*3431.02/WP#T-1611*

# 1st Avenue Culvert Replacements
## (Lakelse Lake)

# Environmental Monitoring Report

*Prepared for:*

**Nechako Northcoast Construction**
PO Box 745
5720 Highway 16 West
Terrace BC V8G 4C3

*Prepared by:*

TRITON
ENVIRONMENTAL CONSULTANTS LTD.

#300 – 4546 Park Avenue
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www.triton-env.com

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## 1.0 INTRODUCTION

Triton Environmental Consultants Ltd. (Triton) is pleased to submit the following Environmental Monitoring Report for works associated with the installation of 8 fish passage culverts along 1st Avenue at Lakelse Lake. Triton was contracted by Nechako Northcoast Construction (NNC) to complete the environmental services work. This report summarizes the fish salvage, environmental supervision, mitigation and monitoring activities undertaken by Triton during the period of September 1, 2003 to September 16, 2003. The report is intended to fulfill the reporting requirements associated with the Fisheries and Oceans Canada Letter of Advice (Appendix I), Fisheries and Oceans Canada Scientific Licence (Appendix II) and Ministry of Water Land and Air Protection Fish Collection Permit (Appendix III).

Triton's work entailed:

- Isolation of the work area and completion of a fish salvage,
- Environmental Monitoring,
- On-site presence during construction activities to provide "Best Management Practices" (BMP),
- Recommendations for construction supervisor and crew, and
- Submission of a post-project monitoring report.

## 2.0 PRE-CONSTRUCTION

### 2.1 Meetings

A pre-construction meeting was held between Robert Cooper, NNC Construction Supervisor, Jason Harris of Triton and Jason Dorey of Triton on September 1, 2003. Scheduling logistics, equipment and labour requirements and fisheries concerns were discussed.

On site meetings were held daily with the Construction Supervisor, Construction Crews and the environmental monitor Jason Harris (Triton). Daily discussions included proposed construction activities, environmental concerns and general construction guidelines.

### 2.2 Fish Salvage

Prior to construction, fish exclusion fences were installed upstream and downstream of the construction sites. Fish exclusion fences were constructed out of 1/8" wire mesh and were secured to 3/4" rebar and wooden stakes adjacent to the stream. Large cobble and sandbags were used to secure the bottom of the fence and act as a seal. Upstream and downstream fences were monitored throughout the day and cleaned to ensure flow levels and velocities were maintained. Upon completion of instream works the fences were removed to allow fish passage through the work site.

Fish salvages were conducted in each of the isolated areas before construction started. If water levels were deep enough, minnow traps were left to soak overnight prior to construction. Typical salvages consisted of multiple passes through the isolated sites with an electrofisher (the day before construction), an overnight minnow trap set and a final electrofishing pass immediately prior to construction. Fish salvage results are summarized in Table 1. As discussed with Rob Dams (Fisheries and Oceans Canada, Assistant Habitat Technician), detailed fish capture results are summarized in Appendix IV.

Table 1. Fish Salvage Results

| | Stream 6A | | Stream 6B | | Stream 5 | | Stream 9 | | Stream 10 | | Stream 12 | | Stream 14 | | Stream 16 | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | # | % | # | % | # | % | # | % | # | % | # | % | # | % | # | % | # | % |
| Coho | 6 | 21% | 3 | 43% | 2 | 22% | 11 | 46% | 0 | 0% | 0 | 0% | 0 | 0% | 1 | 17% | 23 | 13% |
| Cuttroat Trout | 21 | 72% | 4 | 57% | 4 | 44% | 10 | 42% | 13 | 31% | 4 | 19% | 14 | 36% | 2 | 33% | 72 | 41% |
| Dolly Varden | 2 | 7% | 0 | 0% | 3 | 33% | 3 | 13% | 29 | 69% | 17 | 81% | 25 | 64% | 3 | 50% | 82 | 46% |
| Total | 29 | | 7 | | 9 | | 24 | | 42 | | 21 | | 39 | | 6 | | 177 | |

## 3.0 CONSTRUCTION AND MITIGATION

All works associated with the removal and installation of culverts along 1st Avenue (Lakelse Lake) took place under the supervision of an environmental monitor.

Detailed construction photos and notes are provided in Appendix V.

The following sections describe activities completed for each of the culverts. The same culvert isolation, removal and installation procedures were completed for each of the crossings with minor modifications depending on site conditions. Detailed construction plans were submitted to Fisheries and Oceans Canada prior to starting the project. These plans are provided in Appendix VI and include:

- Letter (1 August 2003) from Nathan Voogd, Ministry of Transportation to Mitch Drewes, Fisheries and Oceans Canada Re: 1st Avenue culvert replacements.
- Letter (14 August 2003) from Robert Cooper, Nechako Northcoast Construction to Robert Dams, Fisheries and Oceans Canada Re: Lowering water levels at Beaver Dams.

### 3.1 Diversion of Flows

It was collectively agreed that dewatering of each site would be completed using a sandbag poly dam with a sump and pump diversion. The sump would be located off-channel and upstream of the culvert. Placing the upstream sump off-channel would allow the sump to be

excavated in the dry and connection to the main channel would be completed using a small diversion ditch. A 6" flight pump was then used to divert flows around the site.

Prior to diverting flows around the site the sump was partially filled with approximately 1/5 of the flow within the channel. Dirty water from within the sump was then pumped into adjacent vegetated areas using a 3" pump so that the sump would be clean for diversion to downstream fish habitat. Once the sump water was clean a poly weir was placed at the upstream end of the culvert to allow all stream flow to enter the sump for pumping around the site.

Once the site was dewatered an additional sump and poly weir was installed at the outlet end of the culvert to collect sediment-laden water and stop backflooding from the downstream end. After full isolation of the site a walk through was completed to check for fish in the isolated pools.

### 3.2 Culvert Removal

Once the existing fill was removed from around the culvert, the culvert was removed using an excavator. The sections of pipe removed were then loaded into a dump truck and removed from the site. Any sediment-laden water that entered the site while removing the existing pipe was pumped into adjacent vegetation using a 2" pump.

### 3.3 Culvert Installation

Once the culvert was removed the base was leveled to grade. The new sections of pipe were then laid in the trench and filled with gravel as specified in the Letter (Dated August 1, 2003) from Nathan Voogd, Ministry of Transportation to Mitch Drewes, Fisheries and Oceans Canada Re: 1$^{st}$Avenue culvert replacements (Appendix VI).

Crews shoveled the gravel into the culvert from both ends and leveled the material placed within the culvert using push sticks and shovels. On three of the culverts the gravel was washed into the culvert using a high-pressure hose and a re-circulation system. This method proved to be effective, plus it cleaned the gravel at the same time. Sediment-laden water from the re-circulation method was trapped in a sump at the outlet of the culvert and once the culvert was filled the sediment-laden water was then pumped into adjacent vegetation for filtering.

