Environmental Mitigation Plan
Strimbold Bridge Maxan Creek Deactivation

Prepared for:
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1.0 Project Description

In September 2015, a washed out bridge on Maxan Creek in the Nadina Forest District was identified by DFO and MFLNRO staff as a priority for removal and site restoration. Although the bridge may have been washed out for a few years, the site was not identified as an issue until fall 2015 as it is on a non-tenured road and surrounded by private land so it is not part of any licensee's monitoring program. Therefore is considered a non-tenured abandoned crossing and will be managed as a Crown liability.

The bridge is constructed of steel railroad cars with a wooden deck and no apparent abutments. The running surface is 12m long x 3.3m wide and was likely never constructed to forestry standard. This portion of Maxan Creek (WSC 460-924300) is downstream of Maxan Lake and approximately 2km upstream of the outlet at Bulkley Lake. Several fish species are known in this section of Maxan Creek according to Habitat Wizard including Chinook Salmon, Coho Salmon, Sockeye Salmon, Steelhead, Rainbow Trout, Dolly Varden, Mountain Whitefish, Lamprey, Longnose Sucker, Prickly Sculpin and Lake Chub. This section of Maxan Creek is over 10m wide with a low gradient, characterized by meandering riffle-pool morphology and frequent beaver dams. MFLNRO staff observed a Chinook salmon redd immediately downstream of the site.

There are several safety and environmental issues surrounding removal of the bridge. This environmental mitigation plan identifies these issues and mitigation measures to best accomplish the bridge removal with the least environmental impacts and the safest approach. This plan considers different site conditions that may exist at the time of works and offers more than one scenario for the approach. MFLNRO and DFO staff have been asked for input and agencies are also consulting First Nations regarding the project.

Bridge removal and site restoration is planned for fall 2016 and is expected to take 2 days to complete.

