5 DESCRIPTION OF THE PROJECT

5.1 Overview of the Glebe Option

The Glebe Option involves raising the existing Glebe Weir and constructing an 83 kilometre pipeline and associated infrastructure (pump station and balancing storage) to transport water to the proposed Project site approximately 5 km west of Wandoan (Figure 5-1). The weir will be raised by approximately 2.36 m to 172.9 m AHD, 12.4 m above the streambed. This will increase its storage capacity by 12,400 ML to 30,100 ML.

The weir raising will be achieved primarily by fitting inflatable rubber dams along the existing weir's spillway and abutments. In addition, levee banks are proposed to be constructed across low-lying areas on tributaries on both sides of the Dawson River to contain the storage at the increased FSL. The levee on the left bank will also protect boggomosses (mound springs) in this area. The levees are assessed in detail in the body of this impact assessment.

The existing weir was constructed in 1971. It does not include a fishway, was not designed with knowledge of the potential impacts of weirs on turtles and does not have a multi-level offtake which can be adjusted to select the best quality water for release. Provision for a fishway and multi-level offtake and modifications to reduce impacts on turtles are proposed as part of the Glebe Option.

Water for the Wandoan Coal Project is proposed to be drawn from the weir via a pump station to be constructed on the eastern side of Cockatoo Creek just upstream of its junction with the Dawson River, and piped 83 km to the mine site. The buried underground pipeline is proposed to run for 11 km through private property from the weir to the undeveloped Nathan Road Reserve north of the intersection of the built Nathan Road and the Taroom–Cracow Road.

The pipeline will then generally follow the developed Nathan Road reserve to the Project site. A balancing storage will be required at the high point about halfway along the route, with water being gravity fed from this point to the mine site. Air pressure release valves will be required at high points along the route and scour valves will be required at low points.

Other works required as part of the Glebe Option include:

- upgrading site access roads;
- upgrading power and telecommunications infrastructure serving the weir site;
- relocating public infrastructure such as power poles in areas flooded at the proposed FSL;
- bridging Cockatoo Creek to maintain existing road access to Lot 14 CP FT 1 and installing culverts to maintain access to the homestead on Lot 15 CP FT2;
- relocating private infrastructure such as fences, pumps in the storage and irrigation pipes to allow for the increased storage level;
- relocating power and telecommunications infrastructure along the pipeline route by minor amounts;
- reinstating various access tracks, yards, irrigation pipes, and other farm facilities along the pipeline route; and
- acquisition of land or obtainment of easements for land impacted by the weir raising or the pipeline acquisition.

The camping area immediately adjacent to the weir on the left bank will be closed during the construction period for safety and security reasons. It will be reopened on completion of the weir development.

The estimated capital cost of the Glebe Option is approximately $160 M (at concept design accuracy).

Subject to approvals, works would commence late in 2009 and be operational by January 2012.

5.2 Location and Land Requirements

5.2.1 Location of Infrastructure

Glebe Weir is situated at 326.2 km AMTD on the Dawson River in Central Queensland, approximately 56.9 km (river distance) downstream from Taroom and 96 km upstream from Theodore (Figure 5-1).

