3431.03 / WP#T-1726

# 1st Avenue Culvert Replacements (Lakelse Lake)

# Stream Crossings 2 to 4

# **Environmental Monitoring Report**

*Prepared for:*

**Nechako Northcoast Construction**
PO Box 745
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Terrace, BC
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March 2004

*Prepared by:*

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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 3 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 March 16, 2004 to March 22, 2004. This report is intended to act as a supplement to the environmental monitoring report submitted to NNC in January 2004. This report will fulfill the reporting requirements associated with the Fisheries and Oceans Canada Letter of Advice, Fisheries and Oceans Canada Scientific License and Ministry of Water Land and Air Protection Fish Collection Permit.

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 March 16, 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 Dorey. Daily discussions included proposed construction activities, environmental concerns and general construction methodology.

### 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 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. The

use of electrofishing was not permitted as an acceptable fish salvage method due to water temperatures less than 4°C and the potential of active redds within the salvage area. Minnow trapping was selected as an effective fish salvage option. Minnow traps were set within each isolated area and minimums of two overnight sets were conducted prior to construction. Fish salvage results are summarized in Table 1. Detailed fish capture results are summarized in Appendix I.

Table 1. Fish Salvage Results

| | Stream 2 | | Stream 3 | | Stream 4 | | Totals | |
|---|---|---|---|---|---|---|---|---|
| | # | % | # | % | # | % | # | % |
| Coho Salmon | 0 | 0% | 6 | 67% | 23 | 43% | 29 | 39% |
| Cutthroat Trout | 3 | 25% | 1 | 11% | 3 | 6% | 7 | 10% |
| Dolly Varden | 9 | 75% | 2 | 22% | 25 | 47% | 36 | 50% |
| Rainbow Trout | 0 | 0% | 0 | 0% | 1 | 2% | 1 | 1% |
| Sculpin | 0 | 0% | 0 | 0% | 1 | 2% | 1 | 1% |
| Total | 12 | 100% | 9 | 100% | 53 | 100% | 74 | 100% |

## 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 are provided in Appendix II.

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.

### 3.1 Diversion of Flows

Each site was dewatered using a diversion dam that redirected stream flow to an excavated sump hole where the flow was pumped around the construction site. The sumps would be located adjacent to the channel and upstream of the culvert. Placing the upstream sump adjacent to the channel allowed the sump to be excavated in the dry and water was diverted from the main channel with a small diversion ditch. Depending on the stream flow a 6" or 3" pump was then used to divert stream flow 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 so the sump would be clean for stream flow diversion to downstream fish habitat. Once the sump water was clean diversion dam was placed at the upstream end of the culvert to allow all stream flow to enter the sump for pumping around the site.

When the site was dewatered an additional sump was installed at the outlet end of the culvert to collect sediment-laden water and stop groundwater from back flooding the construction area. 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 from the excavation and placed along the road shoulder for removal from the site. Sediment-laden water that entered the site while removing the existing pipe was pumped from the downstream sump into adjacent vegetation.

### 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 III).

Crews shoveled the gravel into the culvert from both ends and leveled the material placed within the culvert using shovels and stream flow. This method was effective and the use of stream flow cleaned the gravel at the same time. Sediment-laden water from was trapped in a sump at the outlet of the culvert and pumped into adjacent vegetation for filtering.

The effectiveness of silt abatement strategies was 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 allowed a portion of stream flow 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 to filter out sediment and prevent sediment-laden water from entering downstream fish habitat. The culverts were flushed for approximately 20 or until turbidity suggested that the majority of fine sediments had been flushed out of the culvert. Stream flow was then re-instated back into the main channel by removing the upstream weir. Fully flooding the culvert resulted in increased turbidity for approximately 10 minutes.

Once flows were completely re-instated the upstream sump was blocked off from the main channel. The sump was then pumped dry and filled with gravel. Clean up of the work site was conducted and loose road shoulders were contoured.

## 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 stream banks were re stabilized.

- 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 dry perimeter work site prior to main channel breaching was pumped into vegetated areas to allow for sediment-laden water to filter before re entering the stream.

- 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.

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

# APPENDIX I

## Detailed Fish Capture Results

## Fish Abundance

A total of 73 salmonids and 1 sculpin were salvaged from streams (isolated construction sites) along 1st Avenue (Lakelse Lake) during the March 16, 2004 to March 22, 2004 construction period. Salmonid species captured included: 29 coho salmon, 7 cutthroat trout, 36 Dolly Varden, 1 rainbow trout. Table 1 summarizes the captures by stream (isolated section) along 1st Avenue.