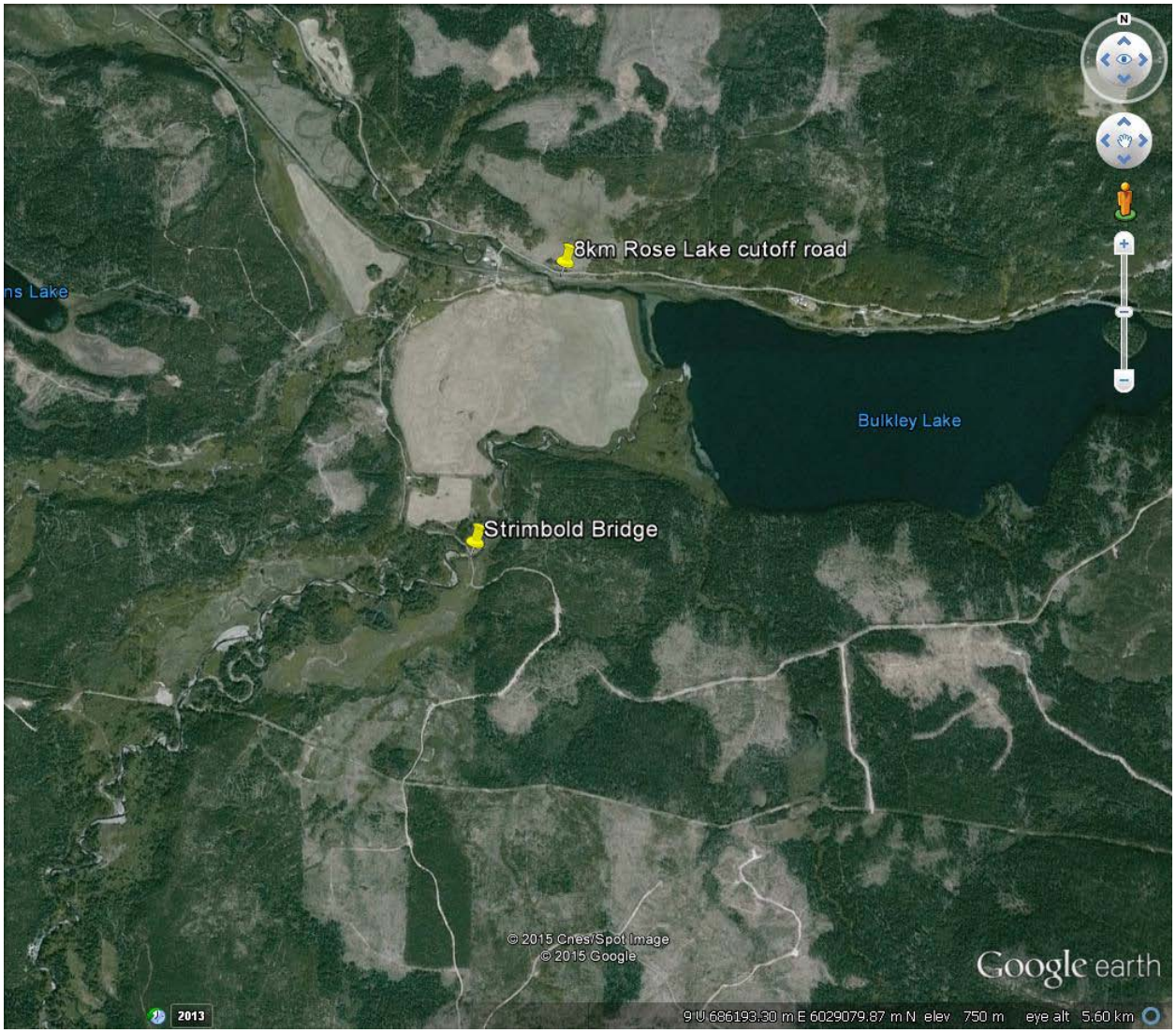


Figure 1. Google Earth location image, retrieved October 19, 2015.

Photo 1. Strimbold Bridge, September 29, 2015.

Photo 2. Strimbold bridge on Maxan Creek, debris on upstream side, known Chinook spawning on downstream side, September 29, 2015.

2.0 Safety and Environmental Considerations

Safety and environmental risks have been identified as follows and considered in developing the work approach and mitigation measures.

1. **Water Levels**: MFLNRO engineering staff prefer the lowest water levels for safe work conditions. According to the hydrometric station on the Bulkley River at Houston, the most reliable low water time is mid-September to mid-October.

