

## AR-CV-144-1

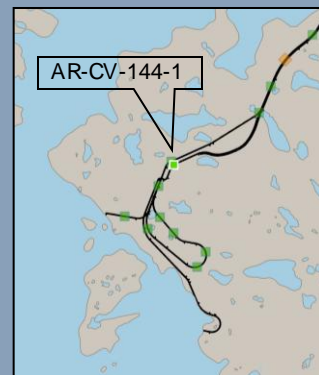
Zone: 17W

Easting: 595001

Northing: 7802717

Station: 145+000

Fish Habitat	Important fish habitat
Structure Design	No. Barrels: 3 Diameter: 3 m Length: 45m Slope: 1.7 %
Drainage Area	2.41 km <sup>2</sup>
Design Flow	10 yr 3 day delay = 0.09 m <sup>3</sup> /s 200-yr = 0.71 m <sup>3</sup> /s
Velocity per Barrel	10 yr 3 day delay = 0.71 m/s 200 yr = 1.22 m/s



### Description of Crossing Structure

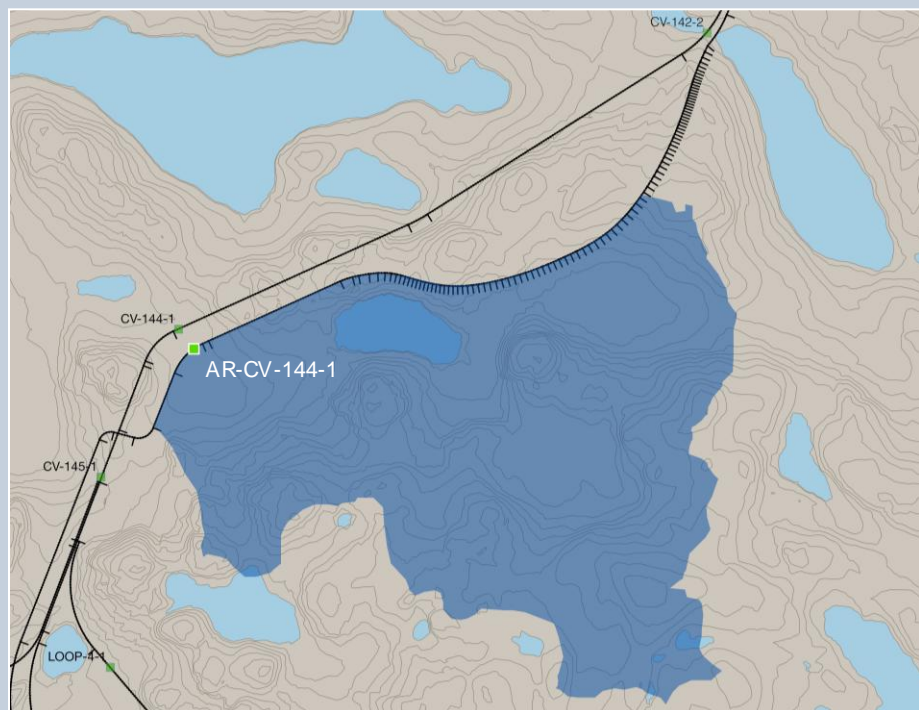
The representative access road culvert, AR-CV-144-1 is located in a section of road that crosses a well-defined valley corridor approximately 90m upstream of proposed rail crossing location CV-144-1, and consists of three 3000mm diameter culverts. The barrels are set in a staggered configuration to ensure that during low-flow conditions there is concentration of flow in the central barrel in order minimize wetted width and maximize flow depth. The secondary culverts are required to convey large design storm events and act as relief culverts if the main barrel becomes blocked by ice and snow during spring freshet. The road embankment slopes will be 1:5:1 with 8.1 m of fill over the culvert invert. The projected 25 year settlement is less than 0.2 m.

### Crossing Construction

Machinery to be used for the construction includes trucks, crane, and backhoe (for spoils removal). Materials and machinery will be transported to and from the site on an access road or on the rail alignment.

Crossing construction will occur in frozen conditions and thus there will be no water flow during construction. Temporary crossing of the watercourse will be required and will be constructed using a snow fill or ice bridge in accordance with applicable DFO, Nunavut Operation Statement. The temporary watercourse crossing will remain in place for the duration of the culvert construction only and will be removed as soon as possible. The temporary crossing will not impact water flow as it will be removed prior to the spring melt.

**E337697-2000-07-124-0002**



- Representative Culvert
- ◆ Representative Bridge
- Culvert Locations
- ◆ Bridge Locations
- Drainage Area
- Rail Alignment
- Watercourses
- Lakes



0 400 800 m

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November 8/2011

DOCUMENT CONTROL



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Zone: 17W

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Station: 145+000

### Fish Habitat

### Important fish habitat

### Structure Design

No. Barrels: 3  
Diameter: 3 m  
Length: 45m  
Slope: 1.7 %

### Drainage Area

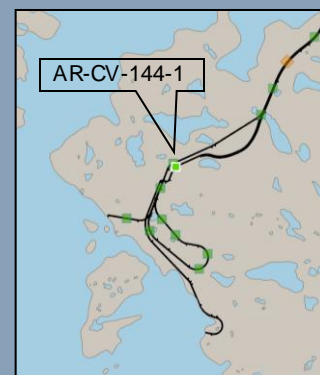
2.41 km<sup>2</sup>

### Design Flow

10 yr 3 day delay = 0.09 m<sup>3</sup>/s  
200-yr = 0.71 m<sup>3</sup>/s

### Velocity per Barrel

10 yr 3 day delay = 0.71 m/s  
200 yr = 1.22 m/s



## Site Photos

1



2



3



Photo 1 is looking upstream of the crossing. Photo 2 is looking looking downstream and photo 2 is looking across the stream.