Table 1. Fish Salvage Results

| | Stream 2 | | Stream 3 | | Stream 4 | | Totals | |
|---|---|---|---|---|---|---|---|---|
| | # | % | # | % | # | % | # | % |
| Coho Salmon | 0 | 0% | 6 | 67% | 23 | 43% | 29 | 39% |
| Cutthroat Trout | 3 | 25% | 1 | 11% | 3 | 6% | 7 | 10% |
| Dolly Varden | 9 | 75% | 2 | 22% | 25 | 47% | 36 | 50% |
| Rainbow Trout | 0 | 0% | 0 | 0% | 1 | 2% | 1 | 1% |
| Sculpin | 0 | 0% | 0 | 0% | 1 | 2% | 1 | 1% |
| Total | 12 | 100% | 9 | 100% | 53 | 100% | 74 | 100% |

## Species Composition

Dolly Varden and cutthroat trout were captured at all culvert locations. Dolly Varden were the most abundant species captured and accounted for 50% of the total salvaged fish. Cutthroat trout only made up 10% of the total salvaged fish despite being present at each culvert location. Coho salmon were salvaged from two stream culvert locations and made up 39% of the total salvaged fish. One unidentified sculpin and 1 rainbow trout were captured out of Stream 4. Figure 1 summarizes the species composition by culvert location (isolated section) along 1st Avenue.

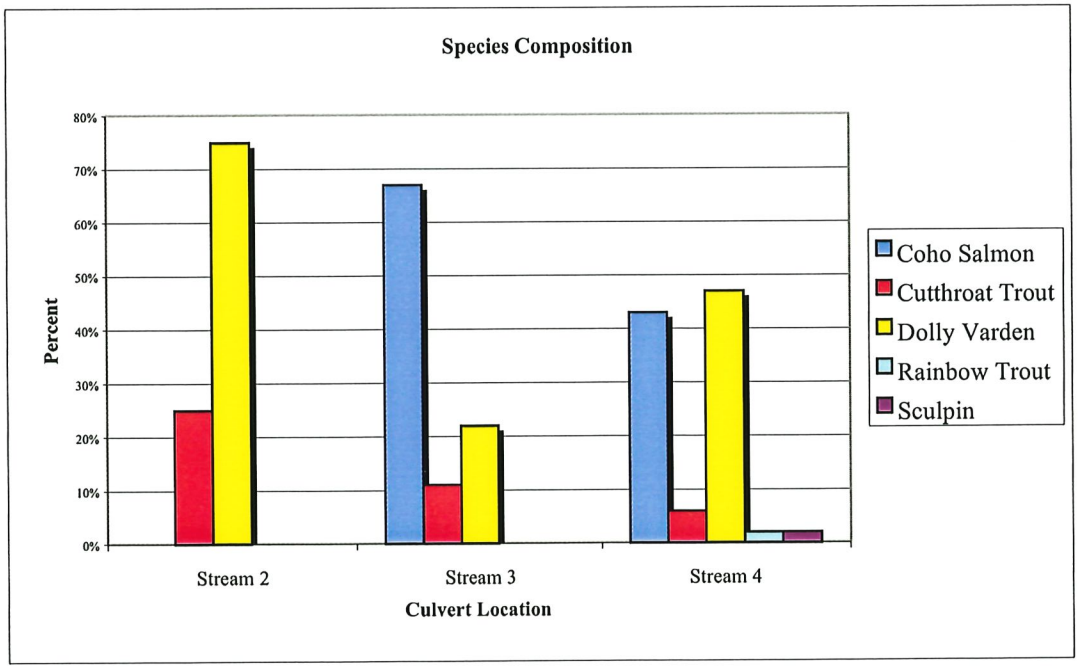



Figure 1. Summary of species composition.

Stream 4 contained the greatest diversity of fish species, which in this case probably reflects the presence of higher quality habitat in Stream 4 when compared to the other two streams. Stream 2 had the lowest diversity of fish species. The low diversity of fish species in Stream 2 is likely a result of the habitat (dominated by shallow riffles) that was salvaged. Coho were the dominant fish species in Stream 3, which is likely a result of the flooded wetland type habitat present at this location.

**Fish Length**

Overall, 29 coho, 7 cutthroat trout, 36 Dolly Varden, 1 rainbow trout, and 1 unidentified sculpin were measured for fork length. Mean and median fork length was not calculated for rainbow trout and sculpin because only 1 specimen of each species was captured. Table 2 summarizes fork length data for species captured.