The effectiveness of silt abatement strategies were monitored throughout the day for each of the culverts.

### 3.4 Reintroduction of Flows

Water was reintroduced to the main channel (through the completed culvert) by partially breaching the upstream diversion dam. Partially breaching the upstream dam would allow a portion of water to enter the culvert and flush the gravels of fines. The sump downstream of the culvert was then used to trap the silt-laden water. This water was then pumped into

adjacent vegetation for filtering. After approximately 20 minutes of flushing, flows were fully re-instated back into the main channel by removing the upstream weir. Fully flooding the culvert resulted in small sediment plumes that lasted on average approximately 10 minutes.

Once flows were completely re-instated the upstream sump was blocked off from the main channel. The sump was then drained by side-casting the water in the sump into forested areas. Gravel was then used to fill the sump.

Clean-up of the work site was conducted and loose road shoulders were contoured.

Small pieces of riprap were placed in the channel around the outlet of each of the culverts to act as a weir and provide stability for the gravels placed within the culvert.

## 4.0 MONITORING AND MITIGATION

- All works associated with the culvert replacements took place under the supervision of an environmental monitor.
- All equipment and machinery was in good operating condition and free of leaks, excess oil or grease.
- Vegetation on and adjacent to the stream banks was disturbed as little as possible and upon completion of the works, the banks were restabilized.
- All pump intakes were located within the salvaged work area.
- A spill control kit was present on site during all works.
- Water seepage entering the main channel through the upstream weir prior to main channel breaching as well as drainage water entering the dry perimeter of the work site was pumped up over the banks to allow it to filter through forested habitats before re-entering the creek.
- Measures were taken to ensure no deleterious substances entered fish bearing waters.
- Culvert fill materials were approved by Fisheries and Oceans Canada representative prior to infilling the culverts.
- Fish salvages were conducted prior to commencement of the works. The necessary permits for fish salvage were obtained from Fisheries and Oceans Canada and Ministry of Water Land and Air Protection.

## 5.0 CONCLUSIONS

- Overall the work crew was well informed and aware of the environmental requirements for the work site. The work crew was receptive to suggestions and recommendations made by the environmental monitor. Onsite discussions were held with each of the contractors to address environmental concerns.

- A small pulse of silt laden water was often released during re-introduction of the mainstem through the newly installed culvert. This pulse was of low intensity and of short duration. Small pulses of silt laden water are characteristic of critical construction periods during instream works.

- Mitigation measures, favourable weather conditions, site topography and culvert design resulted in an environmentally sound construction project.

# APPENDIX I

## Fisheries and Oceans Canada Letter of Advice

Fisheries and Oceans Canada
Pêches et Océans Canada

5235 A Keith Avenue
Terrace, British Columbia
V8G 1L2

Your reference: 526 2 35

Our reference: 03-HPAC-PA4-000-000319

August 15, 2003

Geoff Phillips
Ministry of Transportation
4825 Keith Ave
Terrace, B.C., V8G 1K7

**Attention:** Geoff Phillips
A/District Highways Manager

Dear Geoff Phillips,

Fisheries and Oceans Canada (DFO) has received your proposal to Install Eight Fish-Passage Culverts Along 1st Avenue at Lakelse Lake. To expedite future correspondence or inquiries, please refer to your file name and number when you contact us.

Referral File No.: **03-HPAC-PA4-000-000319**
File Name: **First Avenue Culvert Replacements (2003) - Lakelse Lake B.C.**

It is our understanding that your proposal consists of:

**Replacement of Eight Fish Passage Culverts – 1st Avenue Lakelse Lake, B.C.**

as outlined in the following plans:

**Nathan Voodg (MOT) referral letter with culvert design specifications, dated Aug 1, 2003. Also see, Robert Cooper (Nechako Northcoast Construction) detailed construction plan, dated August 14, 2003.**

If these plans have changed since the time of your submission, the advice provided in this letter may not be applicable to your circumstances and you should consult with us to determine if further review is required.

We have reviewed your proposal under the habitat protection provisions of the *Fisheries Act.* The measures described in your plans are not adequate to protect fish and fish habitat. Therefore, please ensure that the following additional measures are incorporated into your plans.

The eight culverts planned for replacement in 2003 are listed as follows:
**Tributaries 5, 6, 9, 10, 12, 14, 16 & 6b.**

All pump intakes shall be located within the isolated/salvaged work area, or have suitable fish friendly screens attached. As well, a diffusion box shall be used on the outlet of any diversion discharge lines.

Biodegradable hydraulic fluid is recommended in all machinery working in or around water.

All necessary measures must be incorporated to ensure no deleterious substances enter fish-bearing waters.

A suitable spill control kit shall be present on site during any instream works.

The construction work window is from July 15 to Sept 15, 2003. All streams will be examined by a DFO representative prior to the commencement of construction to ensure that no redds/spawning fish are present within the proposed work areas.

Any disturbed areas adjacent to fish-bearing streams **shall be hydro-seeded shortly after the completion of construction.**

The newly-installed culverts must be filled with suitable erosion resistant material (See Table 1. for specific culvert fill depths). Any questions regarding culvert fill materials should be discussed with a DFO representative.

With the additional measures outlined above, the proposed work is not likely to result in the harmful alteration, disruption or destruction (HADD) of fish habitat, which is prohibited unless authorized by DFO.

If the HADD of fish habitat occurs as a result of a change in the project plans, or because of a failure to properly implement the measures outlined in your plans and this letter, contravention of subsection 35(1) of the *Fisheries Act* could occur. Subsection 35(1) states:

*"No person shall carry on any work or undertaking that results in the harmful alteration, disruption or destruction of fish habitat."*

This advice is intended to provide recommendations to ensure that the proposed works are completed in a manner that avoids adverse impacts to fish and fish habitat. It is not an authorization pursuant to subsection 35(2) of the *Fisheries Act* to conduct works that will result in a HADD.

Please note that this letter of advice does not allow the deposit of deleterious substance into waters frequented by fish and does not release you from the responsibility for obtaining any approvals that may be required under federal, provincial or municipal legislation.

We request that you notify us at least ten days before starting the work and that a copy of this letter be kept on site while works are in progress. If you have any questions concerning the above, or if my understanding of the project is either incorrect, incomplete, or if there are changes to the proposed work, please contact me directly by telephone at (250) 615-5354, or by fax at (250) 615-5364.

Rob Dams.
Assistant Habitat Technician

cc. Mitch Drewes DFO
Ricardo Correia DFO

Canada

# APPENDIX II

## Fisheries and Oceans Canada Scientific License

Fisheries and Oceans | Pêches et Océans

# SCIENTIFIC LICENCE 2003-051
## (Pursuant to Sections 52 & 56, Fishery [General] Regulations)

**DATE ISSUED:** 11 August, 2003 **VALID TO:** 31 December, 2003
**NAME:** Triton Environmental Consultants Ltd.
**ADDRESS:** Box 88 Terrace BC V8G 4A2
**TELEPHONE:** (250) 635-1494
**FAX:** (250) 635-1495

**PURPOSE:** To provide Environmental services (on-site environmental supervision, monitoring of instream construction activities, fish salvage, sediment control and drainage management) associated with the installation of 14 culverts on behalf of Nechako Northcoast Construction of Terrace, BC.

