Bell and Fraser Lake Beaver Deceiver

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This document outlines the beaver deceiver installed at the discharge of Bell lake into the culvert under highway 366. It is fully constructed and fully operational. Though the beavers have been active since installation, the system is working as designed. At the time of writing, the lake levels are high but that is due to the high amount of rain we have received recently and throughout the summer. The lake levels should drop to more normal levels soon. No clearing of debris or damming materials has taken place since installation.
No maintenance of the system has been necessary and each component is in good shape. Despite this, I will continue to inspect the installation and report on any deficiencies until next summer.

Original Design: **(See figures 1 and 2)**

The original design called for four different components, namely:

1. **The trapezoid at the culvert**
2. **The pipe leading upstream**
3. **The inlet cage**
4. **The fake dam over the pipe**

All four components were to work in conjunction to not only provide a defence against damming but also to ensure a continuous flow of water and a more stable level in the lakes.

All of these were built and installed except for the fake dam.

1. Trapezoid:

The original design required a perimeter of fencing in the form of a trapezoid at the culvert with a mesh floor to keep the beavers from digging underneath. The mesh used for the fencing (and floor) was to have 6in by 6in spacing and be of heavy construction (6Ga wire or larger) and extend up out of the water by at least 18in or preferably 24in. This trapezoid was to be installed in the water stream and leave at least 2 ft of clearance between the fence and the bank. Fence posts were to be spaced no more than 4 ft apart and sunk (pounded) into the stream bottom.
Fencing and posts were to be either coated (enamel, powder-coat) or galvanised.

This trapezoid is meant to discourage beavers from damming the perimeter as it is too long and though they were likely to try damming on the outside of the fence, close to the culvert, they supposedly get discouraged as any further damming must occur farther away from the culvert. Apparently, they normally give up. Other parts of the design were meant to discourage them from even trying to dam at the trapezoid.

2. Pipe:

In addition to the culvert fencing, a pipe was to be installed through the fence wall, leading to a deeper part of the water upstream. The pipe itself needed to be of sufficient diameter to allow a decent flow of water and be of a durable material. Cinder blocks attached with wire were to be installed at various points along the length of the pipe in order to ensure that the pipe stayed below the water level. If, for any reason, the pipe were to rise above the lake level, then flow would cease. Drilling of holes along the top of the pipe at about a two foot interval would allow any trapped gases to escape and lessen the chance of the pipe wanting to float up.

3. Inlet Cage:

The inlet of this pipe was to be protected with a cylindrical mesh cage making it difficult, if not impossible for any beaver to plug it up. The cylindrical cage needed to be of sufficient diameter to keep the beavers from reaching the inlet and have a similar mesh size to the trapezoid. This would keep the beavers from getting in yet allow any smaller fish or wildlife to pass through. The pipe inlet needed to be underwater to keep the beavers from hearing any gurgling sounds which usually makes them want to dam it up.

4. Fake Dam:

It was proposed to build a “fake” beaver dam over the pipe approximately halfway between the trapezoid and the cylindrical cage. The purpose of this dam was to tempt the beavers to build another dam (if they were so inclined) at a location suitable to us. The idea was to half-ass the job and thereby encourage them to finish it properly. This dam not only would have discouraged them from damming further upstream (away from our devices) but also would have provided a mechanism by which we could have regulated the level of the lakes and thereby giving us a more consistent waterline throughout the year (except for periods of excessive rain or drought). The height of the outflow end of the pipe would dictate the height of the water levels.

Another function of the dam would have been to prevent too much debris from floating down onto the trapezoid.

