



Restoring Native Fish Passage

**Remediation Work to 5 Sites in the Lower
Burdekin and Townsville Areas**

Matthew Moore, Tim Marsden & Darren Jennings

2011



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Cover Figure: Top: Rock-ramp fishway located on middle Sheepstation Creek under normal flow conditions.

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Sheepstation Creek Fishways

Upper Sheepstation Creek (5 Ways Crossing)

BAR116 on Sheepstation Creek (5 Ways Crossing) was constructed as per the concept design in the 'Burdekin Fishway's Summary Report 2010-11'. Steel baffles were dyna bolted to the two outside walls of the culvert barrels (figure 1). The baffles were spaced 600 mm apart; accept for the last meter, where the baffles were spaced 300 mm apart. The rock-ramp fishway consisted of 3 ridges constructed out of large 1 m sized rock specifically placed into position via a 21 tonne excavator (figure 2). This was secured and locked into place by large 1.3 m size armour rock placed at the 'toe' of the fishway and 300 - 800 mm sized rock used to form the walls and stabilise the banks. The drops between pools in the fishway ranged between 50-80 mm, providing suitable conditions for lowland fish communities of the greater Burdekin region. For full fishway designs please refer to pages 30-32 in appendix 1 of this report.

Materials:

Culvert Baffle Fishway

- 24 Baffles (Engineered C-section Purlins - laser cut and galvanised)

Rock-Ramp Fishway

- ≈44 tonne of 800 mm rock
- ≈44 tonne of 300 mm rock
- ≈23 tonne 800 mm rock
- ≈28 tonne 1.3 m armour rock
- Total of ≈140 tonne of rock for fishway.
- 21 tonne excavator + rock grab (17 hours)

Materials Costing

- ≈\$17391

Supervision/Approvals/Organisation/Reporting

- 18 Full Time Equivalent Day's (FTED's)



Figure 1. Baffles dyna bolted to the two outside walls of the culverts.



Figure 2. Excavator placing 1 m size rock to form the bottom ridge of the fishway.



Figure 3. Excavator placing 1 m size rock to form the bottom ridge of the fishway.



Figure 4. Finished rock-ramp fishway. Photo taken downstream of the entrance to the fishway.

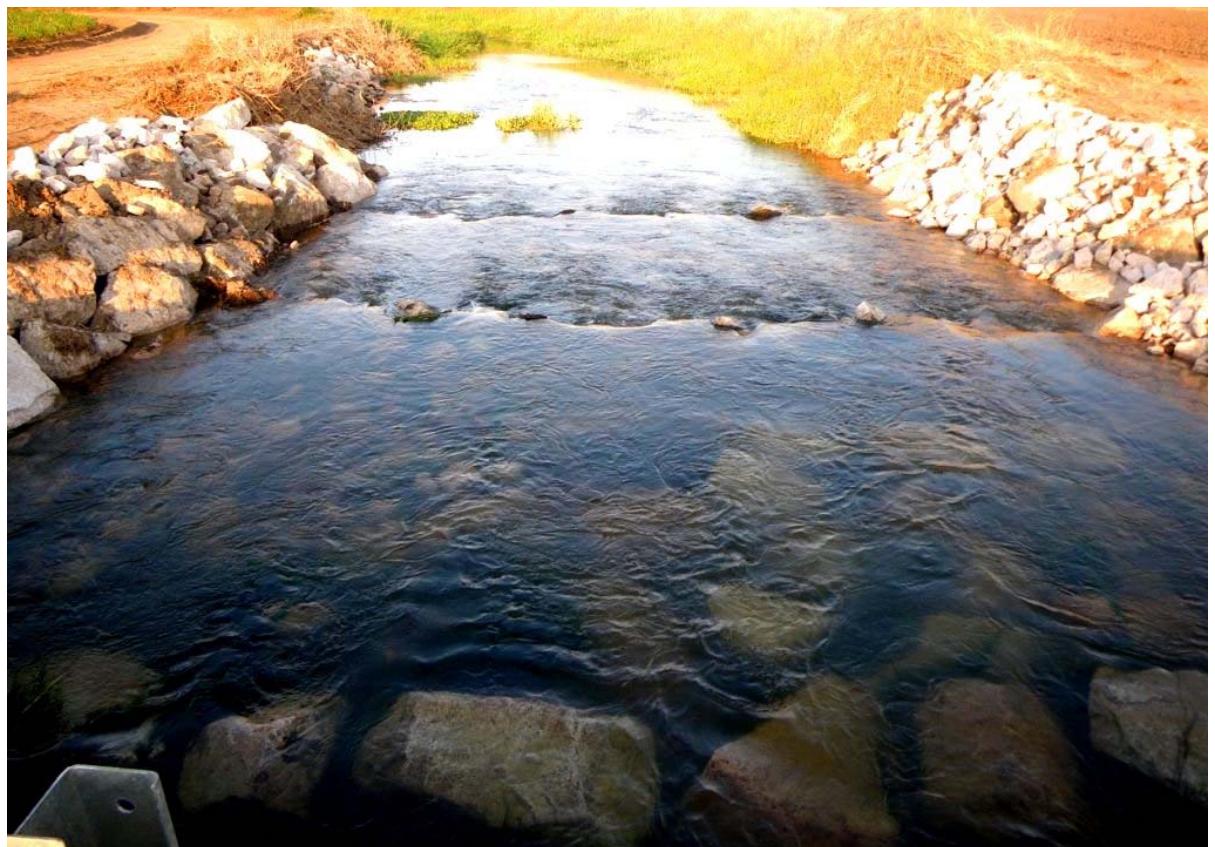


Figure 5. Top view of the finished rock-ramp fishway on Sheepstation Creek.

Middle Sheepstation Creek (Old Crossing)

BAR1113 on middle Sheepstation Creek (Old Crossing) was constructed as per the concept design in the 'Burdakin Fishway's Summary Report 2010-11' apart from one minor change to the access road located above the fishway exit. The access road is required for the cattle farmer to access grazing areas across Sheepstation Creek. It was originally designed to be 300 mm under water in 'normal' flow conditions. However, after consulting with the farmer on site, it was decided that the access road should be raised by 200 mm, so that the road only has 100 mm of water flowing over it under normal flow conditions.

The rock-ramp fishway consisted of 3 ridges constructed out of large 800 mm size rock specifically placed into position via a 21 tonne excavator (figure 8). This was secured and locked into place by large 1 m size armour rock placed at the 'toe' of the fishway and 300 - 800 mm sized rock used to form the sides of the fishway and stabilise the banks. 40 mm ballast rock was used to surface the access road at the fishway exit. The drops between pools in the fishway ranged between 50-80 mm, providing suitable conditions for lowland fish communities of the greater Burdakin region. For full fishway designs please refer to pages 40 & 41 in appendix 1 of this report.

Materials:

- ≈46 tonne of 800 mm rock
- ≈13 tonne of 500 mm rock
- ≈67 tonne 300 mm rock
- ≈39 tonne of 40 mm ballast
- Total of ≈166 tonne of rock
- 21 tonne excavator + Grab (12 hours)

Materials Costing

- ≈\$10100

Supervision/Approvals/Organisation/Reporting

- 15 Full Time Equivalent Day's (FTED's)



Figure 6. Excavator constructing the first ridge of the fishway.



Figure 7. Excavator forming the second ridge of the fishway



Figure 8. Excavator sealing the access road. Fishway complete.



Figure 10. Rock-ramp fishway completed and working under 'normal' flow conditions (photo taken at fishway entrance)



Figure 11. Completed fishway under normal flow conditions.

Note: The tailwater level in this photo is lower than normal, because the irrigation flow down Sheepstation Creek had only just been diverted down this part of the system. One day after this photo was taken; the tailwater level had increased, bringing the water level right up to the entrance of the fishway.

Lower Sheepstation Creek - East Branch (Rob Wills Property)

Bar1115 located on the east branch of lower Sheepstation Creek (Rob Wills property) was remediated with a fishway that differed slightly from the concept design in the 'Burdekin Fishway's Summary Report 2010-11'. The original design consisted of installing 1500 mm x 1500 mm box culverts. However after further discussions and on site assessments it was decided that the configuration should change. The new designed fishway was constructed out of two 1200 mm (diameter) x 1.6 mm x 5000 mm (length) corrugated galvanised spiral tubing (pipes).

The corrugations in the pipes are extremely beneficial for fish passage as they disrupt the flow of water, creating low energy resting areas for juvenile fish species. The corrugations also reduce the velocity of water passing through the pipes providing easier access for upstream passage for all fish species likely to be encountered at this site. In addition to this the corrugated pipes provided a substantial cost saving to the project. Rock armouring at the base of the downstream side of the pipes to prevent scouring below the river bed and undercutting the pipes remained as per original concept design. For full fishway designs please refer to pages 35-37 in appendix 1 of this report.

Materials:

- 2 x 1200 mm (diameter) x 1.6 mm x 5000 mm (length) corrugated galvanised spiral tubing (pipes)
- 21 tonne Excavator (9 hours)
- ≈27 tonne of 300 mm
- ≈13 tonne of Gabion rock
- ≈40 tonne of type 2.4 Road Base
- Wacka Packa - 1 day hire

Materials Costing

- ≈\$10877
-

Supervision/Approvals/Organisation/Reporting

- 14 Full Time Equivalent Day's (FTED's)



Figure 12. Tim Marsden checking the levels in preparation for the corrugated pipes.



Figure 13. Excavator levelling the road base in preparation for the pipes.



Figure 14. Excavator lifting the pipes prior to placing them into position.



Figure 15. Pipes set at the correct level prior to the excavator filling around them with road base to secure them into position.



Figure 16. Completed corrugated pipe fishway with rock armouring to secure the pipes into position. Photo taken from upstream.