**Subject to the following conditions:**

1. **Notification:** Prior to sampling and upon completion of any fishing activities the local Fishery Officers of the Department of Fisheries and Oceans must be informed of the exact time, location, purpose and samplers. Please notify Terrace District office, (250) 615-5350

2. **Areas of collection: Drainages to the eastern side of Lakelse Lake along 1st Avenue.**

3. **Authorized methods of capture:** Electroshocking, baited Gee-trapping, dip netting, angling, visual assessment, and/or pole seining. ***PLEASE NOTE:*** ***All set nets and minnow traps must be clearly marked with the licencee's name and a contact telephone number.***

   **Note:** Recent research has emphasized the fact that electrofishing and even wading can be severely damaging to eggs and alevins in the gravel. Electrofishing and wading therefore must be avoided at times and in locations where spawners, eggs or alevins may be present.

4. All fish captured to be released alive at the point of capture, except for voucher specimens retained to confirm species identity. ***In the event of fish salvage*** **all fish captured to be released alive as soon after and as near as possible to the point of capture.**

5. All collection activities are to take place **under the supervision of Jason Dorey (Project Manager), Steve Jennings, Jason Harris, Shawn Glesbrecht, Greg Knox, Murray Metcalfe and/or Shawna Hartman.**

6. A Summary Report is to be submitted to: ***Please refer to Scientific Licence No. 2003-051***
   **Mitch Drewes/Rob Dams**
   **Fisheries & Oceans Canada**
   **5235 A Keith Avenue**
   **Terrace, BC V8G 1L2**

7. This licence must be carried by the collector at all times and presented upon request.

8. This licence may be canceled at the discretion of the local Fishery Officer, if necessary, for the protection or conservation of the resource.

9. A permit is also required by the Ministry of Water, Land and Air Protection (MWLAP).

Signature of Licence Holder

Authorized Officer
BC North Coast Area, DFO

AUG 12 2003

# APPENDIX III

## Ministry of Water Land and Air Protection Fish Collection Permit

BRITISH COLUMBIA

# FISH COLLECTION PERMIT

Lakelse Lake

Your File:
**Permit/Receipt No.:** **393771K**
MWLAP File: 34770-20

Date: August 7, 2003

**Permittee:** Triton Environmental Consultants Ltd.
PO Box 88, Terrace, BC V8G 4A2
Tel: (250) 635-1494; Fax: (250) 635-1495

Jason Dorey, Stephen Jennings, Jason Harris, Shawn Giesbrecht, Shawna Hartman, Greg Knox, Murray Metcalfe "and unnamed assistants"

are hereby authorized, under Section 19 and pursuant to Section 108 (4) of the Wildlife Act, and as provided in Section 18 of B.C. Reg. 125/90 to collect fish for scientific purposes from non-tidal waters subject to the conditions set forth herein:

**Objective:** To provide Environmental Services (on-site environmental supervision, monitoring of instream construction activities, fish salvage, sediment control, and drainage management associated with the installation of 14 culverts along 1st Avenue at Lakelse Lake.

**Permitted Waters:** Drainages to the eastern side of Lakelse Lake along 1st Avenue. Kalum Forest District (Region 6, Management Unit: 6-11.)

**Permitted Times:** August 8, 2003 – March 31, 2004

**Permitted Species:** All species except salmon. See General Condition 9.

**Permitted Gear:** Electrofisher, minnow traps, dip nets and pole seines.

**Special Conditions:** Please note permit conditions 7, 12 and 13 of General Conditions on reverse side of this permit.

Authorized by:

Amount: $25.00

for Regional Manager
Fish and Wildlife Program

Date: 7 AUG '03

Any contravention or failure to comply with the terms and conditions of this permit is an offense under the Wildlife Act, SBC 57/82 and B.C. Reg. 337/82 Sec. 8.

**Ministry of Water, Land & Air Protection**

Fish & Wildlife Branch
Skeena Region

Mailing Address:
PO Box 5000
Smithers BC V0J 2N0

Location Address:
3726 Alfred Avenue
Smithers BC
Telephone: (250) 847-7260
Facsimile: (250) 847-7728

# APPENDIX IV

## Detailed Fish Capture Results

## 1st Avenue (Lakelse Lake) - Detailed Fish Capture Results

### Fish Abundance

A total of 177 salmonids were salvaged from streams (isolated construction sites) along 1st Avenue (Lakelse Lake) during the September 1, 2003 to September 16, 2003 construction period. Salmonid species captured included: 23 coho, 72 cutthroat trout and 82 Dolly Varden. Table 1 summarizes the captures by stream (isolated section) along 1st Avenue.

Table 1 summary of salmonid captures by stream along 1st Avenue.

| | Stream 6A | | Stream 6B | | Stream 5 | | Stream 9 | | Stream 10 | | Stream 12 | | Stream 14 | | Stream 16 | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | # | % | # | % | # | % | # | % | # | % | # | % | # | % | # | % | # | % |
| Coho | 6 | 21% | 3 | 43% | 2 | 22% | 11 | 46% | 0 | 0% | 0 | 0% | 0 | 0% | 1 | 17% | 23 | 13% |
| Cuttroat Trout | 21 | 72% | 4 | 57% | 4 | 44% | 10 | 42% | 13 | 31% | 4 | 19% | 14 | 36% | 2 | 33% | 72 | 41% |
| Dolly Varden | 2 | 7% | 0 | 0% | 3 | 33% | 3 | 13% | 29 | 69% | 17 | 81% | 25 | 64% | 3 | 50% | 82 | 46% |
| Total | 29 | | 7 | | 9 | | 24 | | 42 | | 21 | | 39 | | 6 | | 177 | |

Figure 1 summarizes the salmonid captures (number of fish caught) by stream (isolated section) along 1st Avenue.