Figure 1: Plan View (not to scale)

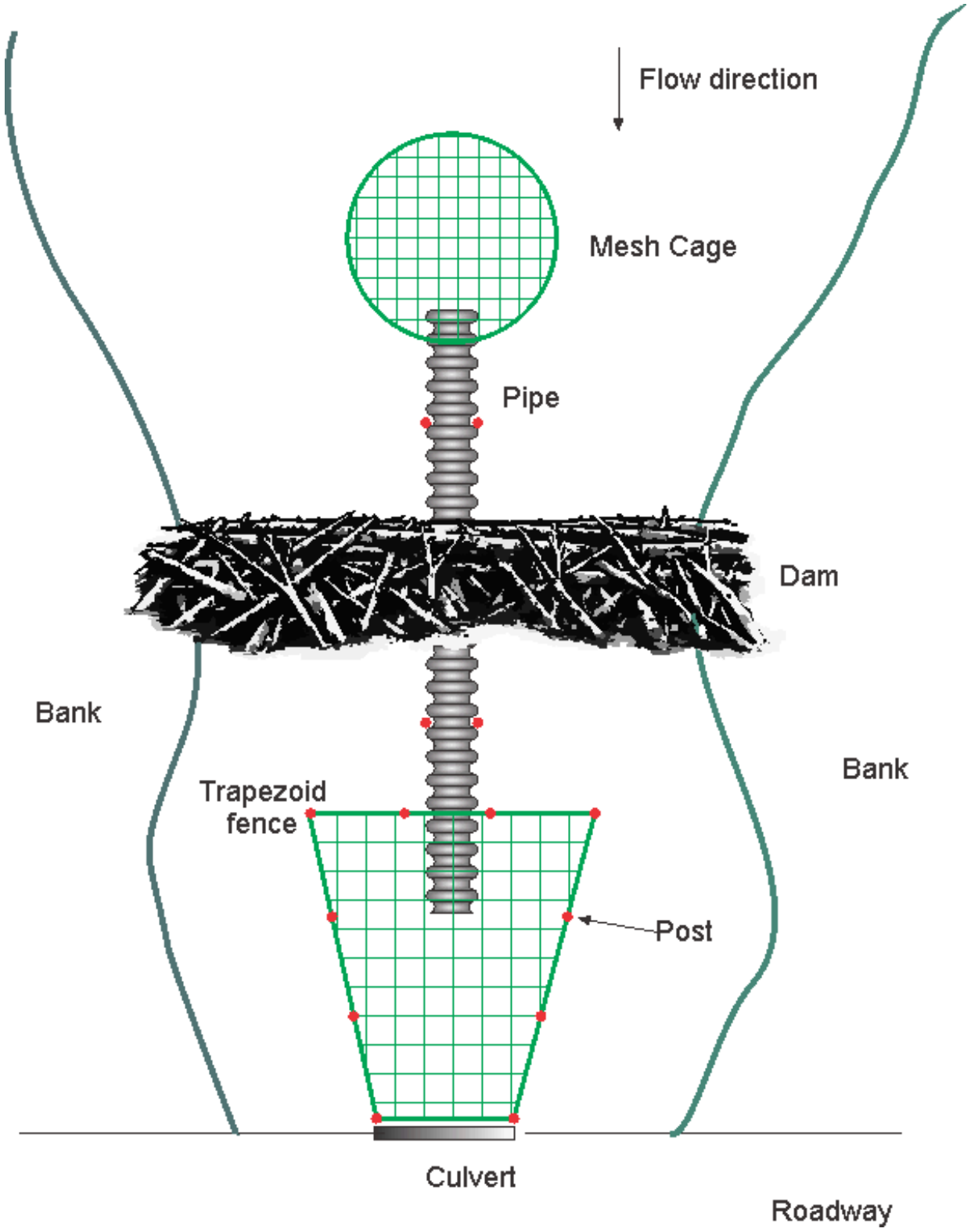
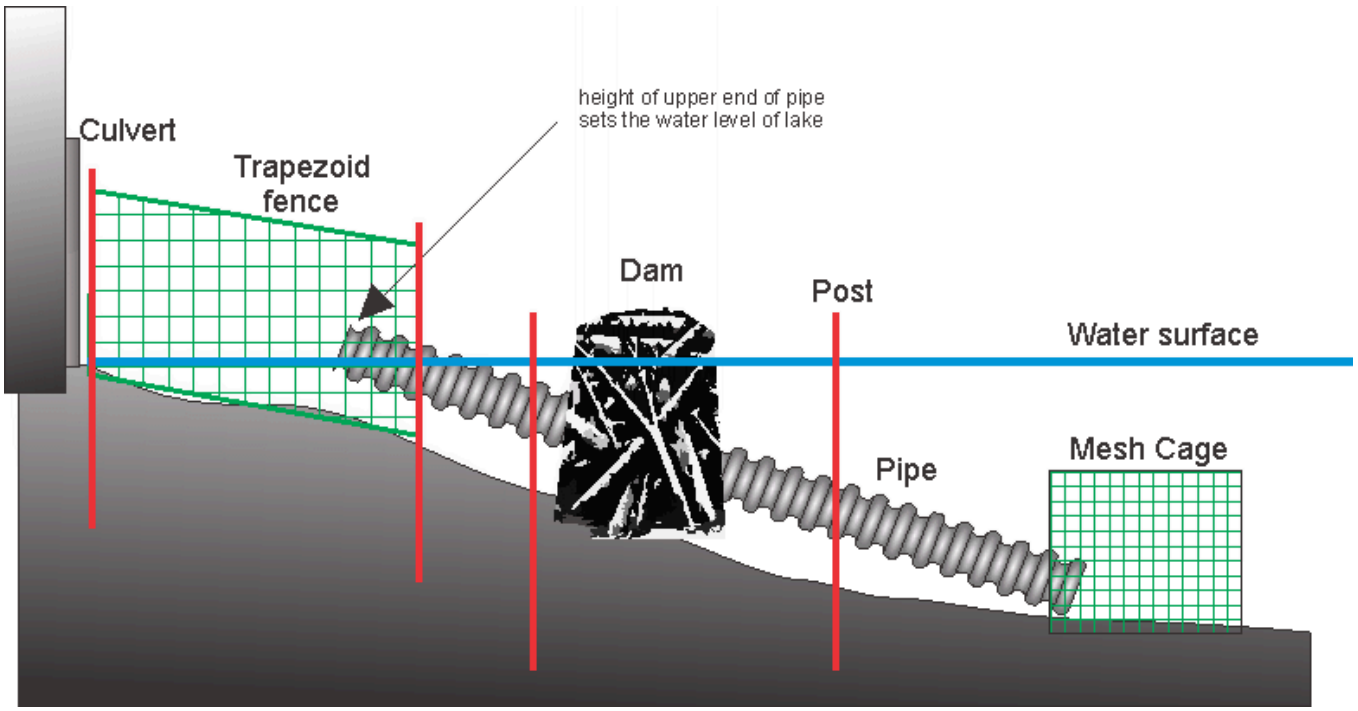


