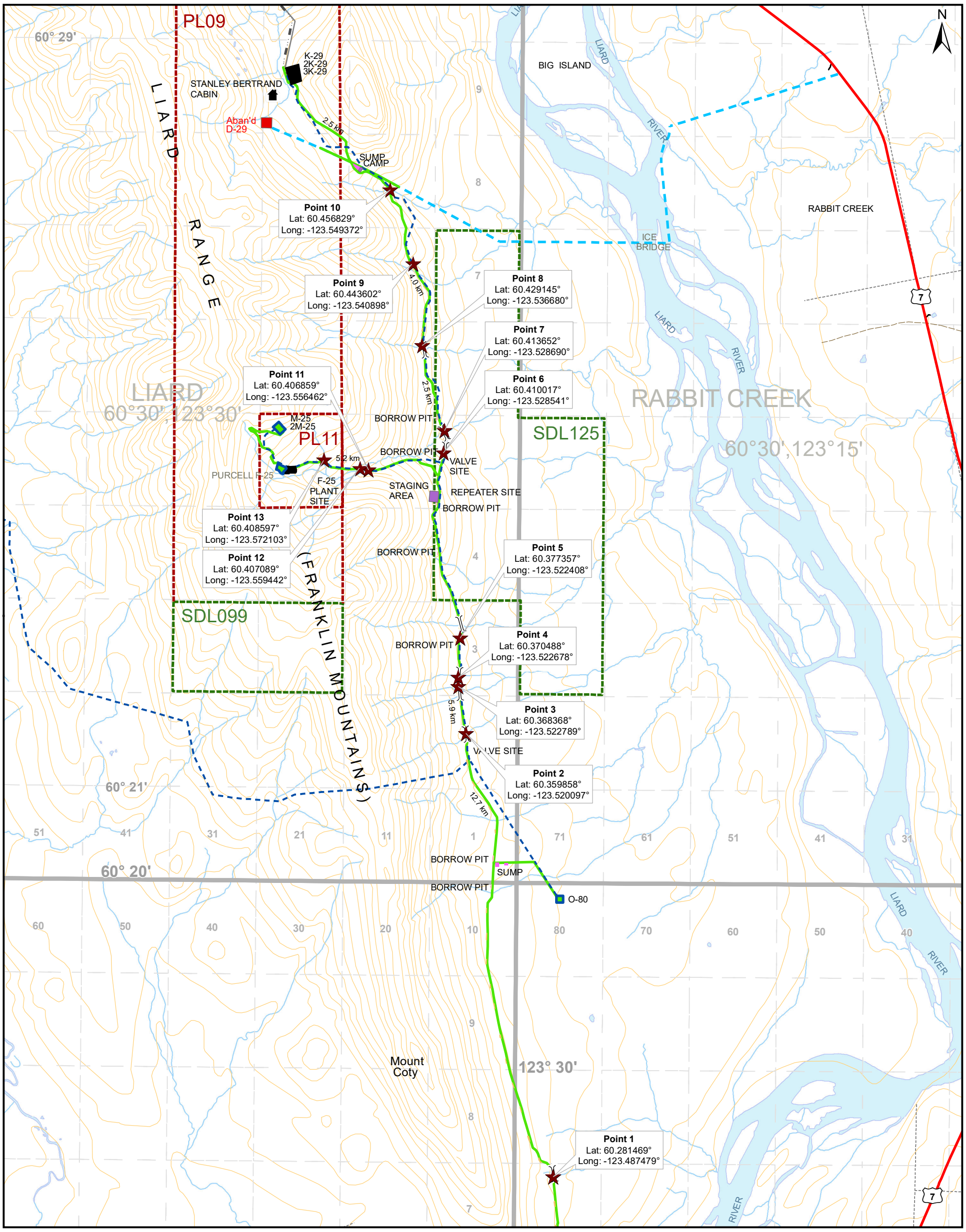
Date of Inspection: _____ **Inspector (please print):** _____

Signature: _____

Observations

Site #	Site Location	Photo ID	Comments
W1			
W2			
W3			
W4			
W5			
W6			
W7			
W8			
W9			
W10			
W11			
W12			

Appendix E: Liard West Erosion and Sedimentation Map



Legend

Leases
- Built - Tied-in
- Reclaimed

Facilities
- Camp - Built
- Battery - Built
- Sump - Built
- Borrow Pit - Built
- Decking Site - Built

Gathering System
- Built
- Foreign

Access Roads
- Access Built
- Access Foreign
- Bridge
- Cabins

Transportation
- Highway
- Old Paramount Ice Road
- Road
- Trail
- Cut Line

Boundaries
- SDL Lands
- PL Lands
- Contours

Waterbody
- Waterbody
- Watercourse

Potential Sites
- Erosion and Sediments

REV.	Rev.	Description	Tech./Chk.	Date
00	-	-	-	-
	-	-	-	-
	00	Original Map Prepared	FRS/DRD	2023-03-14

Paramount resources ltd.

Potential Sites for Erosion and Sedimentation

FORT LIARD

within

60°50', 123°45' to 60°10', 122°45'

NORTHWEST TERRITORIES

0 0.5 1 2 3 4 5 Km

Scale: 1:75,000

Client Doc. No.: TBD
UGS Job No: 231032E
UGS Doc No.: 231032-OM-01.mxd
Projection: NAD 1983 UTM Zone 10N

UNIVERSAL Geomatics Solutions

Toll Free: 1-866-454-3031 www.ugsc.ca