Table 2. Fork lengths for species captured.

| | Coho Salmon | Cutthroat Trout | Dolly Varden | Rainbow Trout | Sculpin |
|---|---|---|---|---|---|
| Number | 29 | 7 | 36 | 1 | 1 |
| Mean (SE) | 71.5 (2.5) | 100.7 (13.4) | 92.9 (3.12) | na | na |
| Median | 70 | 105 | 95 | na | na |
| Min. | 50 | 55 | 60 | 115 | 55 |
| Max. | 105 | 145 | 135 | 115 | 55 |

Length frequency distributions for coho and Dolly Varden captured at culvert locations prior to construction are provided in Figure 2 and Figure 3. Length frequency distributions were not generated for cutthroat trout, rainbow trout, and sculpin because the sample size was not large enough for graphical representation.

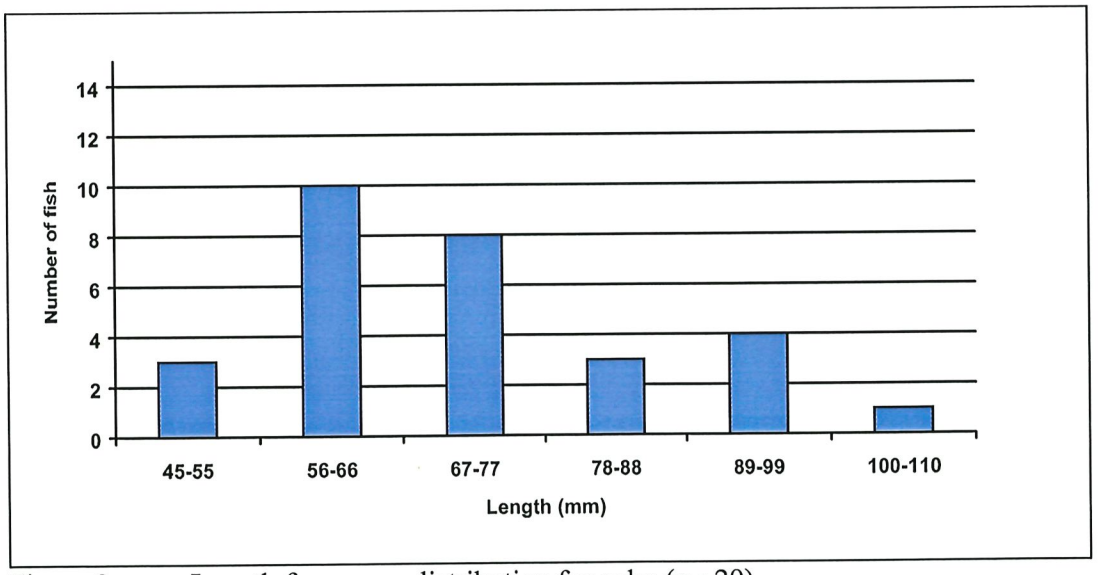



Figure 2. Length frequency distribution for coho (n= 29)

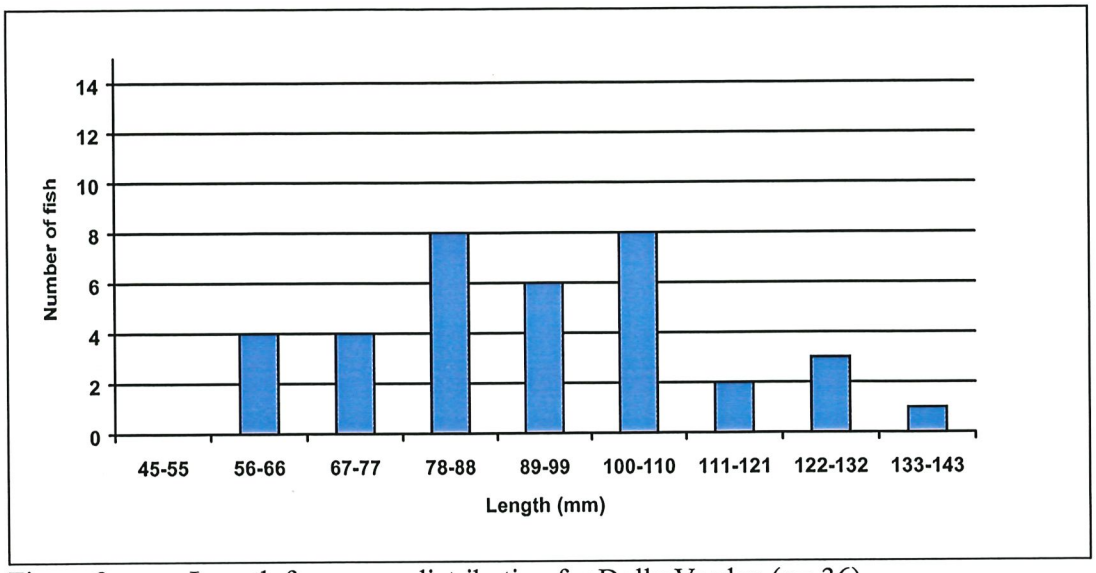



Figure 3. Length frequency distribution for Dolly Varden (n= 36)