Figure 2: Side View
(flow direction is from right to left)



Estimated Costs:

The following shows the projected costs of materials:

Item #	Description	Qty	Unit Price	Price
1	T-Posts 7ft	18	$15.99	$287.82
2	Mesh Panel (4ft x 16ft)	5	$119.99	$599.95
3	T-Post clips	6	$2.49	$14.94
4	tie wire 9ga	1	$39.99	$39.99
Subtotal				$927.76
HST				$120.61
Total				**$1048.37**

Proposed Construction:

It was proposed that construction be done in phases. Both the trapezoid and cage were to be built ahead of time on a dry area next to the stream and then positioned into place. Posts were then to be sunk to fix their position.

The pipe was already on site and left over from a previous attempt. It is flexible and can easily be put into position. The pipe would however need to have holes drilled into it all along the top of it to allow any gases to escape. Some posts were to be sunk on either side of the pipe to prevent it from shifting or rising up..

The dam was to be constructed after the installation of the other elements and likely would have required extra effort and time to build.

Actual Design:

The actual design (the one built and installed) did not differ in too many ways from the proposed design except for the “fake” dam.

It was rather difficult to source the exact galvanised mesh panels in the desired 6-inch mesh size. Although some were located, delivery was constantly being delayed. After months of delay, it was decided to use 6in x 8in mesh size that other builders had had partial success with. The design was slightly altered to add a second layer of mesh (offset from the first) at strategic locations near the culvert. Luckily, these mesh panels were less expensive.

Every aspect of the original design was used but it required fewer T-posts, thereby reducing the costs further.

Actual Construction:

Once all materials were sourced, they were brought to my (David) place to be cut and assembled. This proved to be relatively easy and required only 3-4 hours of work. The (mostly) assembled trapezoid and cylinder were then brought on site for final assembly.