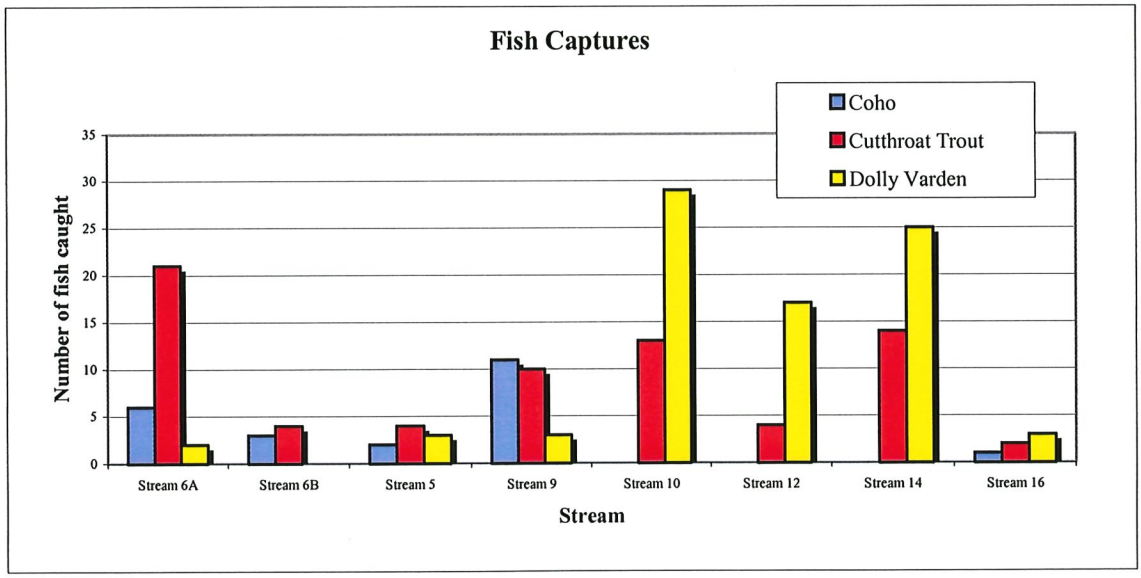


Figure 1 summary of fish captures by stream (isolated section) along 1st Avenue.

### Species Composition

Cutthroat trout were captured at all sample sites and accounted for 41% of the total catch. Dolly Varden were captured at seven sites and accounted for 46% of the catch, with coho being captured at six sites and accounting for 13% of the total catch respectively.

Figure 2 summarizes the species composition by stream (isolated section) along 1st Avenue.

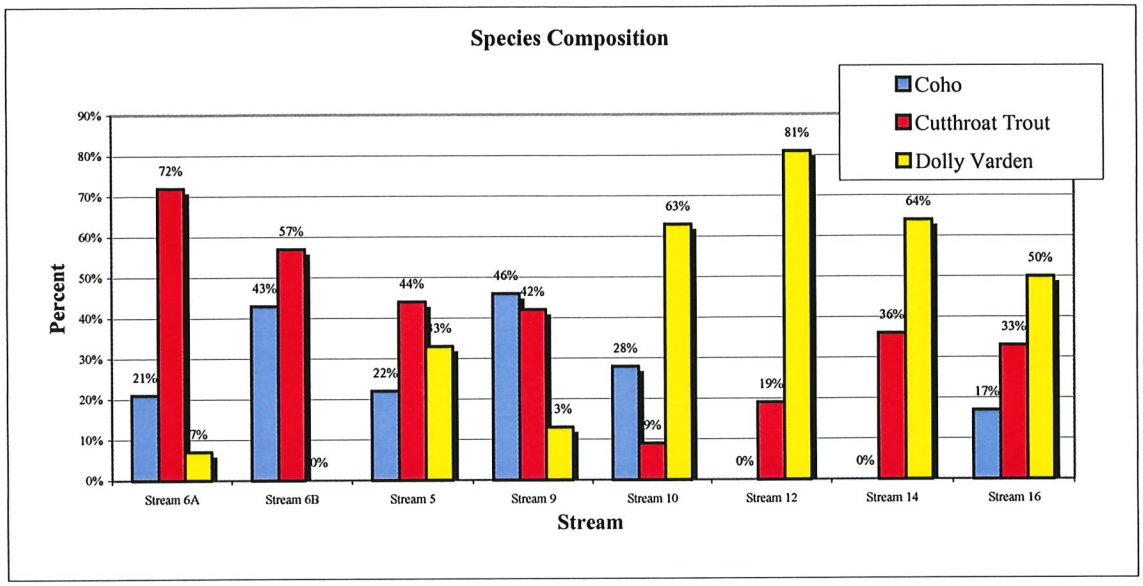


Figure 2 summary of species composition by stream (isolated section) along 1st Avenue.

## Fish Length

Overall, 23 coho, 72 cutthroat trout and 82 Dolly Varden were measured for fork length. Table 2 summarizes the data.

Table 2 fork lengths for salmonids sampled.

| | coho | cutthroat trout | Dolly Varden |
|---|---|---|---|
| Number | 23 | 72 | 82 |
| Mean (SE) | 67.2 (12.7) | 79.3 (34.6) | 94.6 (24.7) |
| Min. | 50 | 30 | 40 |
| Max. | 100 | 190 | 160 |

Length frequency distributions for salmonids captured by stream (isolated section) along 1st Avenue are provided in the figures below.

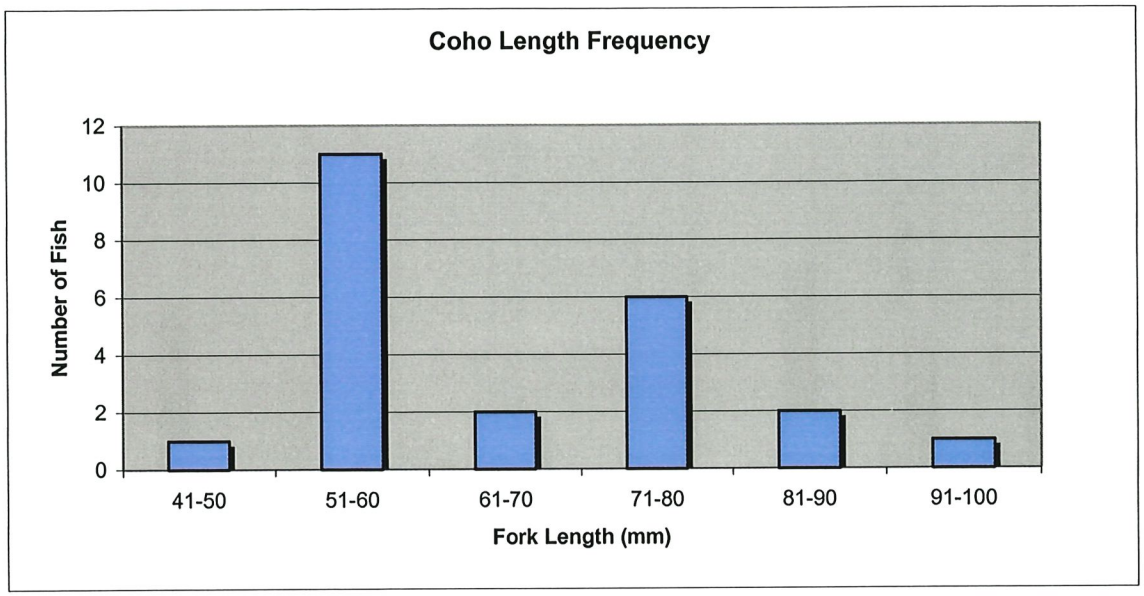


Figure 3 length frequency distribution for coho captured in streams (isolated sections) along 1st Avenue.