Townsville Town Common Wetland

The bund wall (BAR1099) located on Townsville Town Common Wetland was remediated with a fishway that differed slightly from the concept design in the 'Burdekin Fishway's Summary Report 2010-11'. After further site assessments it was decided that the 400 mm high concrete nib wall that was originally planned to stretch across the spillway was not required. It was originally believed that the concrete spillway acted as the control for the wetland, and that overflow from the wetland spilled over it first. However, further site investigations found that overflow from the wetland first spilled over another 'spillway' on the eastern side of the bund wall. Therefore the proposed concrete nib wall on the spillway would have prevented initial attraction flows close to the fishway, and diverted them to the spillway located on the opposite side of the bund wall.

To remedy this, the control level of the rock-ramp fishway was constructed slightly lower than the two spillways located on the bund wall, providing initial attraction flows down the fishway. Attraction flows simply draw in migrating fish that are seeking a point within a waterway in which to facilitate their upstream movement. There were no more alterations to the configuration of either the rock ramp fishway or the culverts downstream of the wetland as per the concept design. For full fishway designs please refer to pages 24-27 in appendix 1 of this report.

Materials:

- ≈60 tonne of 900 mm blast rock
- ≈180 tonne of 100-300 mm blast rock
- ≈20 tonne of 1200 mm blast rock
- ≈30 tonne of 45 mm ballast
- ≈15 tonne of road base
- 6 cubic meters of 50 mpa concrete
- 30t excavator (45 hours) & Backhoe (20 hours)
- 10 culverts 2 x (2.4m x 2.4m) plus 8 x (1.2m x 1.2m).
- Slab pored by STEWART BURBIDGE CONCRETING

Materials Costing

- ≈\$31542

Supervision/Approvals/Organisation/Reporting

- 35 Full Time Equivalent Day's (FTED's)



Figure 16. Large 1.2 m sized rock used to form the 'toe' of the fishway.



Figure 17. Ridges and side walls of fishway in position.



Figure 18. Aerial view of fishway showing the entrance pool completed with rock fill in the bottom.



Figure 19. Completed rock-ramp fishway. Photo taken standing at the entrance to the fishway.



Figure 20. Aerial view of the fishway's geographic position (bottom right) relative to the wetland, upper tidal reaches and the city Townsville (in background).



Figure 21. Pouring the base slab for the culverts to sit on.



Figure 22. Nine of the twelve culverts in position.



Figure 23. Culverts into position, rock armoured and completed.

Ironbark Creek Pipe

The old pipe (BAR1114) located on Ironbark Creek (Shirbourne Road, Giru) was completely removed to provide 100% fish passage transparency. This particular barrier was not initially selected as a barrier requiring remediation in the 'Burdekin Fishway's Summary Report 2010-11'.

Materials:

- 21t excavator (11.5 hours)
- Truck Hire (10 hours)

Heavy Machinery Costing

- $\approx \$4625$ (Not charged to NQ Dry Tropics)

Supervision/Approvals/Organisation/Reporting

- 9 (FTED's)

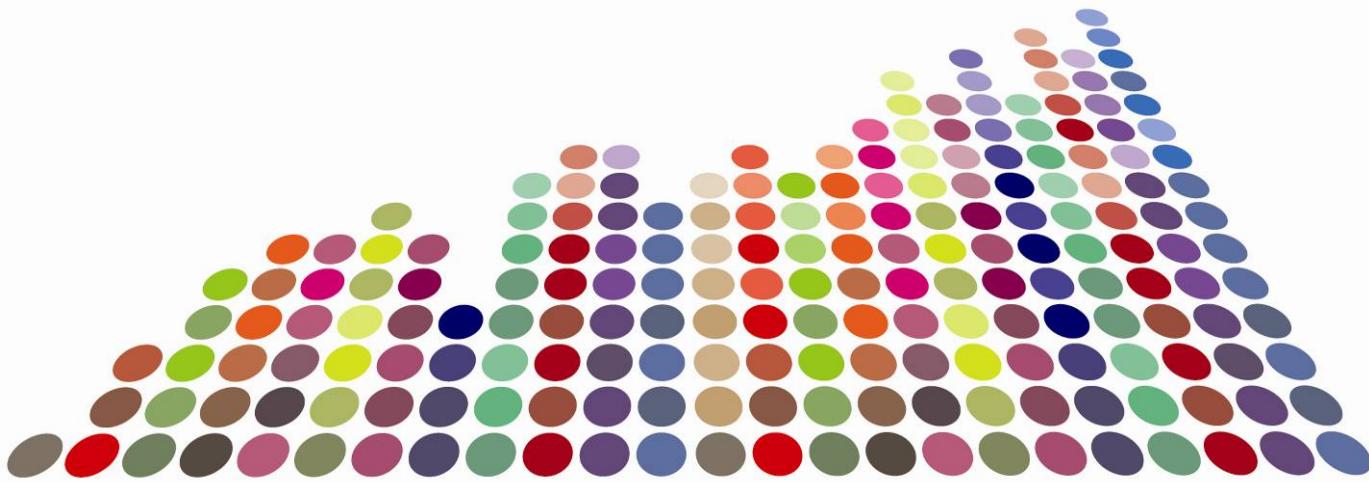


Figure 21. Pipe located on Ironbark Creek.



Figure 22. Pipe removed and fish passage restored on Ironbark Creek.

Appendix 1 Burdekin Fishway Designs 2010 / 2011



Burdekin Fishway Designs 2010 / 2011

**Alana O'Brien
Tim Marsden
Darren Jennings**



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Introduction

NQ Dry Tropics have contracted Fisheries Queensland to provide concept designs and potential costings for fishways at four locations in the NQ Dry Tropics region. The four locations are;

- BAR1113 – Sheepstation Creek Old Crossing,
- BAR1115 – Barratta's Crossings on Jerona Road,
- BAR1116 – Sheepstation Creek Five Ways Crossing and
- BAR1099 – Townsville Town Common Wetland.

On inspection of the sites and after discussions with Paul Duncanson, BAR1115 has been substituted with the barrier on Sheepstation Creek East Branch at Rob Wills property. BAR1115 has been replaced due to the following;

- Tidal movement occurs in both directions through the barrier allowing fish passage,
- During flow events Jerona Road forms an informal rock ramp fishway allowing fish passage,
- The size of the current culverts and the tidal nature of the watercourse are a safety hazard (confined space) for the installation of baffles and
- The current culverts are relatively new and the cost of replacement of larger culverts would prove to be too expensive.

Townsville Town Common Wetland

Site

The Town Common is located approximately 6.5km from the centre of Townsville and covers almost 3250 ha. The Common was once part of the extensive Bohle River basin, now it stands isolated due to urbanised development, (www.environment.gov.au). Sedimentation from the Bohle River during times of flow has instigated quite different landscapes, including estuarine tidal mud flats, brackish and freshwater swamps, and grass and eucalyptus woodland areas. This highly dynamic wetland system averages 1.150m of rainfall annually, with much of this falling between December and March which is typically the wet season, (www.jcu.edu.au).

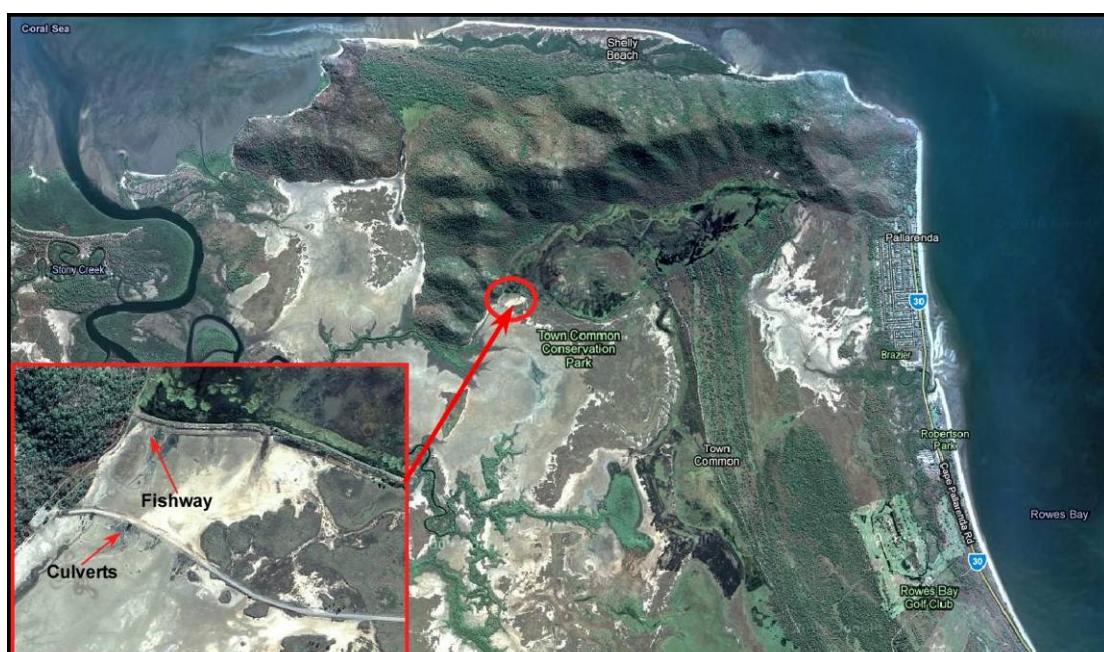


Figure 1 – The location of proposed culvert and fishway construction within the Townsville Town Common.

Description

Human influences have had a major impact on this environment with walking tracks & bunds creating distinctive fresh/salt zones. They have been designed to allow freshwaters to flow away from the area whilst excluding salt waters from penetrating into the upstream habitats. This has created a barrier for migratory fish wanting to move out of the salt and into the fresh on low and medium flows. Figure 2 shows the bund that has created a barrier for fish passage into the fresh. Figure 3 shows the small pipes that cause fast velocities too great for fish to negotiate.