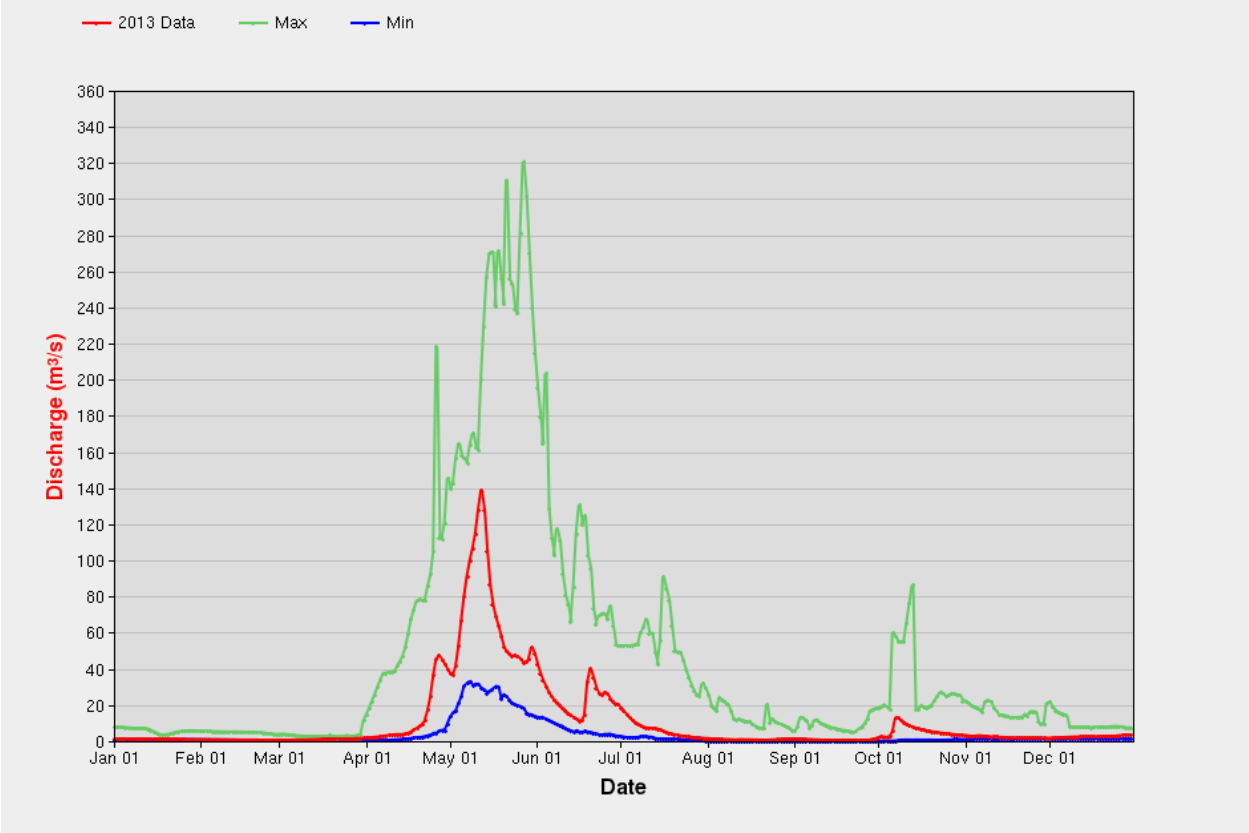


Figure 2. Daily discharge graph for Bulkley River (near Houston) from Environment Canada Wateroffice website (Station 08EE003), retrieved October 20, 2015. Statistics correspond to 44 years of data recorded from 1930 to 2013.

2. **Instream Work Windows**: The assemblage of species in Maxan Creek results in no instream work window according to the Skeena Region (2005) Reduced Risk In-stream Work Windows and Measures as follows:

Species	Work Window
Chinook Salmon	June 1 – July 15
Coho Salmon	July 1 – August 31
Sockeye Salmon	June 15 – July 15
Steelhead	August 1 – April 30
Rainbow Trout	August 1 – March 31
Dolly Varden	April 15 – August 15

3. **Fish at Site**: Chinook Salmon were observed by MFLNRO staff immediately downstream of the site on September 29, 2015. Eggs would stay in the gravels until May or June of the following year depending on temperatures. Resident fish are expected to congregate under the bridge and within the accumulated debris on the upstream side of the bridge. Works could result in death to fish at the site.

4. **Access**: Access roads from the southeast are partially deactivated and include a gasline crossing and cattleguard that may not support a heavy equipment crossing. Access roads from the northwest are private and the last portion is not maintained. The crossing approaches have been washed out and there are oversteepened banks on each side of the bridge now.

Photo 3. Oversteepened bank on northwest side, November 11, 2015.

5. **Bridge Weight**: According to estimates provided by Howard Debeck, Road and Bridge Engineer with MFLNRO's Northern Engineering Group, the weight and specific location of the bridge within the stream will make it difficult for an average sized excavator to lift:

> "Weight of 1 steel girder is about 9900 kg
> Weight of bridge steel (no deck) is 22600 kg includes 15% allowance for bracing between the girders. Picking up one end - 11300 kg
> Weight of ties and deck is another 12000 kg
> Lifting capacity of Cat 325 size excavator is about 11300 kg "close in" (= 4.5m from center of excavator).
> Lifting capacity of Cat 330 size excavator is about 15000 kg "close in" (and 11000 kg at 6m)
> Lift capacity could be up to 1000 kg more if bucket is removed."