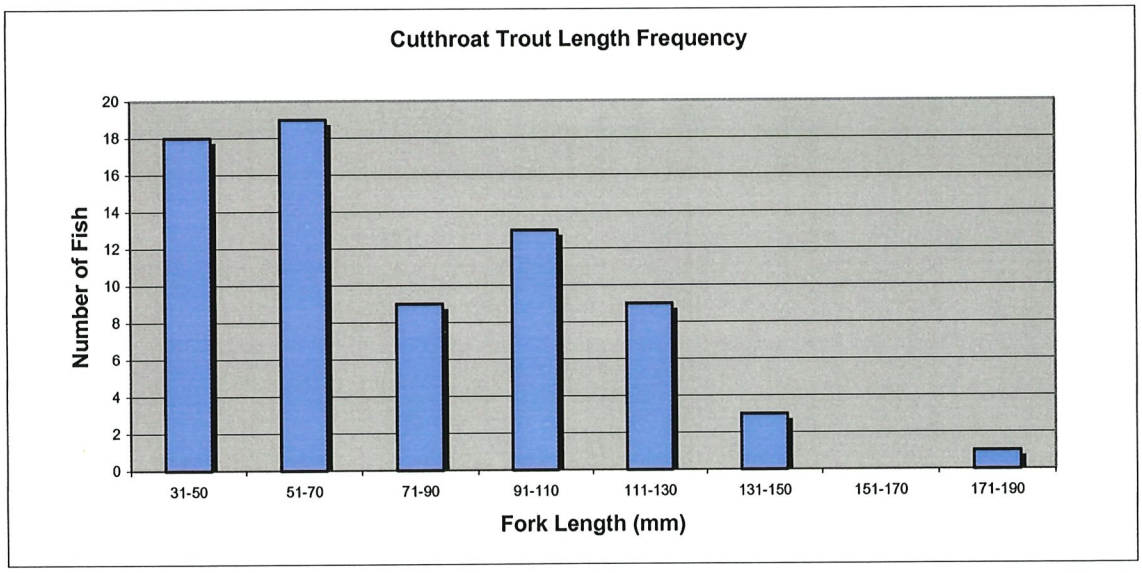


Figure 4 length frequency distribution for cutthroat trout captured in streams (isolated sections) along 1st Avenue.

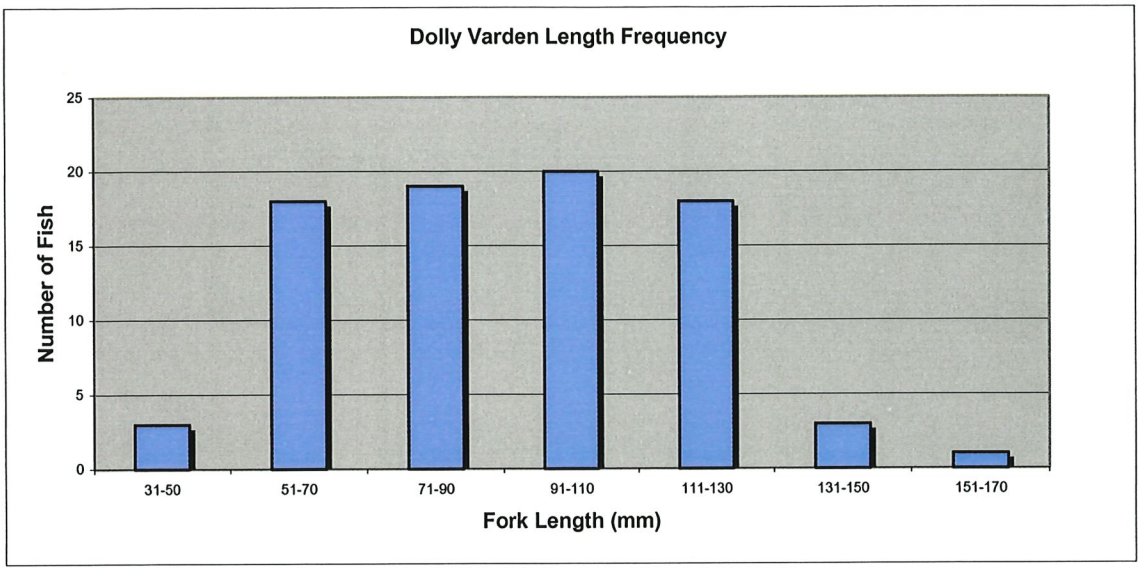


Figure 5 length frequency distribution for Dolly Varden captured in streams (isolated sections) along 1st Avenue.

# APPENDIX V

## Detailed Construction Photos

# Appendix V-6

## Culvert Replacement Environmental Monitoring Photos

| | |
|---|---|
| Location: | 1St Avenue |
| Contractor: | Nechako Northcoast |
| Environmental Monitor: | Jason Harris (Triton) |
| Stream | #6 |
| Date of installation: | September 3, 2003 |
| Existing Culvert size: | 600 mm |
| Replacement Culvert: | Pipe-Arch 14 / 800 / 580 |

Photo 6-1 Crew deciding on upstream sump location.

Photo 6-2 Downstream photo towards downstream stop net.

Photo 6-3 Upstream sandbag / poly plastic dam.

Photo 6-4 Excavating existing culvert.

Photo 6-5 Photo of downstream sandbag / poly plastic weir and isolated dirty water within trench after culvert removal. Poly / boulder diffuser at left of picture.

Photo 6-6 Photo at upstream end of diversion.

Photo 6-7 Laying new section of culvert in trench.


Photo 6-8 Back-filling new culvert.

# Appendix V-6B

## Culvert Replacement Environmental Monitoring Photos

| | |
|---|---|
| Location: | 1St Avenue |
| Contractor: | Nechako Northcoast |
| Environmental Monitor: | Jason Harris (Triton) |
| Stream | #6B |
| Date of installation: | September 4, 2003 |
| Existing Culvert size: | 1000 mm |
| Replacement Culvert: | Pipe-Arch 12 / 1030 / 740 |