## APPENDIX II

## Detailed Construction Photos

## Culvert Replacement Environmental Monitoring Photos

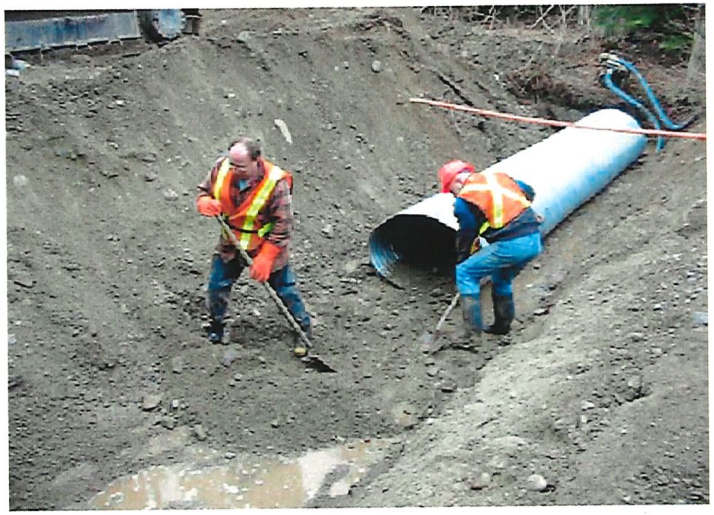
| | |
|---|---|
| Location: | 1St Avenue |
| Contractor: | Nechako Northcoast |
| Environmental Monitor: | Jason Dorey (Triton) |
| Stream | #2 |
| Date of installation: | March 22, 2004 |
| Existing Culvert size: | 500 mm |
| Replacement Culvert: | Pipe-Arch 15m / 1030 X 740 mm |

**Inlet sump and stream flow diversion ditch.**

**Sump located at the downstream end of the culvert excavation.**

**Culvert excavation.**

**Downstream sump.**



**Culvert was infilled with gravel and cobble substrates.**

**Culvert inlet post construction.**

**Culvert was backfilled with gravel material.**

**Culvert outlet post construction.**

**Culvert Replacement Environmental Monitoring Photos**

| | |
|---|---|
| Location: | 1St Avenue |
| Contractor: | Nechako Northcoast |
| Environmental Monitor: | Jason Dorey (Triton) |
| Stream | #3 |
| Date of installation: | March 18, 2004 |
| Existing Culvert size: | 500 mm |
| Replacement Culvert: | Pipe-Arch 13 m / 1030 X 740 mm |

**Inlet sump and stream flow diversion ditch.**

**Downstream sump was excavated to collect sediment-laden water.**

**Downstream fish isolation fence.**

**Downstream sump.**

**Sediment laden water was pumped into vegetated areas for settling.**

**Culvert inlet post construction.**

**Culvert was embedded to allow fish passage.**

**Culvert inlet post construction.**

**Culvert Replacement Environmental Monitoring Photos**

| | |
|---|---|
| Location: | 1St Avenue |
| Contractor: | Nechako Northcoast |
| Environmental Monitor: | Jason Dorey (Triton) |
| Stream | #4 |
| Date of installation: | March 19, 2004 |
| Existing Culvert size: | 600 mm |
| Replacement Culvert: | Pipe-Arch 16 m / 1880 X 1260 mm |

**Downstream fish isolation fence.**

**Stream flow was diverted into upstream sump.**

**Stream diversion dam located upstream of the work site.**

**Culvert inlet prior to backfilling.**

**Downstream sump prior to culvert placement.**

**Infill substrates were flushed with water prior to re directing stream flow through the new culvert.**

**Culvert was filled with gravel and cobble substrates.**

**Culvert outlet post construction.**

## APPENDIX III

**Letter from Nathan Voogd (MoT) to Mitch Drewes (DFO)**
**Re: 1st Avenue culvert replacements**

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**

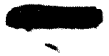
**Northern Region**

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, 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 x 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 x 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 x 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 x 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 x 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.