The bridge weight and corresponding equipment on site will determine whether the structure can be lifted or skidded out of the stream. This issue has both safety and environmental concerns.

6. **Aquatic Habitat Features:** The bridge and debris have created an upstream pool with rearing and overwintering potential. Spawning gravels are present immediately downstream of the bridge. Removal of the debris and bridge will drain the pool and remove cover. Spawning potential may also decrease both by potentially filling in the gravels with fines and by losing the adjacent deeper water that could be used as a holding area.

Photo 4. Downstream spawning substrate, November 11, 2015.

7. **Riparian Values:** Nests (platforms, cavities, nests in shrubs) were not observed in the immediate vicinity of the work site. Riparian vegetation that would be removed during works is limited to grasses on the road and gravel bars.

8. **Woody Debris Accumulation:** While the debris accumulation provides fish habitat, it is a safety concern as the bridge will need to be cabled for removal.

Photo 5. Debris accumulation, November 11, 2015.

9. **Streambed disturbance**: As of fall 2015, the bridge is not significantly embedded in the stream. Even so, lifting or skidding the structure will result in suspension of streambed sediments. BC Water Quality Guidelines for aquatic life will likely not be met for turbidity.

Downstream spawning gravels could be filled in by the suspended sediment at a time of year when they would not be flushed prior to spawning activities.

Table 1: Summary of water quality guidelines for turbidity, suspended and benthic sediments. For complete details (including definitions for background, clear flow, and turbid flow) see Caux et al. (1997) (http://www.env.gov.bc.ca/wat/wq/BCguidelines/turbidity/turbiditytech.pdf)

Water Use	Turbidity	Non-filterable residue (total suspended solids)	Streambed Substrate Composition
Aquatic life (fresh, marine, estuarine)	Change from background of 8 NTU at any one time for a duration of 24 h in all waters during clear flows or in clear waters	Change from background of 25 mg/L at any one time for a duration of 24 h in all waters during clear flows or in clear waters	% fines not to exceed: • 10% <2 mm • 19% <3 mm • 28% <6.35 mm at salmonid spawning sites
	Change from background of 2 NTU at any one time for a duration of 30 d in all waters during clear flows or in clear waters	Change from background of 5 mg/L at any one time for a duration of 30 d in all waters during clear flows or in clear waters	Geometric mean diameter not less than 12 mm (minimum 30-d intragravel DO of 6 mg/L)
	Change from background of 5 NTU at any time when background is 8 - 50 NTU during high flows or in turbid waters	Change from background of 10 mg/L at any time when background is 25 - 100 mg/L during high flows or in turbid waters	Fredle number not less than 5 mm (minimum 30-d intragravel DO of 8 mg/L)
	Change from background of 10% when background is >50 NTU at any time during high flows or in turbid waters	Change from background of 10% when background is >100 mg/L at any time during high flows or in turbid waters	

3.0 Construction Plan and Mitigation Measures

Depending on conditions at the time of works and available equipment, there are different potential approaches for removal of the bridge:

1. **Timing**: Skeena Region instream work windows for streams with spring and fall spawners is generally determined by a Habitat Officer depending on the suite of species and the site conditions. Generally the overlapping windows result in a summer window (usually a two-week period between July 1 and August 15). In order to balance the very high fisheries values at the site, and the great advantage gained by working in low-flow

conditions, we will be asking the Habitat Officer for a **window opening July 15 and continuing through August 15**. The works will take place as close to July 15 as possible at low flows.