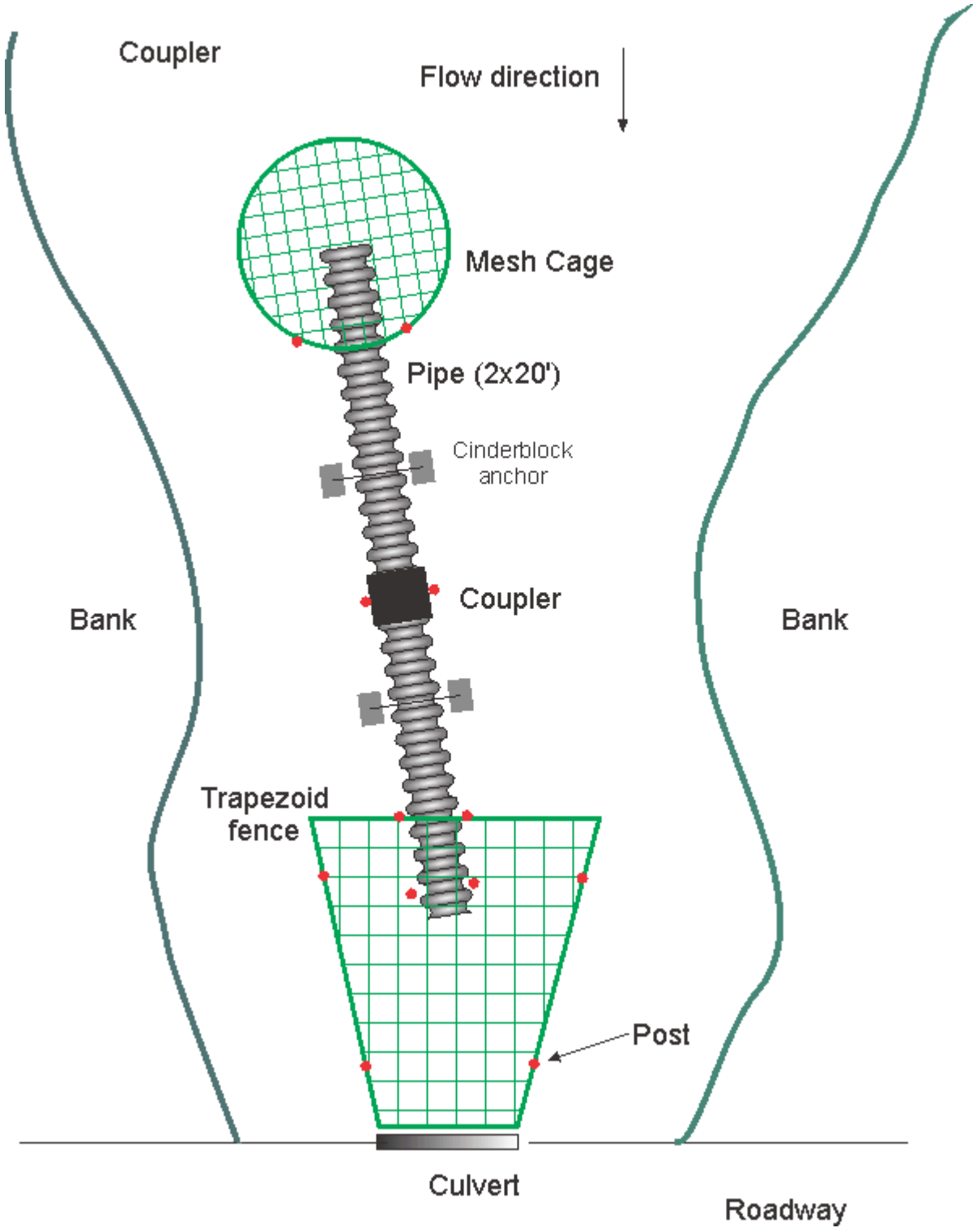
The trapezoid was then assembled, put into place and secured with T-posts at appropriate locations along the perimeter. (thank you Bruno for your help with this)