## Existing Conditions at Crossing Site

Representative access road culvert AR-CV-144-1 is located in the Steensby Port area approximately 90m upstream of permanent rail crossing location CV-144-1. Crossing and approximately 1000 m north of the freight and fuel storage platform. The proposed access road crosses the watercourse between two permanent water bodies. North-South Consultants identified a barrier to fish passage upstream of this crossing location. The aquatic habitat assessment conducted for the DEIS determined that the watercourse is important fish habitat, particularly for ninespine stickleback.

Navigability	Not navigable
Width and Depth	Bankfull width = undetermined Wetted width = 1.7 m Maximum Depth = 0.17 m
Substrate and Vegetation	Channel Morphology: 60% riffle, 40% pool, (35% shallow, 5% deep) Substrate Composition: flooded terrestrial veg., 20% small cobble, 15% large cobble, 10% fines, 2% boulder Stream Cover: 53% flooded terrestrial veg., 5% large cobble, 5% deep pool, 2% boulder
Channel Meander Pattern	Floodplain Width (m): > 100 m Channel Pattern: sinuous/braided Channel Confinement: Unconfined Channel Gradient: <1° Bank Height (L/R; m): 0.10/none Bank Shape (L/R): undefined Bank Stability: low

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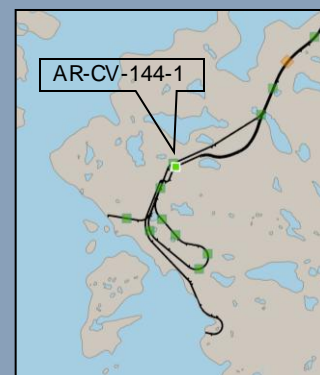
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Predicted Environmental Impact	Proposed Mitigation
Direct loss of fish habitat from structure installation.	<ul style="list-style-type: none"> <li>If construction of the culvert crossings is determined to result in a Harmful Alteration, Disruption or Destruction (HADD) of fish habitat, DFO will determine appropriate measures to ensure "no net loss".</li> <li>Watercourse channel will be restored to the original streamflow characteristics.</li> </ul>
Potential for fish stranding or mortality during construction	<ul style="list-style-type: none"> <li>As no Arctic Char spawning habitat is present, construction can occur during winter season when watercourses are typically dry or frozen to bottom to avoid impacts to fish passage.</li> <li>Culvert will be monitored for blockages and cleaned when necessary. This will ensure passage of juvenile and adult fish</li> <li>If construction occurs during open water season, withdrawal of any water will not exceed 10 % of the instantaneous flow, in order to maintain existing fish habitat</li> </ul>
Potential for barriers to fish passage Long culverts (e.g. > 50 m) may impede fish passage due to the lack of light inside the culvert.	<ul style="list-style-type: none"> <li>Meet DFO requirements for fish passage in culvert design</li> <li>The contractor will work with DFO to identify means of providing as much light as possible in long culverts.</li> </ul>
Potential for loss of riparian habitat within the footprint	<ul style="list-style-type: none"> <li>Restoration of riparian habitat and provision of culvert pools as required.</li> </ul>
Sediment effects and degradation of habitat (water quality) due to sediment or other contaminants both at the crossing and downstream	<ul style="list-style-type: none"> <li>Construction will follow practices outlined in the Section 9.6 and Project EMS (DEIS, Vol. 10)</li> <li>Timing of works in and adjacent to watercourses during winter window to avoid potential impacts to water quality and potential fish habitat.</li> </ul>
Damage to stream banks from construction equipment increases the potential for erosion	<ul style="list-style-type: none"> <li>Operate machinery on land (above the HWM) and in a manner that minimizes disturbance to the banks of the watercourse.</li> <li>Install effective sediment and erosion control measures before starting work to prevent the entry of sediment into the watercourse. Inspect them regularly during the course of construction and make all necessary repairs if any damage occurs.</li> <li>Banks and substrate will be restored to pre-construction condition.</li> </ul>
Removal of vegetation at crossing locations.	<ul style="list-style-type: none"> <li>This removal should be kept to a minimum and within the right-of-way.</li> <li>Approaches will be designed and constructed so that they are perpendicular to the watercourse to minimize loss or disturbance to riparian vegetation.</li> <li>Any disturbed areas will be vegetated by planting and seeding native trees, shrubs or grasses and areas will be covered by mulch to prevent erosion and to help seeds germinate. The site will be maintained until site is stabilized by vegetation.</li> </ul>
Direct or indirect impact from blasting.	<ul style="list-style-type: none"> <li>If blasting is required near watercourse, DFO Blasting Guidelines (Wright and Hopky) will be met where possible.</li> </ul>
Potential for spills of fuel or other fluid from construction vehicles	<ul style="list-style-type: none"> <li>Adhere to contingency plans identified in the project EMS (DEIS, Volume 10).</li> <li>Machinery is to arrive on site in a clean condition and is to be maintained free of fluid leaks.</li> <li>Wash, refuel and service machinery and store fuel and other materials for the machinery away from the water to prevent any deleterious substance from entering the water.</li> <li>Keep an emergency spill kit on site in case of fluid leaks or spills from machinery.</li> <li>Use snow berms (if possible) to prevent deleterious substances from entering the watercourse.</li> </ul>
Solid waste could foul the local environment and attract scavengers (i.e. polar bears)	<ul style="list-style-type: none"> <li>Solid waste generated at the crossing site will be removed from the site and disposed of in accordance with applicable Nunavut regulations.</li> </ul>