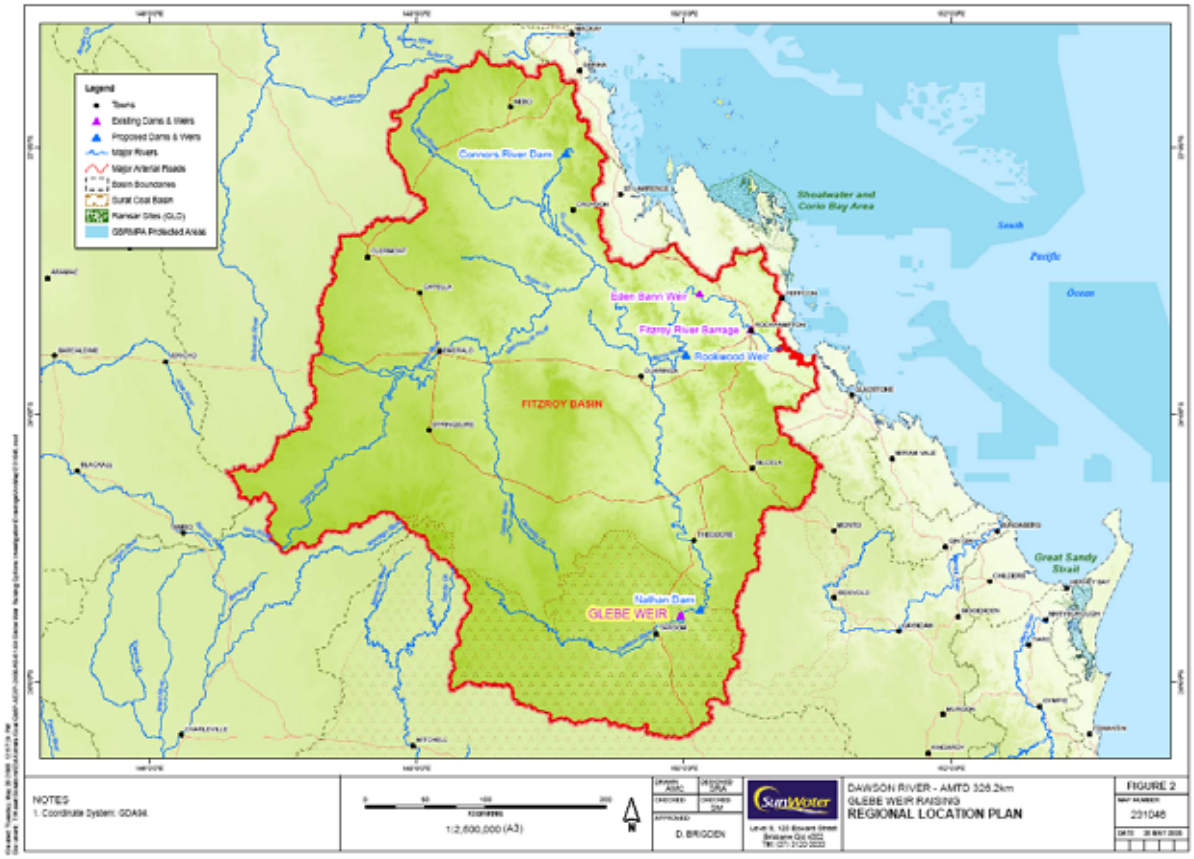


Figure 5-1. Regional location of Glebe Weir.

The geographic location is:

- Latitude: 25º 27' 52.56" S
- Longitude: 150º 2' 5.60" E.

The weir is located in a straight section of the Dawson River approximately 8.5 km downstream from a right angle bend from north-west to north-east and 3 km upstream of a right angle bend from north-east to south-east (Figure 5-2). Land adjacent to this section of river is predominantly level to gently undulating levees and floodplains (Figure 5-3). Cockatoo Creek joins the river on the right bank approximately 0.18 km upstream of Glebe Weir while Boggomoss Creek joins the river on the left bank approximately 0.75 km upstream of the weir. Land adjacent to Boggomoss Creek is level to gently undulating floodplains while that adjacent to Cockatoo Creek is level to gently undulating floodplains with some gently undulating rises and undulating rises in the north-east.

The Dawson River at Glebe Weir comprises a low flow channel approximately 40 m wide and 2 - 3 m deep in a broad bed approximately 180 m wide, between 9 m and 12 m below the crests of the high banks. The distance between the crests of the high banks is approximately 340 m (Figure 5-4).

The Dawson River is the principal southern tributary in the Fitzroy Basin. It flows into the Fitzroy River at approximately 310.3 km AMTD. Thus, Glebe Weir is approximately 636.5 km from the Coral Sea at Keppel Bay and 576.9 km from tidal waters at the base of the Fitzroy Barrage at Rockhampton (Figure 5-1).

Gyranda Weir, on the Dawson River at 284.5 km AMTD and with FSL at 157.25 m AHD, is the nearest in-stream storage downstream from Glebe Weir. Gyranda Weir reservoir extends upstream through Nathan Gorge to approximately 311 km AMTD at FSL. There are no in-stream storages upstream of Glebe Weir.