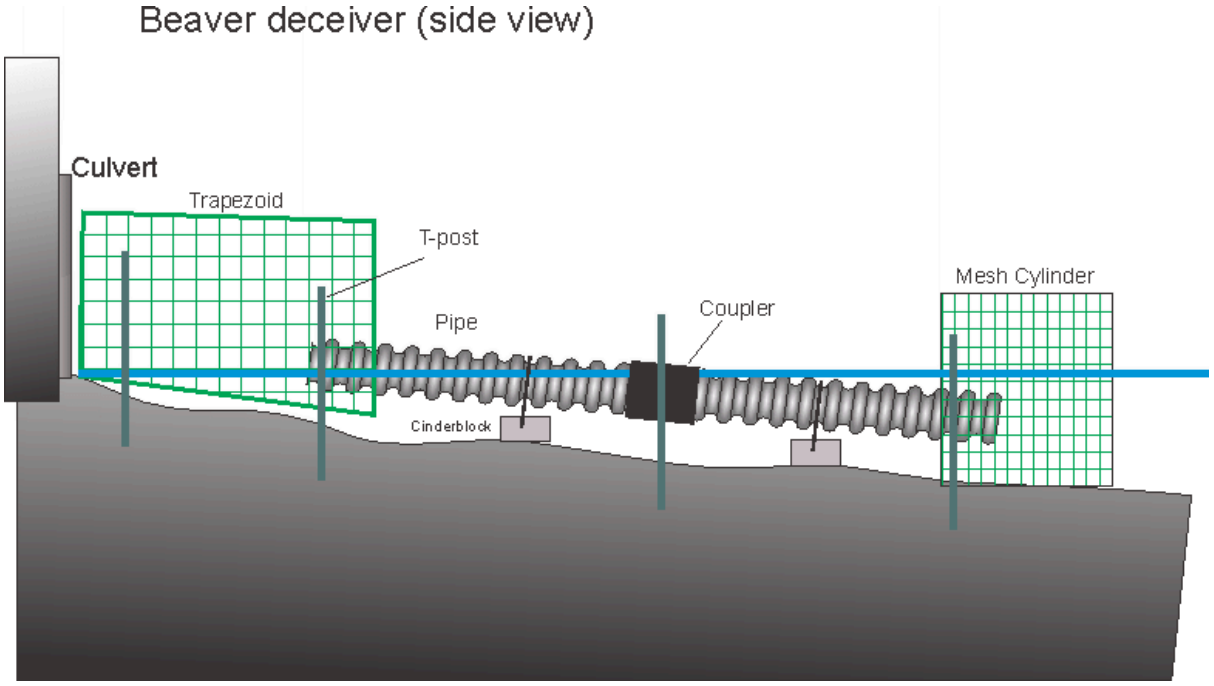
The two lengths of plastic pipe were joined and secured. One end was placed through the wall of the cylinder and securely wired with the inlet located close to the centre and off the bottom. Holes were drilled along the top of the pipe to allow gases to escape. At this point, the cylinder/pipe assembly was dragged to an appropriate location upstream. It is worth noting that though the initial location that was selected was quite deep enough, the bottom at that point was very silty and would likely have plugged up the inlet, rendering it useless. The cylinder was moved aside to a shallower location with a firmer bottom yet still deep enough to keep the inlet underwater.

The other end of the pipe was placed through the wall of the trapezoid with the inlet secured further in with the aid of two more T-posts.

A few days later, the fake dam was started but it soon came to the attention of one of our neighbours who objected to it in a rather forceful manner. It was decided to not antagonise him further and what had been built was then removed. This proved to not alter the functioning of the system too much and was thereby abandoned. The only real downside to not having the fake dam was that the lake water level could not be regulated. Other methods could be used in the future if desired.

Beaver deceiver, as built (not to scale)




Beaver deceiver (side view)
Culvert
Trapezoid
T-post
Pipe
Coupler
Mesh Cylinder
Cinderblock

Materials:

Mesh panels: "10-Line Galvanised Cattle Fence Panel, 4 gauge welded wire"
These panels have a 6in x 8in mesh size and measure 16ft x 48in. Though it is recommended to use 6in x 6in mesh size, others have used these panels without issue though there was some concern that smaller beavers may be able to swim through the openings. It should be noted however that they were not likely to be able to do so while dragging damming materials such as branches. In order to make doubly sure, some offcuts of other panels were added as a second layer and offset in order to make the mesh size 6in x 4in. This was done in the vertical section close to the culvert. The rest of the trapezoid was left as is. Any wildlife that could enter the trapezoid from the culvert, would be able to exit via the larger mesh openings.