Figure 2 - Bund causing a barrier to fish migration between fresh and salt water areas.



Figure 3 - Roadway with pipes to allow salt water through but not allowing fish passage

Solution

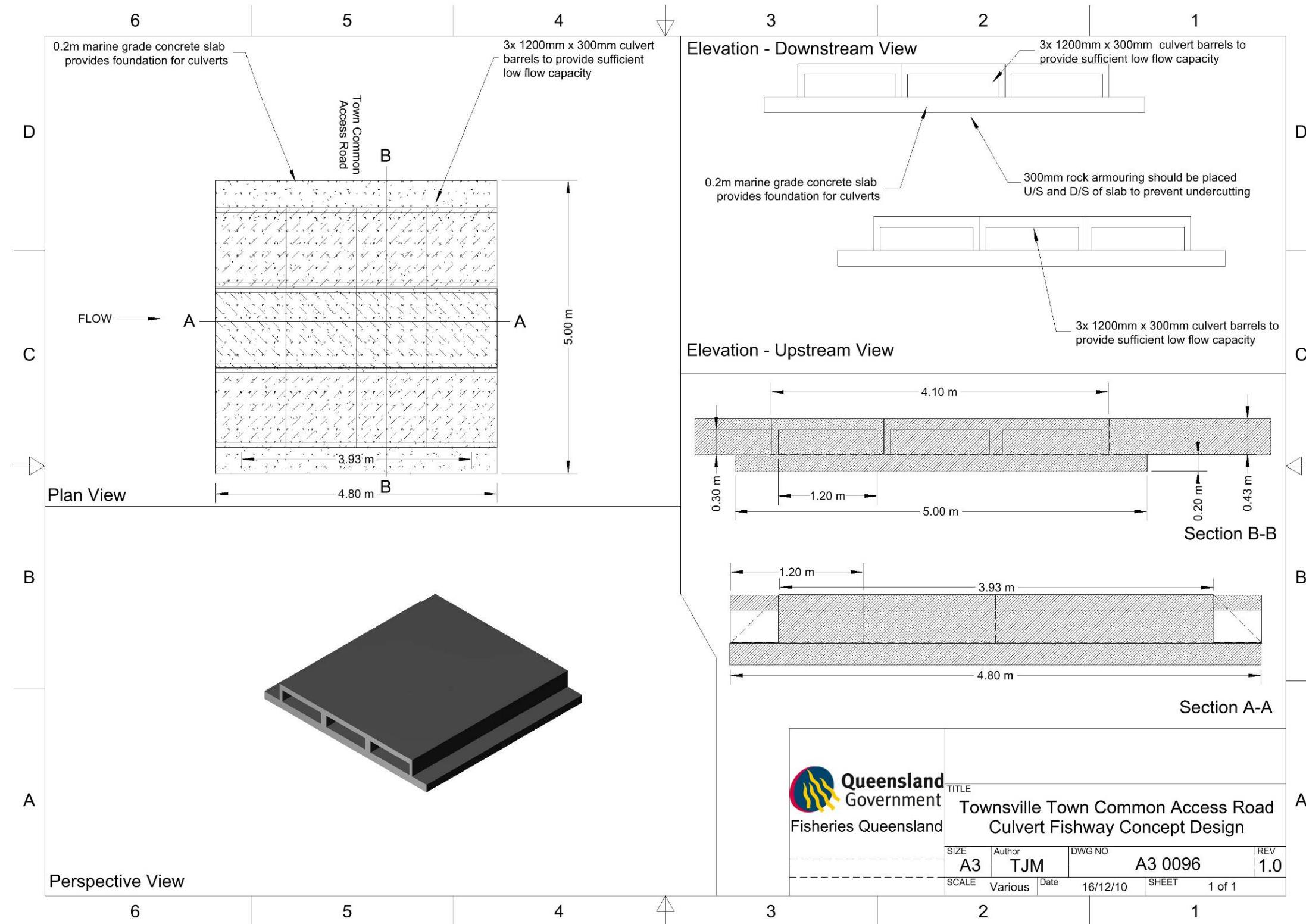
To rectify the issue of fish passage, a series of culverts barrels will be installed where the pipes in figure 2 are currently located. These culverts will be 1200mmx300mm and be set out as three culverts wide and four long (see design chapter for details). This solution will allow the roadway to be maintained whilst opening up the site to allow more water through the culverts, and slowing down velocities. These culverts will be rock arched to reduce scouring along the edges.

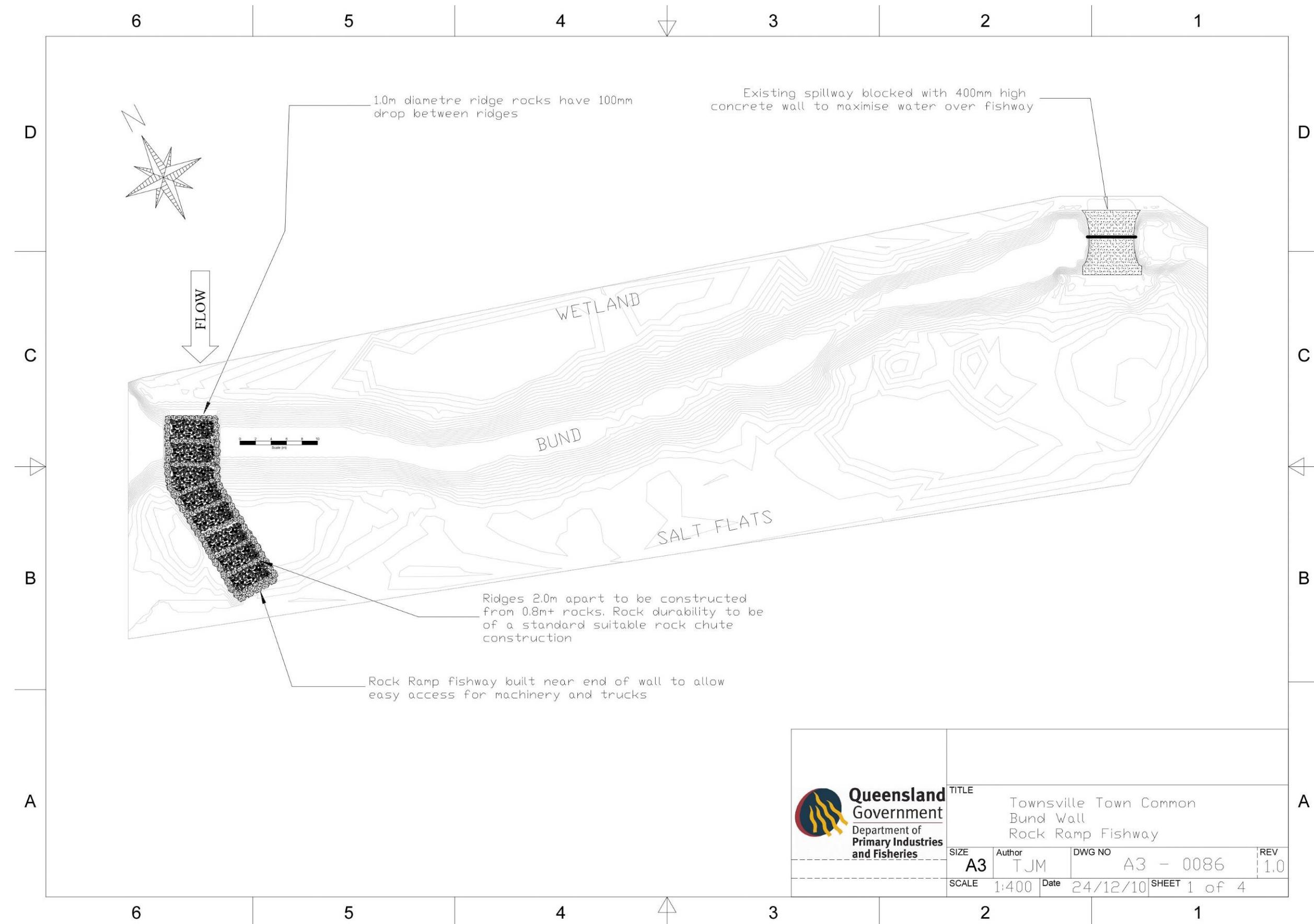
In the bund wall that separates the salt from the freshwaters a rock ramp fishway will be constructed at the very end of the bund to allow for vehicles and machinery access. This will be approximately 24 meters long with 9 ridges throughout. A 400mm high concrete wall will be constructed across the existing spillway to maximise water flowing through the fishway.