The pump station on Glebe Weir will be located on the right bank of Cockatoo Creek about 200 m upstream of its confluence with the Dawson River. The site will be at approximately:

- Latitude: 25º 28' 3.72" S
- Longitude: 150º 2' 3.88" E.

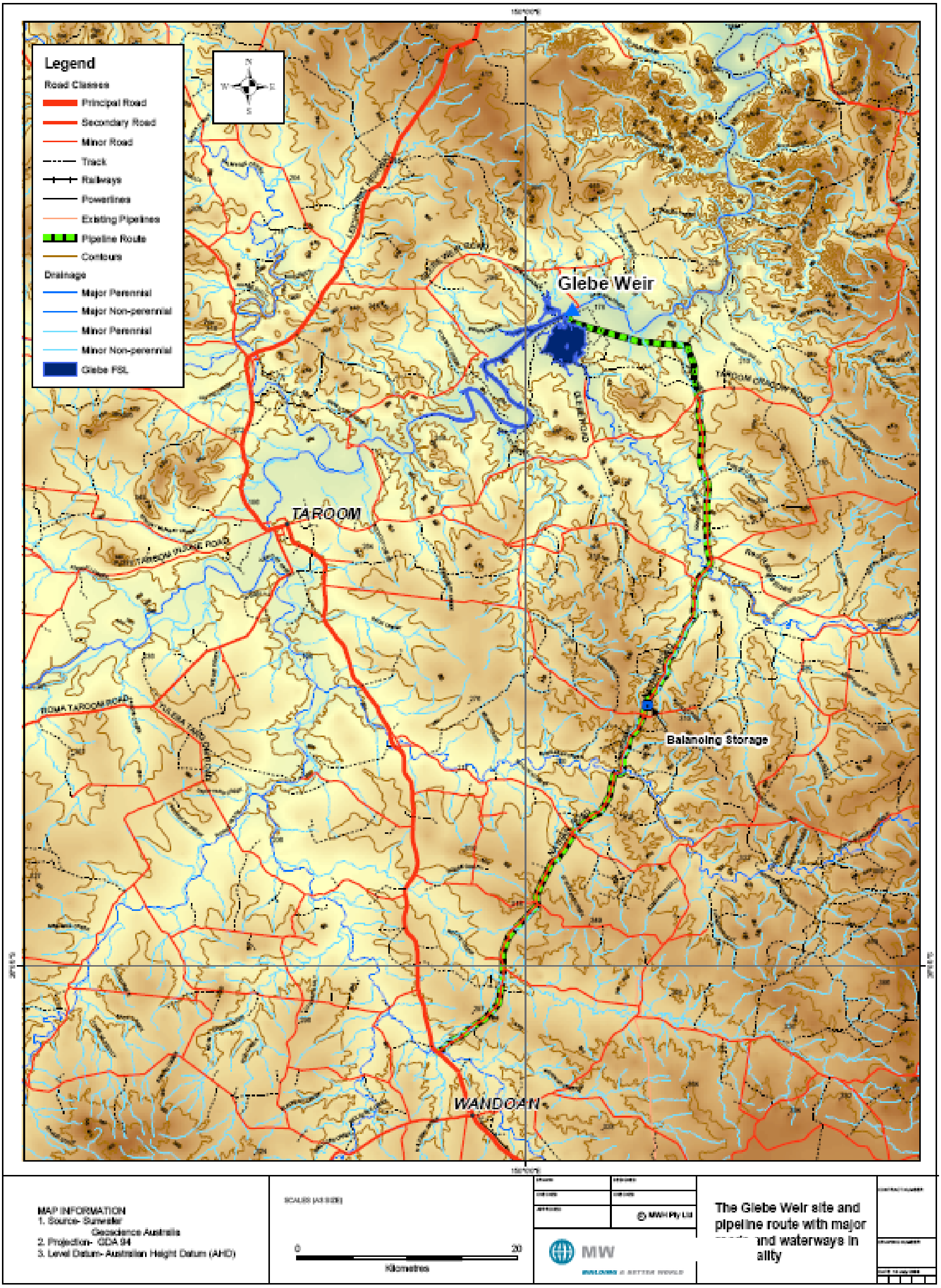


Figure 5-2. The Glebe Weir site and pipeline route with major roads and waterways in the locality.