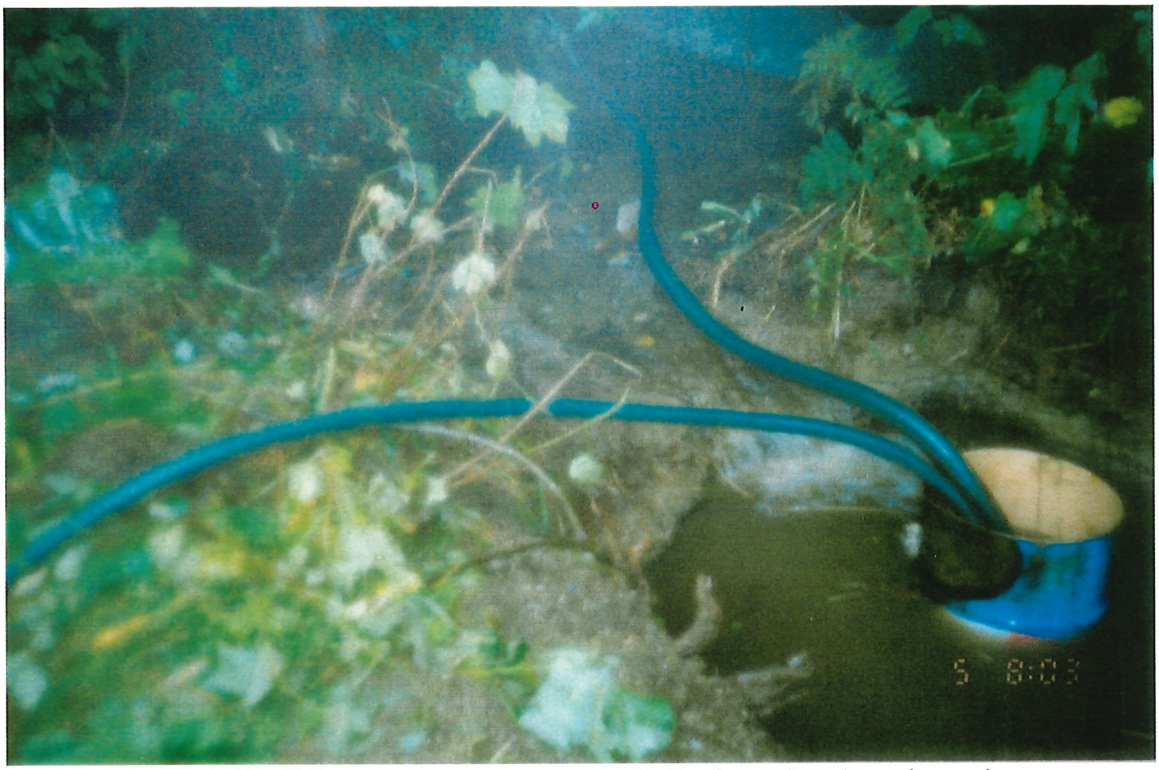

Photo 6B-1 Partially filling sump at upstream end of culvert for cleansing prior to diversion around site.

Photo 6B-2 Sandbag / poly weir at upstream end of culvert.

Photo 6B-3 Sandbag / poly weir at downstream end of site.

Photo 6B-4 Sandbag / poly weir at upstream end of site and fish exclusion fence in background.

Photo 6B-5 Placing culvert under natural gas line.

Photo 6B-6 Crew filling culvert with approved fisheries gravel.

Photo 6B-7 Crew collaring culvert and wrapping natural gas line prior to backfilling.

Photo 6B-8 Flushing of culvert to remove fines from fill materials. Dirty water was pumped into adjacent vegetation.

Photo 6B-9 Full breach of upstream weir and removal of downstream weir.

Photo 6B-10 Backfilling upstream sump.

# Appendix V-5

## Culvert Replacement Environmental Monitoring Photos

| | |
|---|---|
| Location: | 1St Avenue |
| Contractor: | Nechako Northcoast |
| Environmental Monitor: | Jason Harris (Triton) |
| Stream | #5 |
| Date of installation: | September 8, 2003 |
| Existing Culvert size: | 600 mm |
| Replacement Culvert: | Pipe-Arch 16 / 1030 / 740 |

Photo 5-1 Crew filling sump at upstream end of culvert.

Photo 5-2 Excavating roadbed.

Photo 5-3 Removing existing culvert from trench.

Photo 5-4 Leveling culvert bed to grade.

Photo 5-5 Aligning upper and lower sections of culvert prior to collaring.

Photo 5-6 Compacting fill around culvert.

Photo 5-7 Flushing of culvert to remove fines from culvert infill materials. Dirty water pumped into adjacent vegetation.

# Appendix V-9

## Culvert Replacement Environmental Monitoring Photos

| | |
|---|---|
| Location: | 1St Avenue |
| Contractor: | Nechako Northcoast |
| Environmental Monitor: | Jason Harris (Triton) |
| Stream | #9 |
| Date of installation: | September 9-10 2003 |
| Existing Culvert size: | 800 mm |
| Replacement Culvert: | Pipe-Arch 14 / 1880 / 1260 |

Photo 9-1 Searching for natural gas line.

Photo 9-2 Downstream section of culvert being installed under natural gas line.

Photo 9-3 Sump with pump and sandbag / poly weir at outlet of culvert.

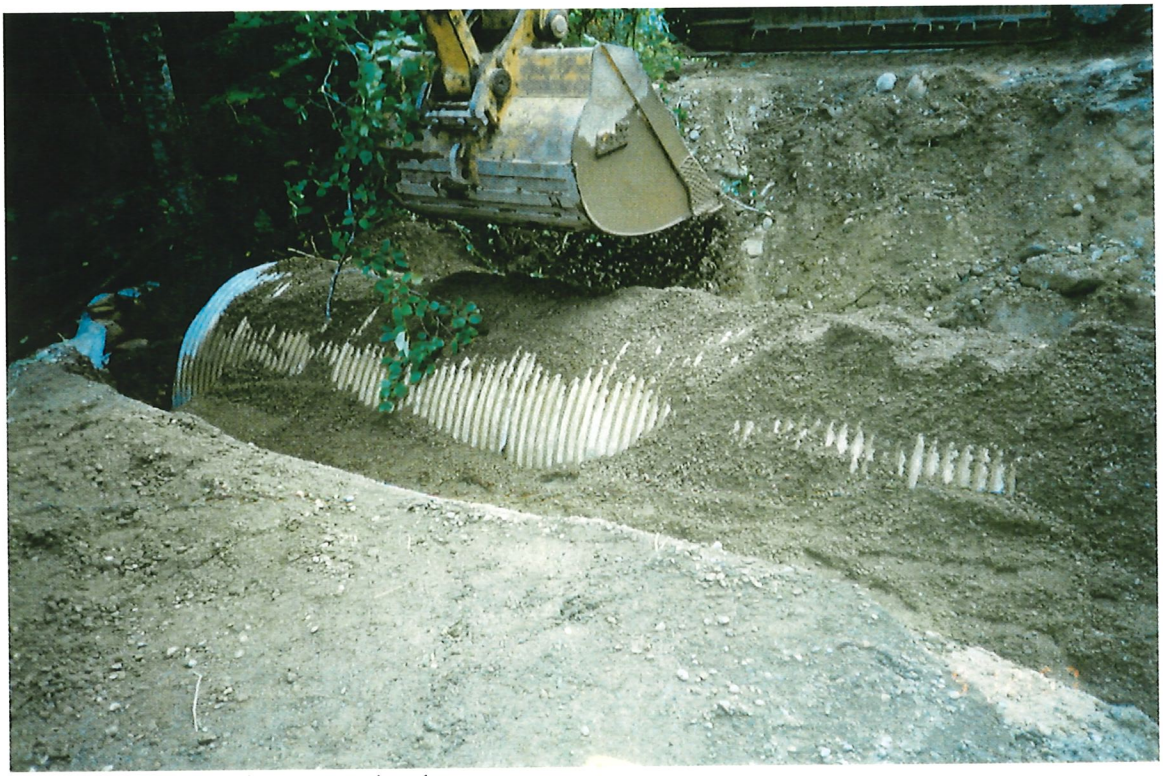

Photo 9-4 Backfilling around culvert.