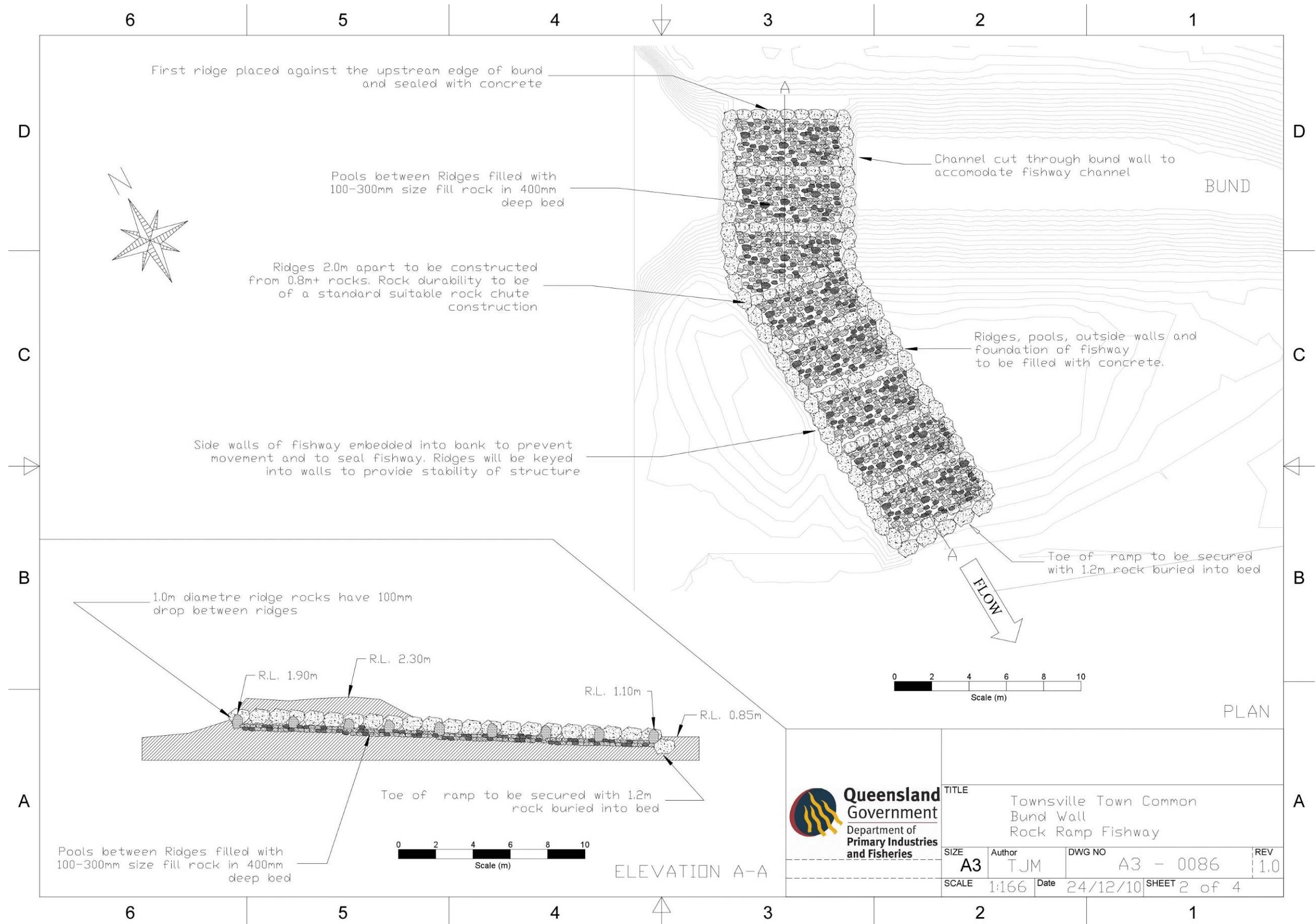
Costing

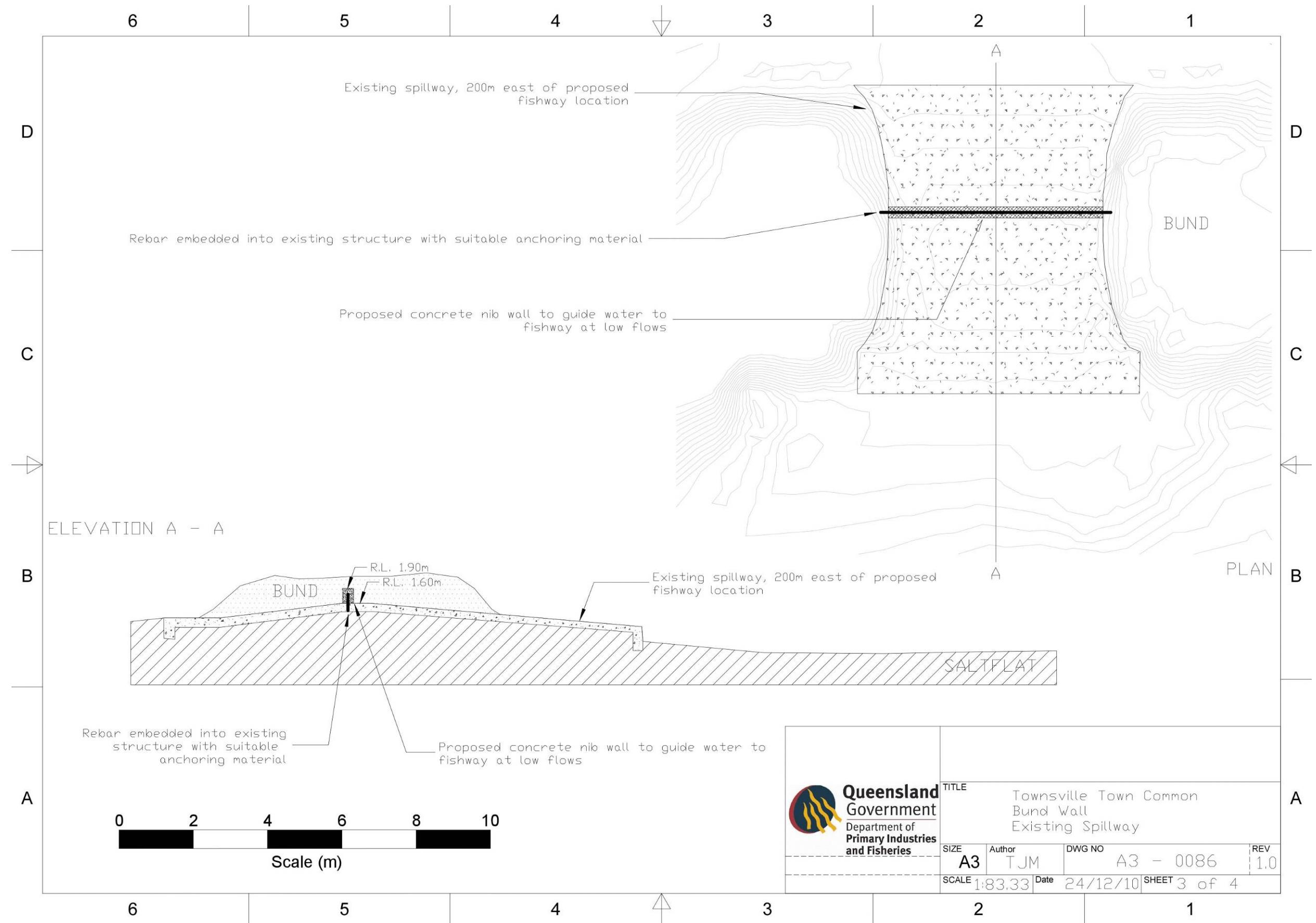
Materials	Total Costs
Construction Organisation (including approvals)	\$5,600.00
Construction supervision	\$24, 200.00
1200x300mm Box culverts	\$ 6,133.65
Concrete – 40/20 mpa	\$2990.00
With waterproofing - Xypex	
Reo Mesh	\$157.00
300-600mm Rock	\$2371.50
800-1000mm Rock	\$3908.85
Concrete Pump	\$468.00
Excavator Hire (30t)	\$5045.00
Misc - tie wire, bar chairs, etc	\$100.00
SUB TOTAL	\$50,506.00
10% Contingency	\$5,050.60
TOTAL	\$55,556.60

Design









Sheep Station Creek, Five Ways Road Crossing

Site

Sheep Station Creek was once a well vegetated system with a series of large wetland lagoons that provided vital habitat particularly for migratory juvenile fish such as barramundi, tarpon and mangrove jack. More recently this system has been utilised as an irrigation channel to provide Burdekin River irrigation water to a large number of agriculture enterprise along the system, (Stewart, 2006). By doing this the system has changed from an ephemeral stream where the creek would often dry up to permanent lagoons in the dry season to a system that flows almost year round.

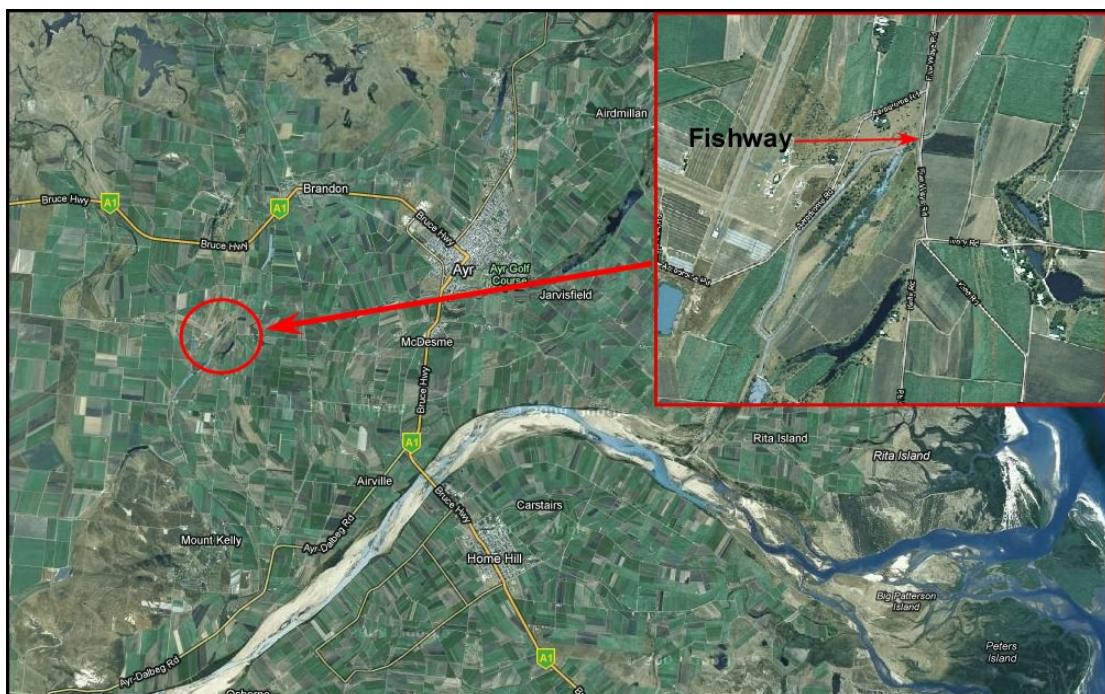


Figure 4 – Location of the first proposed fishway on Sheepstation creek south west of Brandon

Description

The Five Ways road crossing barrier is located 5.5km south west of Brandon. This part of the Sheep Station Creek system has been significantly impacted upon by the modification of the channel to cater for the increased irrigation water. The three culverts across the creek (figure 6), allow fast velocities, which in turn do not allow for fish passage.