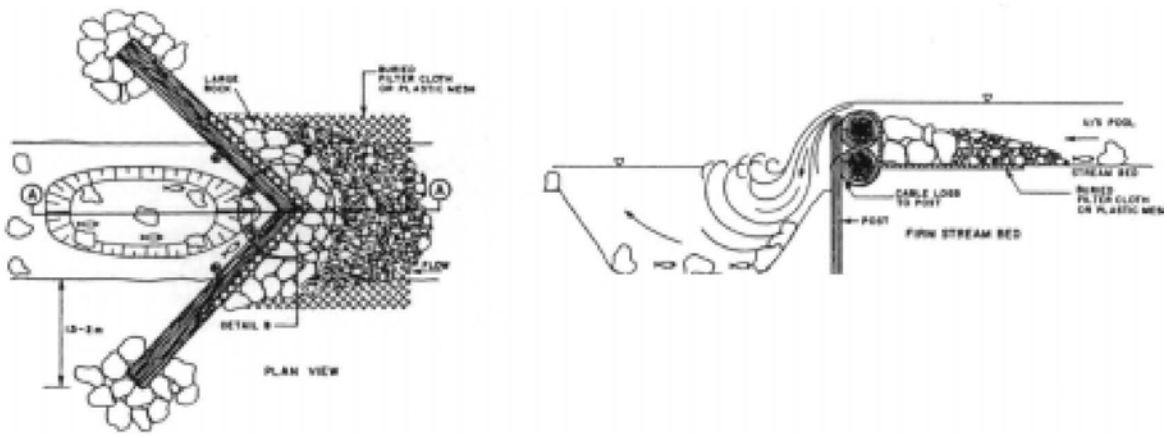
2. **Site Isolation**: According to Table 1 in the Skeena Region Reduced Instream Work Windows and Measures, stream diversion is the suggested technique for this site based on fish presence with spawning habitat. Complete stream diversion would be very difficult at this site as the bridge and debris is damming upstream water in a large deep pool and may require extensive streambed excavation. If water levels are too high to safely work, some of the flow can be diverted to the southeast end of the bridge through excavation of the streambank. The streambank would be excavated maintaining dams at the upstream and downstream ends. The upstream dam would be removed and the water pumped to upland until it runs clean. Then the downstream dam can be removed.
3. **Fish Salvage**: Fish salvage will be required. Fish salvage methods should include electrofishing, minnow trapping and potentially dipnetting. Stop nets may or may not be required depending on whether the site is dewatered. If the stream is diverted, fish salvage should take place while it is being dewatered. A Scientific Fish Collection Permit will be required.
4. **Build access ramps**: The northwest bank is oversteepened and will be pulled back to create a ramp and place the surplus material along the sides of the approach road. If any material needs to be brought below the high water mark for access, geotextile should be put down underneath so that the fill can be completely removed afterwards.
5. **Remove upstream debris**: Some of the upstream debris will have to be removed in order to wrap the bridge with cables for lifting or skidding. The excavator will sit on the gravel bar to reach the debris, which will be put on top of the streambank above the high water mark. Only the excavator bucket and thumb should be in the water (ie., no greased joints). Debris left in the stream is not an environmental concern according to correspondence with MFLNRO and DFO staff.
6. **Remove ties and deck**. IF the bridge is to be lifted out of the stream, ties and decking will be removed while it is still in the stream. The untreated rotten deck will be pulled/cut off exposing tie bolts. Then the bolts will be cut with a torch (about 15 per side). The ties will not be cut over the stream to prevent any creosote from entering the stream. If the bridge is to be skidded out of the stream, the decking and ties will be removed after the bridge is skidded up onto the gravel bar, again without cutting the ties to ensure that any creosote debris would not enter the stream at high water.

Photo 6. Decking and upstream debris, November 11, 2015.