Photo 9-5 Compacting gravel around culvert.

Photo 9-6 Upstream sandbag / poly weir with fisheries gravel for culvert infill.

Photo 9-7 Flight pump and excavator used for 1st Avenue installations.


Photo 9-8 Partial breach of upstream weir for culvert cleanse.

Photo 9-9 Removing dirty water from lower sump during culvert cleanse.

Photo 9-10 Photo of culvert inlet after full breach and sump infill.

# Appendix V-10

## Culvert Replacement Environmental Monitoring Photos

| | |
|---|---|
| Location: | 1St Avenue |
| Contractor: | Nechako Northcoast |
| Environmental Monitor: | Jason Harris (Triton) |
| Stream | #10 |
| Date of installation: | September 11, 2003 |
| Existing Culvert size: | 600 mm |
| Replacement Culvert: | Pipe-Arch 14 / 1880 / 1260 |

Photo 10-1 Excavating around natural gas line.

Photo 10-2 Sump at upstream end of culvert prior to filling.

Photo 10-3 Excavating around natural gas line.

Photo 10-4 Filling upstream sump prior to diversion. Note 3" pump for removing dirty water

Photo 10-5 Backfilling around culvert.

Photo 10-6 Backfilling and compacting around culvert.

Photo 10-7 Inlet of culvert showing distribution of gravel substrates. Note local water intake adjacent to right bank.

Photo 10-7 Outlet of culvert showing local water intake hose running up and through culvert.

# Appendix V-12

## Culvert Replacement Environmental Monitoring Photos

| | |
|---|---|
| Location: | 1St Avenue |
| Contractor: | Nechako Northcoast |
| Environmental Monitor: | Jason Harris (Triton) |
| Stream | #12 |
| Date of installation: | September 12, 2003 |
| Existing Culvert size: | 600 mm |
| Replacement Culvert: | Pipe-Arch 13.5 / 680 / 500 |

Photo 12-1 Placing sump adjacent to stream.

Photo 12-2 Filling upstream sump prior to diversion. Note 3" pump for removing dirty water

Photo 12-3 Diffuser at end of diversion hose.


Photo 12-4 Crew searching for gas line in culvert trench.

Photo 12-5 Compacting gravel around culvert.

Photo 12-6 Water out of culvert after full breach of upstream weir.

# Appendix V-14

## Culvert Replacement Environmental Monitoring Photos

| | |
|---|---|
| Location: | 1St Avenue |
| Contractor: | Nechako Northcoast |
| Environmental Monitor: | Jason Harris (Triton) |
| Stream | #14 |
| Date of installation: | September 15, 2003 |
| Existing Culvert size: | 600 mm |
| Replacement Culvert: | Pipe-Arch 13 / 1030 / 740 |

Photo 14-1 Culvert outlet.

Photo 14-2 Culvert inlet.

# Appendix V-16

## Culvert Replacement Environmental Monitoring Photos

| | |
|---|---|
| Location: | 1St Avenue |
| Contractor: | Nechako Northcoast |
| Environmental Monitor: | Jason Harris (Triton) |
| Stream | #16 |
| Date of installation: | September 16, 2003 |
| Existing Culvert size: | 600 mm |
| Replacement Culvert: | Pipe-Arch 15 / 1390 / 970 |

Photo 16-1 Filling upstream sump prior to diversion.

Photo 16-2 Excavating down to existing culvert.

Photo 16-3 Downstream stop-net and diffuser for diversion hose.

Photo 16-4 Removing waste materials from site.

Photo 16-5 Example of material found throughout road grade.


Photo 16-6 Signage letting resident know of road closures.

Photo 16-7 Photo of inlet immediately after breach of upstream weir.

Photo 16-8 Photo of outlet immediately after breach of upstream weir.

# APPENDIX VI

## Detailed Construction Plans

NECHAKO NORTHCOAST

CONSTRUCTION TERRACE
141187 VENTURES LTD.

P.O. Box 745
5720 Highway 16 West
Terrace, B.C. V8G 4C3
PH. (250) 638-1881
FAX (250) 638-8409


August 14, 2003

Department of Fisheries and Oceans
Terrace, B.C.
Fax 615-5364

**Attention: Robert Dams**

Dear Robert:

Re: Lowering water levels at Beaver Dams.

This is a request a referral from the Department of Fisheries and Oceans regarding work planed for the 8 culvert installations on First Ave.

The sediment control, fish salvage and monitoring will be done by Triton Environmental Consultants. They will have a monitor on site while work is progress.

The method of installation will be as follows. Triton will construct silt control, Isolate the work area and salvage the fish before work starts. A sump will be dug at the up stream end of the work site. Stream water will be pumped to the down stream end of work area. The culvert bed will then be excavated and culvert installed. Once the installation is completed the sump will be filled and the silt control removed. An inspection of the each installation site will be conducted to ensure no spawning activity has begun in the work area the day before the installation.

Our schedule will start on September 2, 2003 and we anticipate completion on or before the 11th of September.

Thank you for your time and consideration.

Yours truly,

Robert Cooper
Roads Superintendent

Cc Dan Beaulac
Grant Watson

BRITISH COLUMBIA


Date: August 1, 2003

File: 526 2 35

Mitch Drewes
Fisheries and Oceans Canada
Terrace District Office

Re: 1st Avenue culvert replacements

Dear Mitch,

We are seeking approval to replace a number of culverts along 1st Ave at Lakelse Lake as identified by Fisheries and Oceans Canada in the Summary of 1st Avenue Culverts that should be changed. The culverts to be changed are at Streams 2, 3, 4, 5, 6, 9, 10, 12, 14, 16, 4&5b, and 6b, as described in the Lakelse Lake Hard Surfacing Project Drainage and Environmental Study (Oct 2001). The purpose of the culvert changes are to replace old or damaged culverts as well as to address fish passage problems through the existing culverts.