Figure 5 - Upper Sheep Station Creek irrigation channel culvert crossing

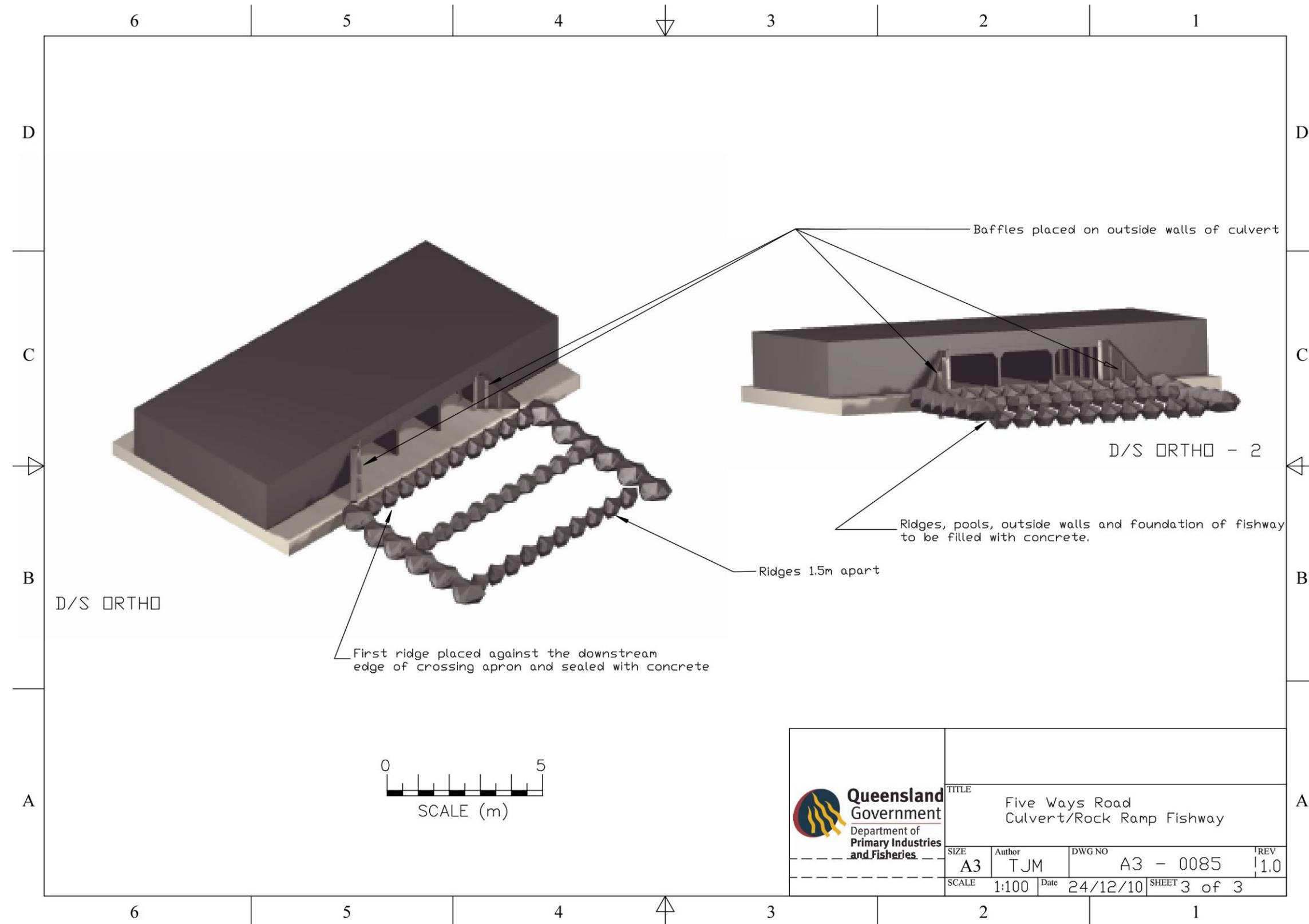
Solution

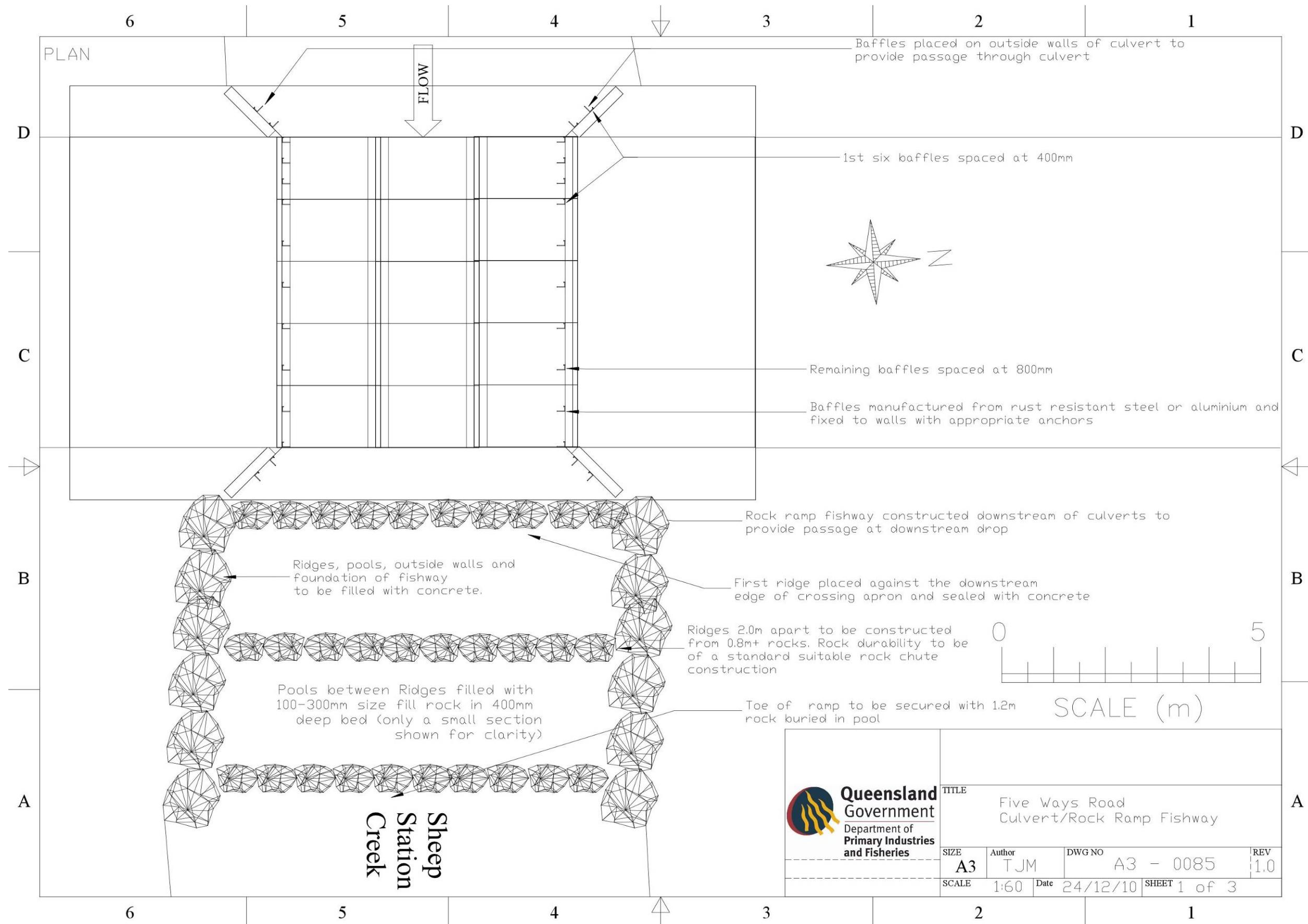
Aluminium baffles to be installed on the outside culvert barrels, set at 600mm apart, at the last meter the baffles will be set at 300mm apart on the upstream side. Rock armouring on the downstream side will be dug into the bed to prevent scouring at the base of the culverts.