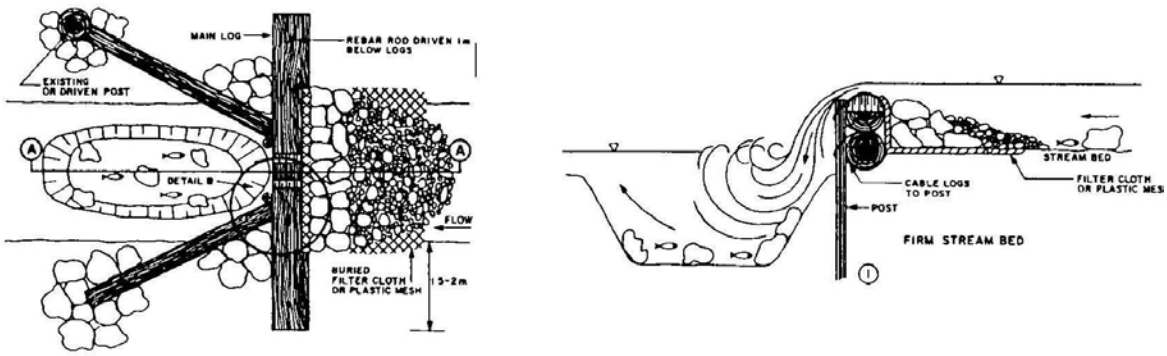
7. **Remove structure**: The bridge may be lifted or skidded out of the stream depending on the conditions at that time, the equipment available and the water levels. If the bridge is too embedded in the streambed to lift or skid, the streambed will have to be excavated to free it. This can only be done in dry or isolated conditions. Once the bridge is skidded or lifted onto the gravel bank, the midspan splice will be cut and/or the bracing between girders for transport up the ramp to the lowbed.

8. **Install Stream Structure**: The bridge and debris are currently maintaining the upstream deeper water (pool) and downstream spawning gravels as well as providing excellent cover for rearing or holding fish that are spawning. In order to maintain the local habitat features at the site, structures should be put back in at that location. The structures should be log weirs augmented with boulder clusters to anchor them. The logs will preferably have intact root wads and be Douglas fir (less preferred are spruce and pine) with the largest diameter possible. Boulder clusters at the streambank where the logs are anchored will prevent the stream from scouring around the outside edges. The following examples are taken from Watershed Restoration Technical Circular No 9 "Fish Habitat Rehabilitation Procedures" Chapter 11 (Slaney and Zaldokas, 1997)

retrieved from www.env.gov.bc.ca/wld/documents/wrp/wrtc_**9**.pdf. Note that stream conditions will change but the weir will provide structure that will catch woody debris and provide cover. The upstream will be dammed deeper water and downstream should have scoured clean gravels.



LOG V WEIR



LOG K DAM

Figure 3. Weir designs from Slaney and Zaldokas (1997).

Photo 7. Examples of spruce logs with root wads which were obtained by pushing trees over with excavator.

9. Site Clean-up: Ensure all debris is removed from the site. If there are any ruts on the gravel bar or on the approach ramp, grade them out. There should be no sites for water to create isolated pools or transport erodible soils below the high water mark. This could involve ditching or keying in logs across the approach slopes to prevent sediments from reaching the stream, covering the approaches will salvaged vegetation from the grubbing stage, and straw or seed if necessary.

4.0 Additional Measures

1. **Monitor water quality (turbidity) during works:** As per BC Water Quality Guidelines for aquatic life, the target is that turbidity levels do not exceed 8 ntu above background levels at any one time for a duration of 24 hours. Turbidity should be measured and documented before works begin and as appropriate during works (generally every 10 minutes to 30 minutes depending on if works are causing increased turbidity) and afterwards until values return to background. If turbidity values during works are exceeded, shut downs may be required until acceptable levels are reached.

2. **Monitor downstream spawning gravels:** As per BC Water Quality Guidelines for aquatic life, spawning gravels should not exceed (by volume) 10% <2mm, 19% <3mm and 28% <6.35mm. Measure downstream streambed substrate composition at the redds immediately downstream of the site before and after works, 2mm, 3mm and 6.3mm sieves will be required. If streambed substrate composition immediately downstream negatively changes as a result of the works, the redds may be washed using a pump from the upstream pool. This is especially important since there would likely be no increased flows before salmon arrive to the site to spawn.
3. **No machinery crossings** of the stream or machine tracks within the wetted stream.
4. **No removal of riparian vegetation (shrubs or trees)**. If any willow clumps need to be removed to skid the bridge onto the gravel bar or up to the lowbed, excavate them and set aside so they can be put back in place afterwards.