Pipe: Single wall, HDPE corrugated culvert pipe
These are 12in diameter, 20ft long, single wall, corrugated plastic pipe. Two of these were already on site, having been used in a previous project. A coupler was also located on site to allow both lengths to be joined end to end, providing a total length of 40ft. The coupling was reinforced with self-tapping screws to prevent any chance of disassembly.

T-posts:
Heavy duty 7ft "T" type fencing posts, enamelled against corrosion. A total of 12 were used for this project. They were pounded into the bottom at select locations to which was attached the mesh panels with the aid of T-post clips.

Tie wire:
A roll of 9ga, galvanised wire was purchased and used for joining or reinforcing some assemblies and for building anchors for the pipe.

Hog clips:
A few 9ga "Hog clips" were used to join sections of the mesh panels. A small quantity was used and was inexpensive enough that the cost was not considered.

Actual costs:

The following shows the actual cost of materials:

Item #	Description	Qty	Unit Price	Price
1	T-Posts 7ft	12	$10.74	$128.88
2	Mesh Panel (4ft x 16ft)	5	$79.99	$399.95
3	T-Post clips	0	$2.49	$0.00
4	tie wire 9ga	1	$39.99	$39.99
Subtotal				$568.82
HST				$73.95
Total				**$642.77**

Observations and conclusions:

Construction of the beaver deceiver began in early May (2024) and proved to be fairly easy without posing too many challenges. The most difficult part was the final assembly and installation as even though the individual components were relatively light, they were rather cumbersome to move into place. Nevertheless, this was done easily with just two persons. Installation was not done until early June to give a chance for the lake level to drop and for the water temperature to rise. The installation was completed by 11 June.

Dealing with the pipe was also pretty easy and extra attention was shown to the joint between the two to ensure that they would not separate after installation. Holes were drilled at the top of the pipe, all along its length, with a half-inch drill bit.
Anchors for the pipe were constructed by joining two cinder blocks in a manner that created a type of saddle. These were dropped over the pipe in two locations in order to prevent the pipe from floating up should any gases form within. The pipe inlet and outlet were wired into place within the mesh cylinder and trapezoid in a manner that kept them in place and in the correct position.

The mesh size of the metal panels was larger than optimal (6x8 vs 6x6) but that was mitigated by adding an extra layer of mesh (recovered from off-cuts) and offsetting it to create smaller mesh openings. This was done at the more critical location near the culvert.

All components were fixed in place using the T-posts, pounded into the lake bed at appropriate locations without too much trouble.

The design of this device was meant to not only keep the beavers from damming up the culvert but also preemptively keep them from damming further upstream. The site location and the relatively shallow bottom contour could allow the beavers to build a dam in a spot that could potentially be difficult to deal with. This was the main reason for the fake dam and why the design seemed rather complex.

After installation, the beavers did try to dam up close to the culvert but after a few attempts, they gave up. This is apparent from the sticks that they used at the trapezoid. It is important that these should be left in place to discourage them from trying again. They do not impede the flow of water. The beavers also tried to dam around the perimeter of the trapezoid using mud and vegetation but also gave it up. Again, the mud should be left in place to discourage further activity.

In the months since installation, there seems to have been little, if any, additional attempts at damming. The mud around the perimeter of the trapezoid does impede some flow but as soon as the water level rises, it overflows the mud and is allowed to flow unimpeded through the culvert. If the beavers decide to dam around the trapezoid, the pipe should take over and allow the water to flow. This is the main function of the system.

Photos:

Site before cleaning

Site after cleaning, showing some debris/damming

Pipes and coupler recovered from previous project

Cutting and bending of mesh panels

Mesh cylinder

Trapezoid shortly after installation

Pipe sections joined up and reinforced

Moving cylinder and pipe into place

Pipe installed within trapezoid (with cinder block anchor)

Cylinder in place

Trapezoid in operation showing some damming

Trapezoid with sticks from attempted damming