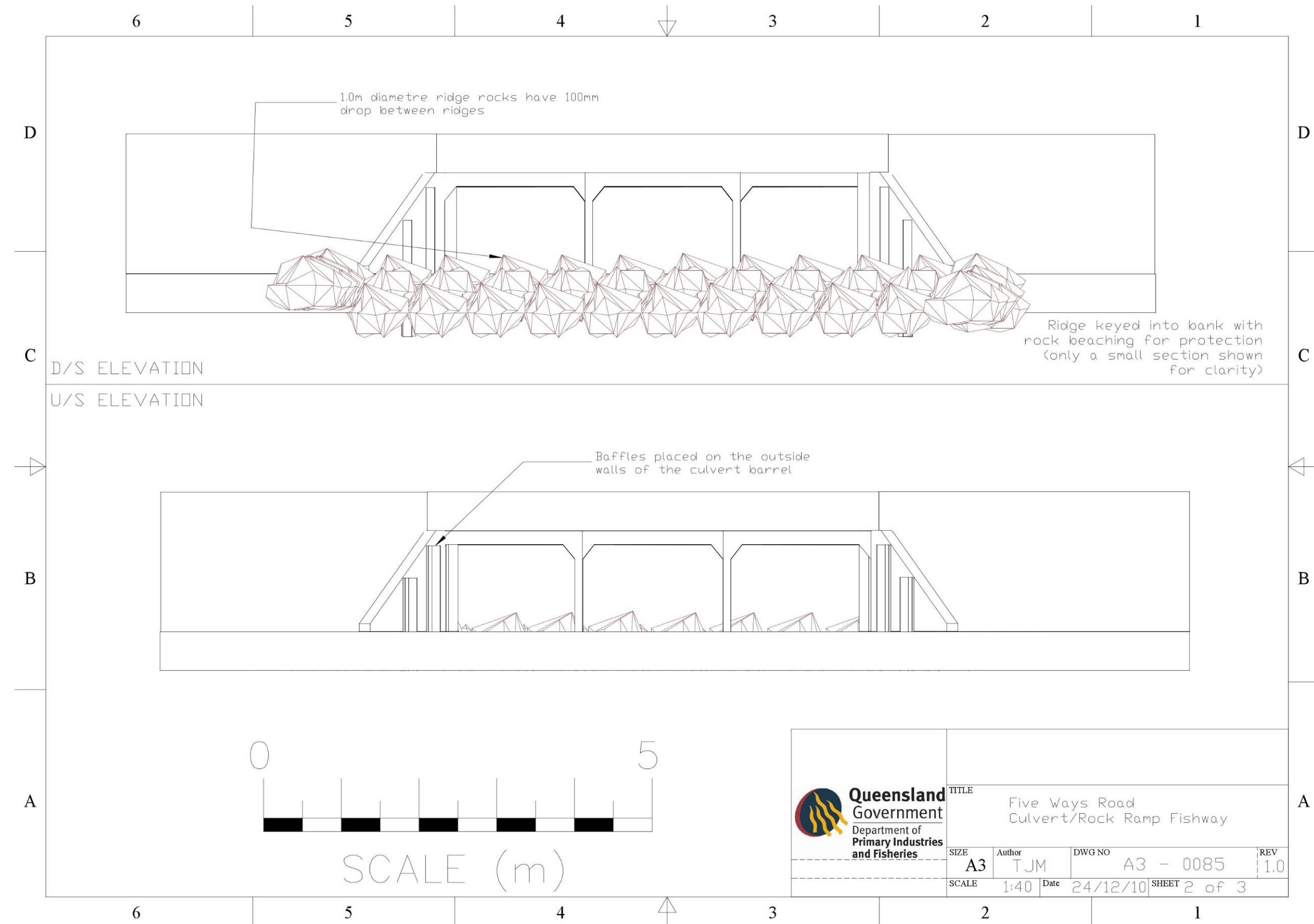
Costing

Materials	Total Cost
Construction Organisation (including approves)	\$3,200.00
Construction Supervision	\$9,680.00
1.5m Aluminium Baffles	\$3,720.00
Bolts & Washers & Misc	\$2,00.00
Rock – 300-600mm?	\$2,310.00
Rock – 800mm	\$4,635.00
Excavator (20T)	\$3,570.00
Concrete	\$1,462.50
SUB TOTAL	\$28,777.50
10% Contingency	\$2,877.75
TOTAL	\$31,655.25

Design







Sheep Station Creek, East Branch - Rob Wills

Site

Sheep Station Creek was once a well vegetated system with a series of large wetland lagoons that provided vital habitat particularly for migratory juvenile fish such as barramundi, tarpon and mangrove jack. More recently this system has been utilised as an irrigation channel to provide Burdekin river irrigation water to a large number of agriculture enterprise along the system, (Stewart, 2006). By doing this the system has changed from an ephemeral stream where the creek would often dry up to permanent lagoons in the dry season to a system that flows almost year round.

Description

The East Branch barrier of Sheep Station Creek is located 6km North West of Brandon. Having been significantly impacted upon by modifications made to allow for irrigation supply, this system has limited natural riparian vegetation along its banks.



Figure 6. Location of the second proposed fishway on Sheepstation Creek north-west of Brandon

Solution

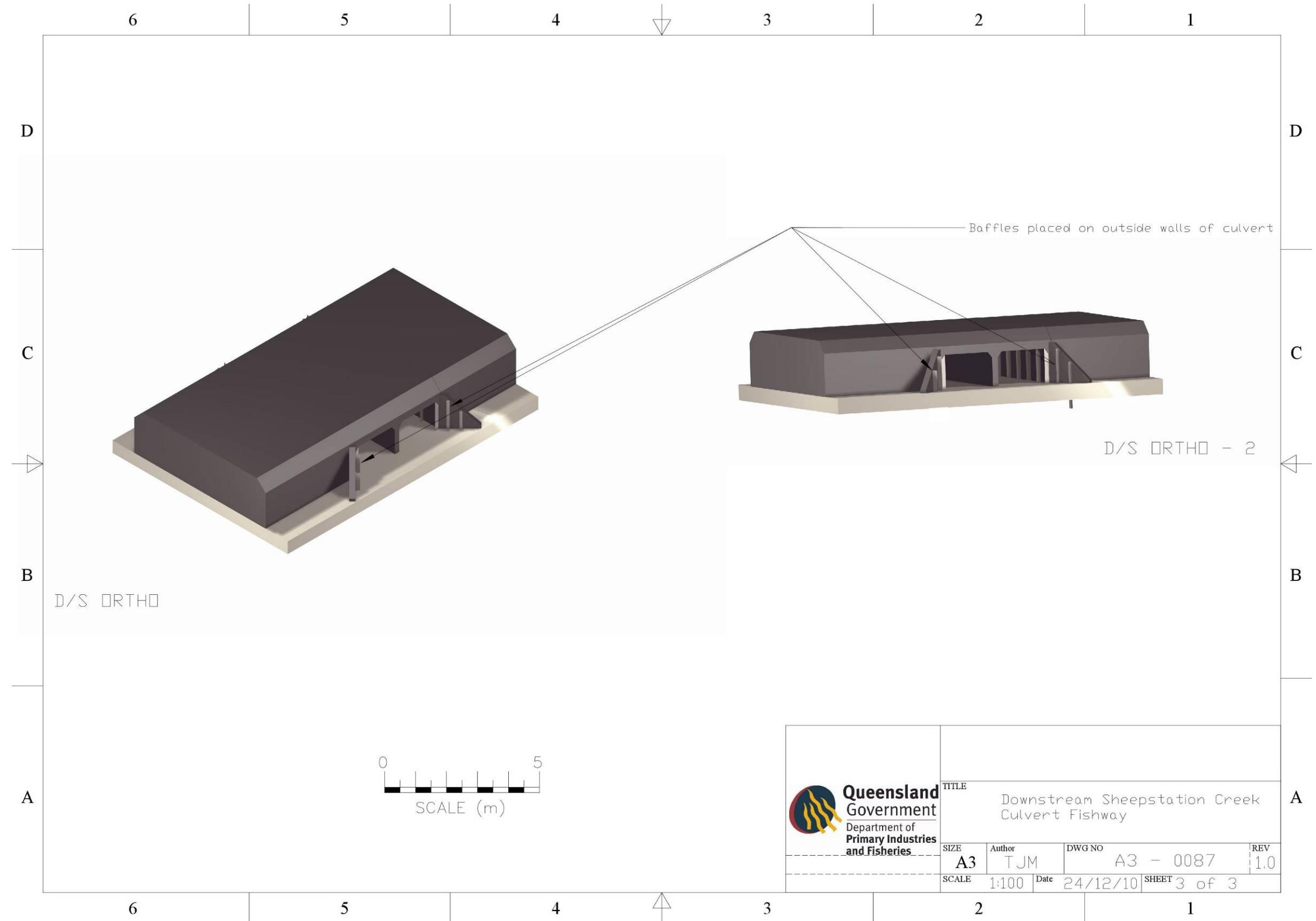
Installing large culverts (1500x1500mm) at the site will open passage and allow slower velocities through the barrier. These culverts will be positioned ...