Further measures from the Skeena Region Reduced Risk Instream Work Windows and Measures (2005) apply to this project as follows:

1. Stop operations near or within streams during periods of heavy or prolonged rainfall.
2. Suspend activities and notify the Ecosystem Officer if spawning fish are observed within the area of the work site.
3. Suspend instream work if stream flows exceed the capacity of sediment control measures.
4. Ensure that all equipment used on site is in good repair and free of any excess oil and grease.
5. Locate machinery on and work from the stream bank rather than within the wetted perimeter.
6. Block all ditch lines running into streams.

4.1 Environmental Monitoring

The environmental monitor will:

1. Ensure permits and authorizations are in place.
2. Be on-site for all works.
3. Approve details of site isolation.
4. Conduct fish salvage.
5. Attend on-site pre-work meeting to review this EMP with workers.
6. Ensure mitigation measures are implemented.
7. Photodocument works.
8. Document any changes to the proposed works.
9. Document any failure of measures.
10. Ensure works are shut down if environmental values are threatened (eg., by weather, fish or wildlife on site).

This documentation will be made available to the project owner (Nadina MFLNRO) or regulatory agencies as requested.

4.2 Materials to be Available On-site

The contractor must have the following equipment available on site:

1. A spill kit with enough absorbent booms appropriate for spills to water to span the current wetted width of the stream twice.
2. Fire pump with enough hose to pump to upland.
3. Silt fence.
4. Materials to build dams (plastic or tarps or geotextile).

5.0 EMP Implementation

5.1 Project Contacts

Project contacts are as follows:

1. Rob Phillips, Engineering Officer, MFLNRO Nadina Forest District, phone 250-692-2200, email Rob.Phillips@gov.bc.ca

2. Karen Grainger, RPBio.,MFLNRO Environmental contractor, phone 250-462-5311, email klg2@telus.net

3. Lana Miller, DFO Resource Restoration Biologist, DFO Smithers, phone 250-847-4892, cell 250-615-7619, email lana.miller@dfo-mpo.gc.ca

4. Mark Beere, MFLNRO Senior Fisheries Biologst, Smithers, phone 250-847-7297, email mark.beere@gov.bc.ca

5. Howard Debeck, Road and Bridge Engineer, Northern Engineering Group, Smithers, phone 250-847-6397, email howard.debeck@gov.bc.ca

6. Chris Broster, Ecosystem Officer, Skeena Region Ministry of Environment, phone 778-505-2045, email Chris.Broster@gov.bc.ca

5.2 Communication

A pre-construction meeting will be held on-site in which the Environmental Monitor will ensure the contractor's crew understands the contents of the EMP including the environmental risks and mitigation.

The Environmental Monitor will confirm that they have authority to shut down works in case of unforeseen risk to environmental values until further mitigation can be put in place.

5.3 EMP Updating

The EMP will be reviewed and updated as necessary at the pre-work meeting. The EMP will also be reviewed under the following circumstances:

- Where unanticipated site conditions and/or environmental conditions arise;
- Where Project scope or planned construction procedures have been modified; and/or
- As construction procedures are developed (ie., not available at the time of the initial EMP report).

All revisions or amendments will be communicated to all applicable personnel at daily morning safety meetings.

6.0 Permitting and Authorizations

- These works require authorization from a MFLNRO Habitat Officer under Part 7 of the Water Act Regulation with respect to:
  1. Working outside of an authorized work window.
  2. Removing material from the stream.
  3. Adding material to the stream.
- A Scientific Fish Collection Permit is required for fish salvage through Front Counter BC and MFLNRO.
- The project requires review by DFO under the Fisheries Act because habitat is being altered.