For the replacements we propose to install corrugated steel pipe (CSP) pipe-arch type culverts. The shape of this style pipe is shown in the attached pages. The CSP pipe-arch was chosen due to the fact that there is limited fill cover above the existing culverts. The pipe-arch allows for a wider pipe without greatly increasing the height of the pipe. The size of pipe for each stream was chosen taking into account the width of the stream as well as the existing amount of road fill above the culverts. The length of each pipe was determined from measurements made by Fisheries and Oceans. Some of the new culvert lengths are longer than the original because the road bank gravel is sloughing in around the culvert ends. All the values for the size, length, existing road fill cover, and stream width can be found in the attached pages in *Table 1*. The height of the road will not be raised for the purpose of installing any of the replacement culverts.

Nechako Northcoast Construction (NNC) will do the installation of the replacement culverts. NNC or MOT will have a sub-contractor to do the work of silt screening and fish trapping during each installation. NNC intends to use a pump to move water from the upstream side of the road, downstream of the fish trap, to the other side of the road, upstream of the silt screen, to allow the stream to continue to flow during installation. Pumps will also be used to clear water out of the construction site. The replacement culverts will be installed below the grade of the existing culverts. This will allow for the culverts to be partially filled with natural materials from the stream bed. We will hand place the natural on site materials in the culvert bottoms. If there is not enough natural material available in the case of the gravel fill, screened gravel of 2 inch diameter and less will be used.

Yours truly,

Nathan Voogd

Nathan Voogd, YEP Student MoT

Enclosure
cc Ministry of Water Land & Air Protection



**Ministry of Transportation**

**Northern Region**

Skeena District
4825 Keith Avenue
Terrace, B.C. V8G 1K7
Telephone: (250) 638-6440
Facsimile: (250) 638-6414

Table 1

| | 1st Avenue Culverts – July 2003 – Nathan Voogd, MoT | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Stream / Pipe # | Existing Amount of Road Fill inches (cm) | Existing Culvert L (m) / ∅ (mm) | Comments | Replacement Culvert Type / Length (m) / Span × Rise (mm) | Cost of material ($) | Stream Width (mm) | Notes Try for 2 FT. |
| 04 | 1 | 48 (120)<br>52 (130) | 12.2 /<br>1000<br>600 | 2 pipes, 1000 pipe is a half pipe<br>Spawning Upstream<br>Gravel streambed | Concrete Box Culvert / 14.64 / 3050 × 1200 | [redacted] | 3600 US<br>3200 DS | Outside dimensions are 3558 × 1708, would have to be buried slightly to allow for proper fill cover, gravel fill |
| 04 | 2 | 38 (100) US<br>52 (130) DS | 14.1 /<br>500 | DS side of pipe is partially collapsed and completely submerged<br>mud streambed | Pipe-Arch / 15 / 1030 × 740 | [redacted] | 900 US<br>700 DS | Pipe can be filled ~30cm leaving a rise of ~50cm, can have ~1m of fill on top then |
| 04 | 3 | 43 (110) | 12.0 /<br>500 | US end of pipe in poor condition, DS side is rusted badly, mud/organic streambed and in culvert | Pipe-Arch / 13 / 1030 × 740 | [redacted] | 1000 US<br>1000 DS | Pipe can be filled ~30cm leaving a rise of ~50cm, can have ~1m of fill on top then |
| 04 | 4 | 50 (130) | 15.4 /<br>600 | Pipe is in good condition<br>No material in culvert,<br>muddy streambed | Pipe-Arch / 16 / 1880 × 1260 | [redacted] | 2600 US<br>1400 DS | Can be filled ~50cm, leaves rise of ~70cm, can have ~1m of fill |
| 03 | 5 | 50 (130) | 15.4 /<br>600 | Bottom half of pipe is rusted badly<br>Spawning Upstream<br>Gravel streambed | Pipe-Arch / 16 / 1030 × 740 | [redacted] | 900 US<br>800 DS | Pipe can be filled ~30cm leaving a rise of ~50cm, can have ~1m of fill on top |
| 04 | 4 & 5b | 30 (80) | 9.9 /<br>700 | Pipe is rusted, gravel streambed and in culvert, no post barrier on roadside | Pipe-Arch / 12 / 1880 × 1260 | [redacted] | 2200 US<br>1800 DS | Can be filled ~50cm, leaves rise of ~70cm, can have ~80cm of fill |
| 03 | 6 | 24 (60) US<br>40 (100) DS | 13.8 /<br>600 | US end of pipe is bent out of shape, culvert clean, gravel/sand streambed | Pipe-Arch / 14 / 800 × 580 | [redacted] | 750 US<br>800 DS | Can be filled ~20cm, leaves rise of ~40cm, can have ~80cm of fill |
| 03 | 6b | 20 (50) US<br>30 (80) DS | 11.3 /<br>1000 US<br>600 DS | US side of pipe is a 1000 half pipe, DS side is a 600, mud/organic streambed, no post barrier on roadside | Pipe-Arch / 12 / 1030 × 740 | [redacted] | 1150 US<br>1700 DS | Can be filled ~30cm, leaves rise of ~50cm, can have ~60cm of fill |

Table 1 Continued

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 03 | 9 | 14 (40) US<br>20 (50) DS | 12.4 /<br>800 | Pipe is in good condition<br>Gravel streambed, some gravel in culvert | Pipe-Arch / 14 / 1880 × 1260 |  | 1800 US<br>2200 DS | Can be filled ~50cm, leaves rise of ~70cm, can have ~50cm of fill |
| 03 | 10 | 16 (40) US<br>25 (65) DS | 12.2 /<br>600 | Pipe looks in good condition, gravel in culvert, mud US | Pipe-Arch / 14 / 1880 × 1260 |  | 2000 US<br>2000 DS | Can be filled ~50cm, leaves rise of ~70cm, can have ~50cm of fill |
| 03 | 12 | 6 (15) US<br>25 (65) DS | 11.5 /<br>600 | Pipe is in poor condition<br>Gravel/organics streambed | Pipe-Arch / 13.5 / 680 × 500 |  | 750 US<br>600 DS | Can be filled ~20cm, leaves rise of ~30cm, can have ~40cm of fill |
| 03 | 14 | 24 (60) US<br>36 (90) DS | 12.65 /<br>600 | Pipe is rusted, culvert clean, gravel streambed DS, mud streambed US | Pipe-Arch / 13 / 1030 × 740 |  | (adjusted)<br>1200 US<br>800 DS | Can be filled ~30cm, leaves rise of ~45cm, can have ~1m of fill |
| 03 | 16 | 27 (70) US<br>44 (110) DS | 13.4 /<br>600 | Pipe is half filled with gravel and debris, gravel streambed | Pipe-Arch / 15 / 1390 × 970 |  | 1400 US<br>1500 DS | Can be filled ~38cm, leaves rise of ~60cm, can have the same amount of fill |

Other Comments:

Only Streams 1 and 5 are identified as spawning streams and need gravel fill.
Most of the other streams have muddy organic streambeds.
L = length
∅ = diameter
Pipe Arch prices do not include taxes or shipping.