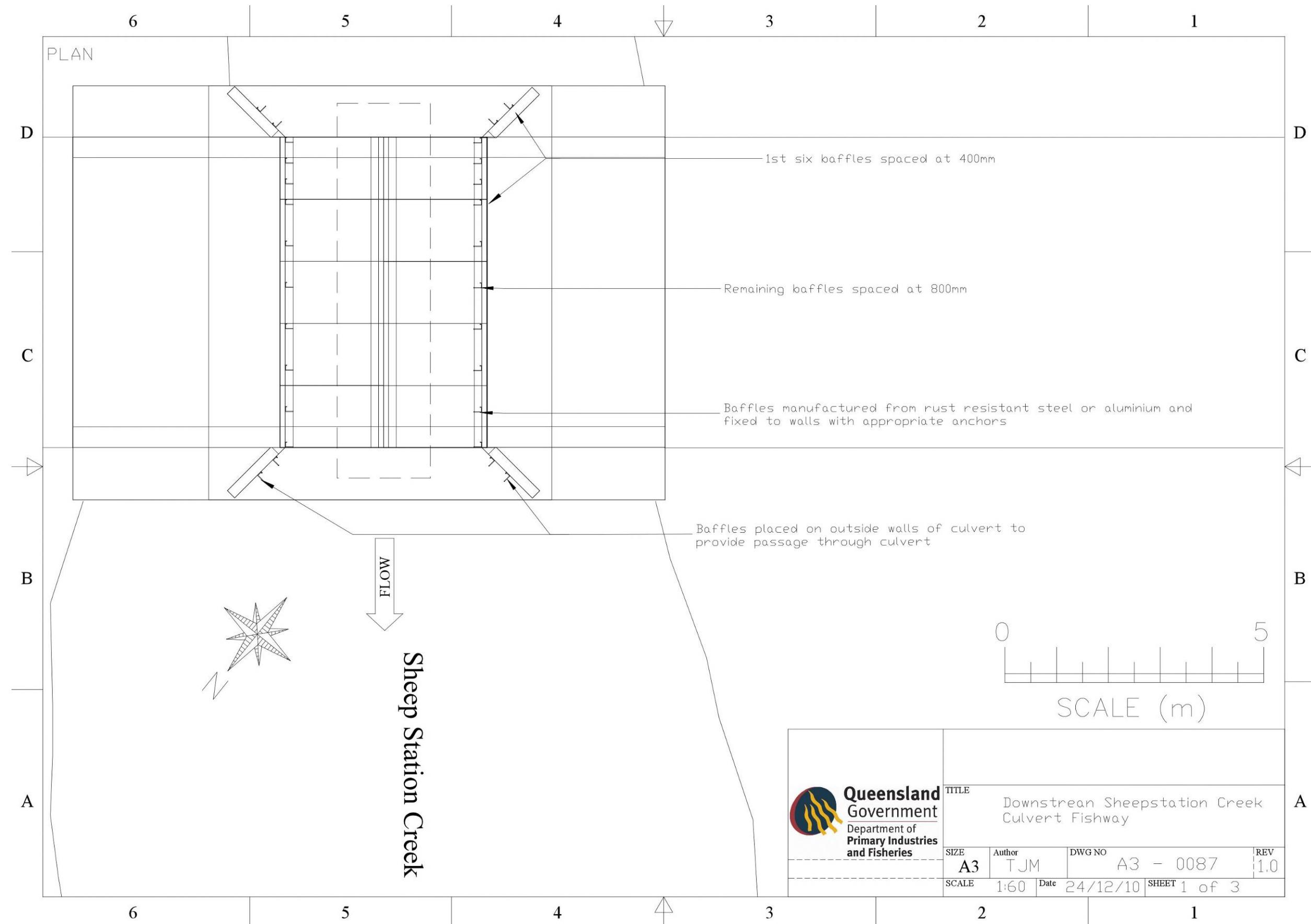
Rock armouring at the base of the downstream side of the culverts will prevent scouring below the river bed and undercutting the culverts. This will also act as a nature-like rock ramp to aid in fish passage.

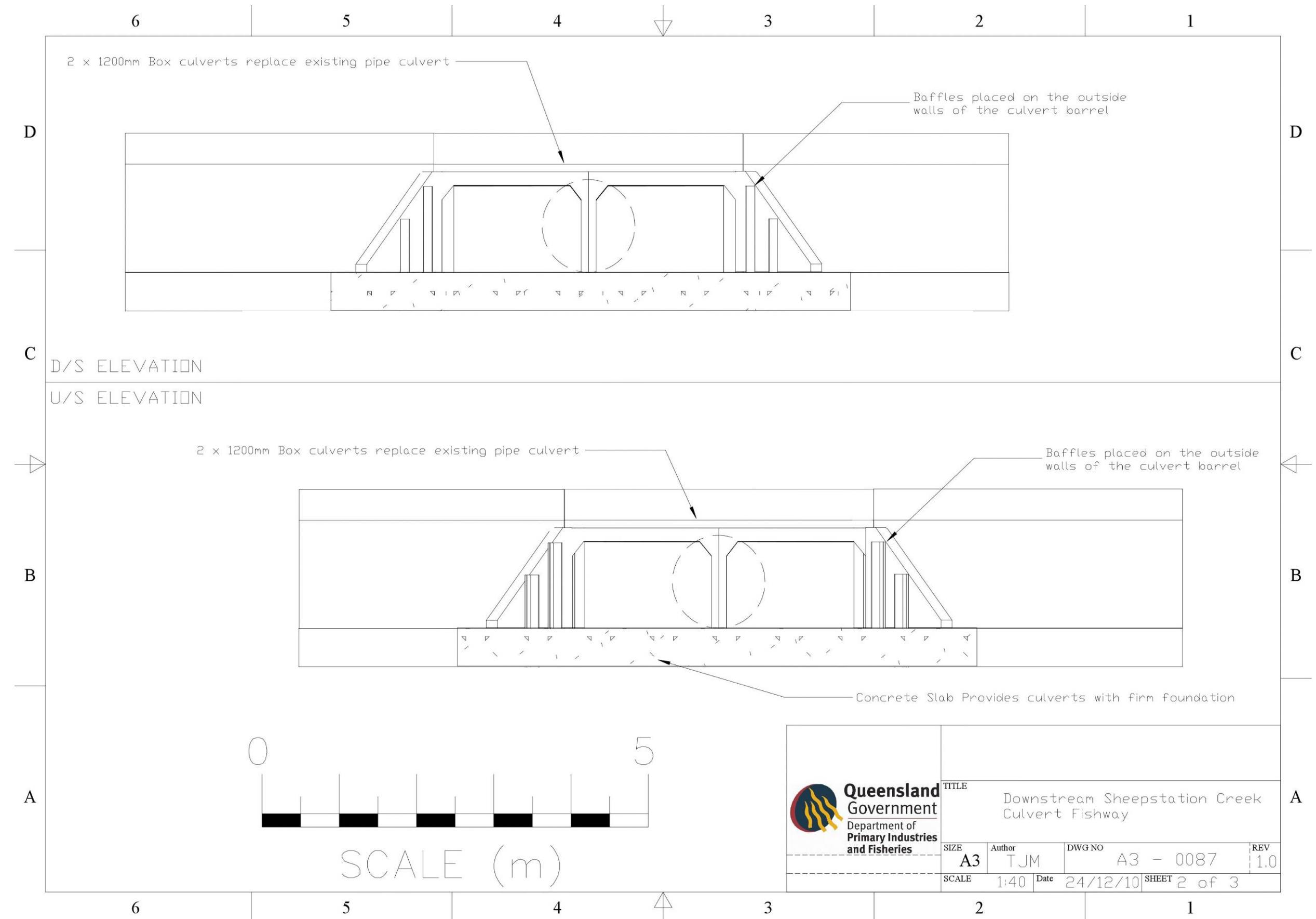
Costing

Materials	Total Cost
Construction Organisation (including approvals)	\$3,200.00
Construction Supervision	\$9,680.00
1500x1500mm Culverts	\$19,063.00
Baffles	\$4,030.00
Concrete	\$2,295.00
Reo Mesh	\$ 144.00
Excavator	\$3,270.00
Water pump (large)	\$1,500.00
SUB TOTAL	\$43,182.00
10% Contingency	\$4,318.20
TOTAL	\$47,500.20

Design







Sheep Station Creek, Old Crossing

Site

Sheep Station Creek was once a well vegetated system with a series of large wetland lagoons that provided vital habitat particularly for migratory juvenile fish such as barramundi, tarpon and mangrove jack. More recently this system has been utilised as an irrigation channel to provide Burdekin river irrigation water to a large number of agriculture enterprise along the system, (Stewart, 2006). By doing this the system has changed from an ephemeral stream where the creek would often dry up to permanent lagoons in the dry season to a system that flows almost year round.

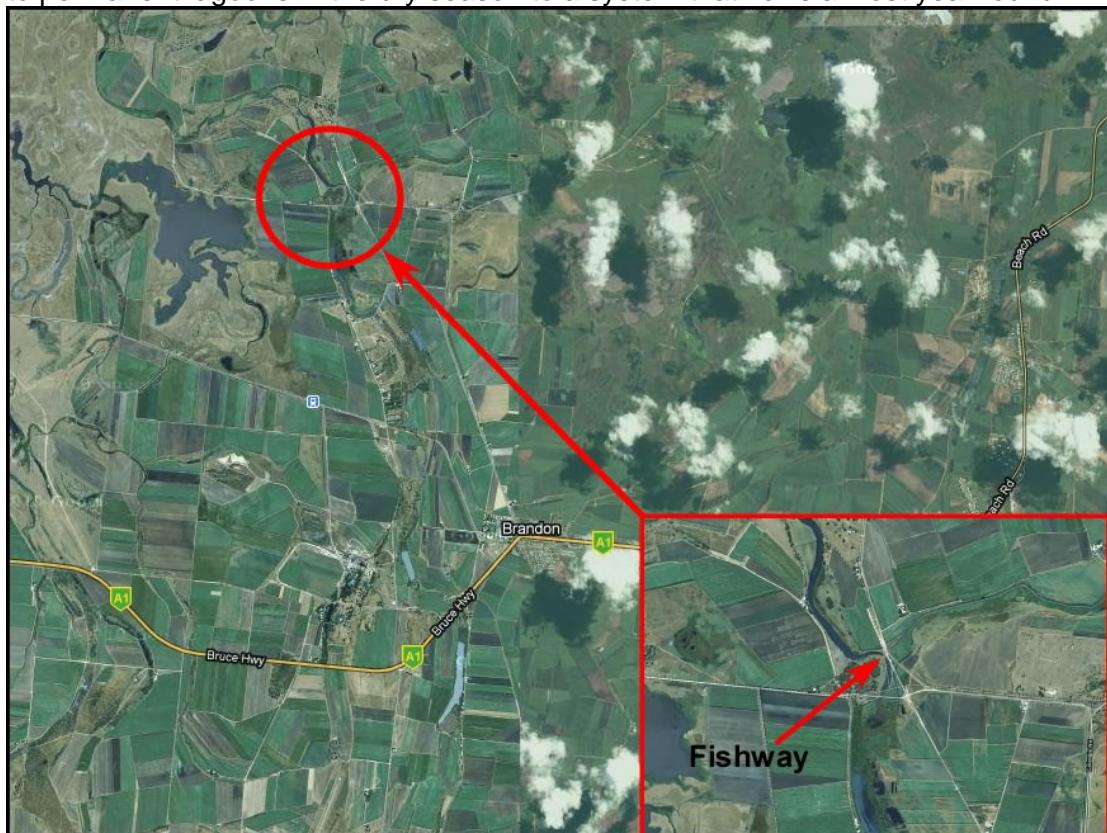


Figure 7. Location of the third proposed fishway on Sheepstation Creek north-west of Brandon

Description

The Old Crossing barrier of Sheep Station Creek is located 5km North West of Brandon. Having been significantly impacted upon by modifications made to allow for irrigation supply, this system has limited natural riparian vegetation along its banks.

Solution

The old outlet works are to be removed allowing all flow to pass over a full width rock ramp fishway to be installed immediately downstream of the existing outlet works

location. This will be 7.5 meters long by 12 meters wide with 4 ridges. If required by land holders a concrete crossing can be also be installed.

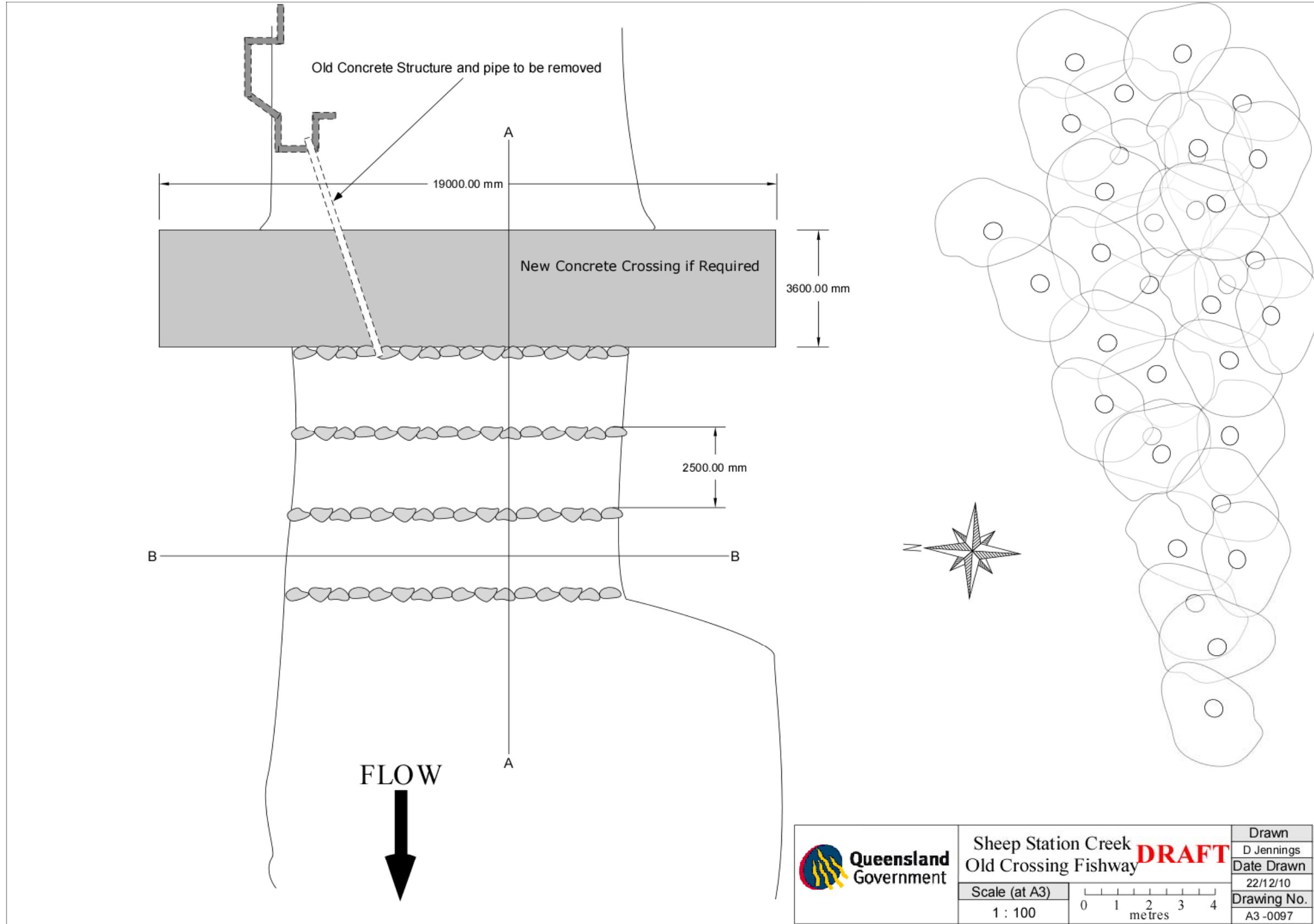


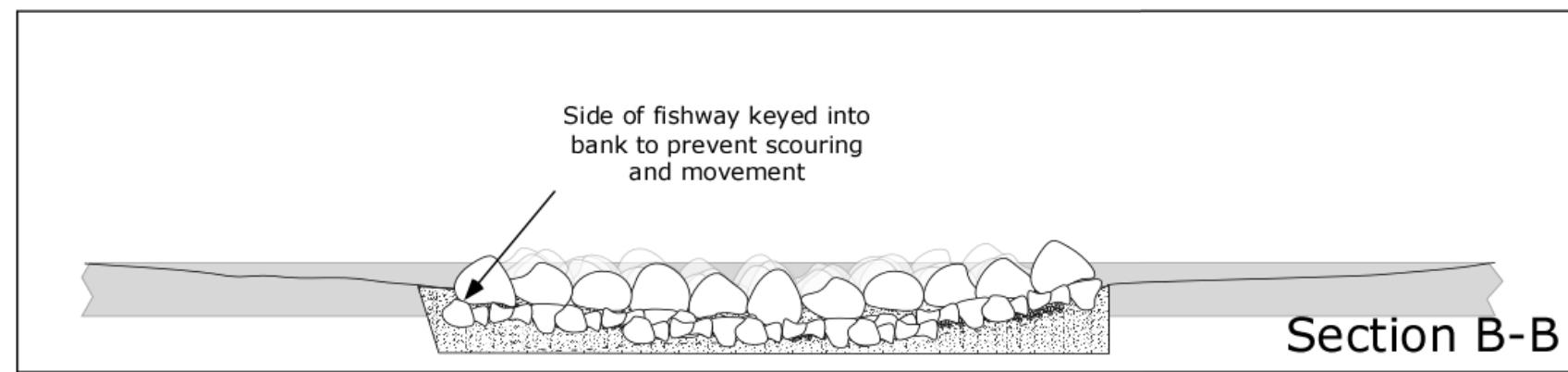
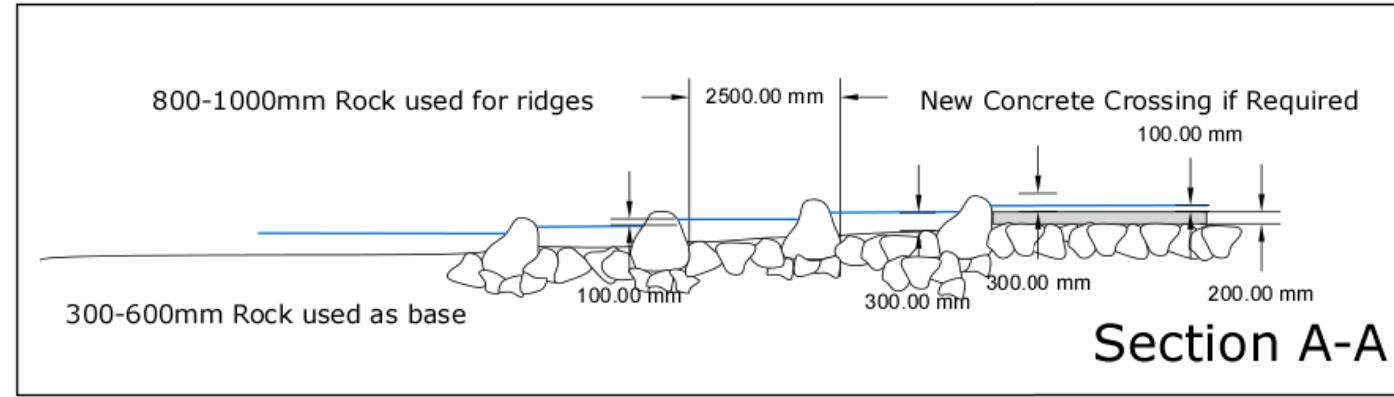
Figure 8. The existing structure at Sheepstation Creek to be removed and a rock ramp fishway to be built.

Costing

Materials	Total Cost
Construction Organisation including Approvals	\$3,200.00
Construction Supervision	\$7,260.00
Reo Mesh for Crossing	\$ 288.00
Concrete for Crossing	\$,3150.00
Concrete for Rock Ramp	\$ 788.00
300-600mm Rock	\$1,260.00
800-1000mm Rock	\$1,260.00
Excavator	\$3,945.00
Rubbish Removal	\$ 420.00
SUB TOTAL	\$21,571.00
10% Contingency	\$2,157.10
TOTAL	\$23,728.10

Design





 Queensland Government	Sheep Station Creek Old Crossing Fishway DRAFT	Drawn
		D Jennings
Date Drawn		Date Drawn
		22/12/10
Drawing No.		Scale (at A3)
		1 : 100 0 1 2 3 4 metres
		A3 -0097