During construction of the pipeline a 30 m wide corridor will be required to allow for associated construction works, however, the area required for operation of the pipeline will be 16 m wide. The pipeline from Glebe Weir to the Wandoan Coal Project will run:

- From the pump station on Glebe Weir at approximately:
  - Latitude: 25º 28' 3.7" S
  - Longitude: 150º 2' 3.9" E
- South-east to approximately:
  - Latitude: 25º 28' 21.0" S
  - Longitude: 150º 2' 17.5" E
- East-south-east to approximately:
  - Latitude: 25º 29' 15.0" S
  - Longitude: 150º 5' 40.5" E
- Ease-south-east to the undeveloped Nathan Road reserve at approximately:
  - Latitude: 25º 29' 29.5" S
  - Longitude: 150º 8' 0.0" E
- South to the intersection of the Taroom — Cracow Road and the developed Nathan Road at approximately:
  - Latitude: 25º 31' 56.2" S
  - Longitude: 150º 8' 28.0" E and
- South along Nathan Road, in the vicinity of the road reserve to the Wandoan Coal Project on the western side of the Leichhardt Highway at approximately:
  - Latitude: 26º4'13.2" S
  - Longitude: 149º 55' 37.0" E.

The pipeline will cease at the property boundary.

A balancing storage is proposed at Latitude 25º 47' 13.4" S Longitude 150º 5' 58.5" E at an elevation of approximately 325 m AHD. The area required for the balancing storage is approximately one hectare.

The construction sites for both the weir raising and the Glebe Weir pump station should be confined within the area defined by the following coordinates:

- Latitude: 25º 27' 39.3" S
- Longitude: 150º 2' 11.9" E

- Latitude: 25º 27' 54.0" S
- Longitude: 150º 2' 20.4" E

- Latitude: 25º 28' 8.8" S
- Longitude: 150º 2' 3.5" E

- Latitude: 25º 27' 46.4" S
- Longitude: 150º 1' 54.5" E.

All areas covered by the raised FSL and the proposed levees are considered part of the works area and a buffer area of 50 m beyond FSL and the levees will be required for revegetation works.

A number of currently unlicensed resource extraction areas are being investigated for their suitability to provide materials for the Glebe Option. These include a sand extraction area at the junction of Cockatoo Creek and Sandy Creek used for the construction of Glebe Weir in 1971 and a road base source on the Taroom Cracow Road near Glebe Road that has historically been used in local shire road works.

5.2.2 Land Requirements

Eight rural properties (comprised of eleven lots) are riparian to the present Glebe Weir reservoir and will potentially be impacted to varying extents by the Glebe Option. No additional properties will be directly affected by raising the weir (Figure 5-5). Nine of the eleven riparian lots are under Freehold title and two under Leasehold. Five of the freehold properties and one of the leasehold properties have been acquired by the State of Queensland to facilitate the Nathan Dam Project if it proceeds, and another property has been acquired for the purpose of either Nathan Dam or Glebe Weir raising. These seven properties are administered by DNRW. In addition, there is one small Reserve (a camping area and one small parcel of Unallocated State Land on the left bank of the Dawson River immediately adjacent to Glebe Weir). Both of these are under the control of Banana Shire Council. The inundation area near Boggomoss Creek will also impinge on Boggomoss Area No.1, which is listed on the Register of the National Estate (Figure 5-5).

The major land use in the vicinity of the Glebe Option is grazing on sown, naturalised, and native pastures. Approximately 1200 ha of additional land will be inundated by the raised weir and its associated levee, primarily in the area of overbank inundation near Cockatoo Creek.

The pump station will be sited on the right bank of Cockatoo Creek on lot 14, FT1. The pipeline will cross both this property and lot 2, FT734 before it reaches the undeveloped Nathan Road reserve north of the Taroom — Cracow Road. It is proposed to locate the pipeline in the Nathan Road reserve from this point, other than for a number of very minor deviations, to the Project. For a detailed discussion of land requirements, refer to Chapter 7.

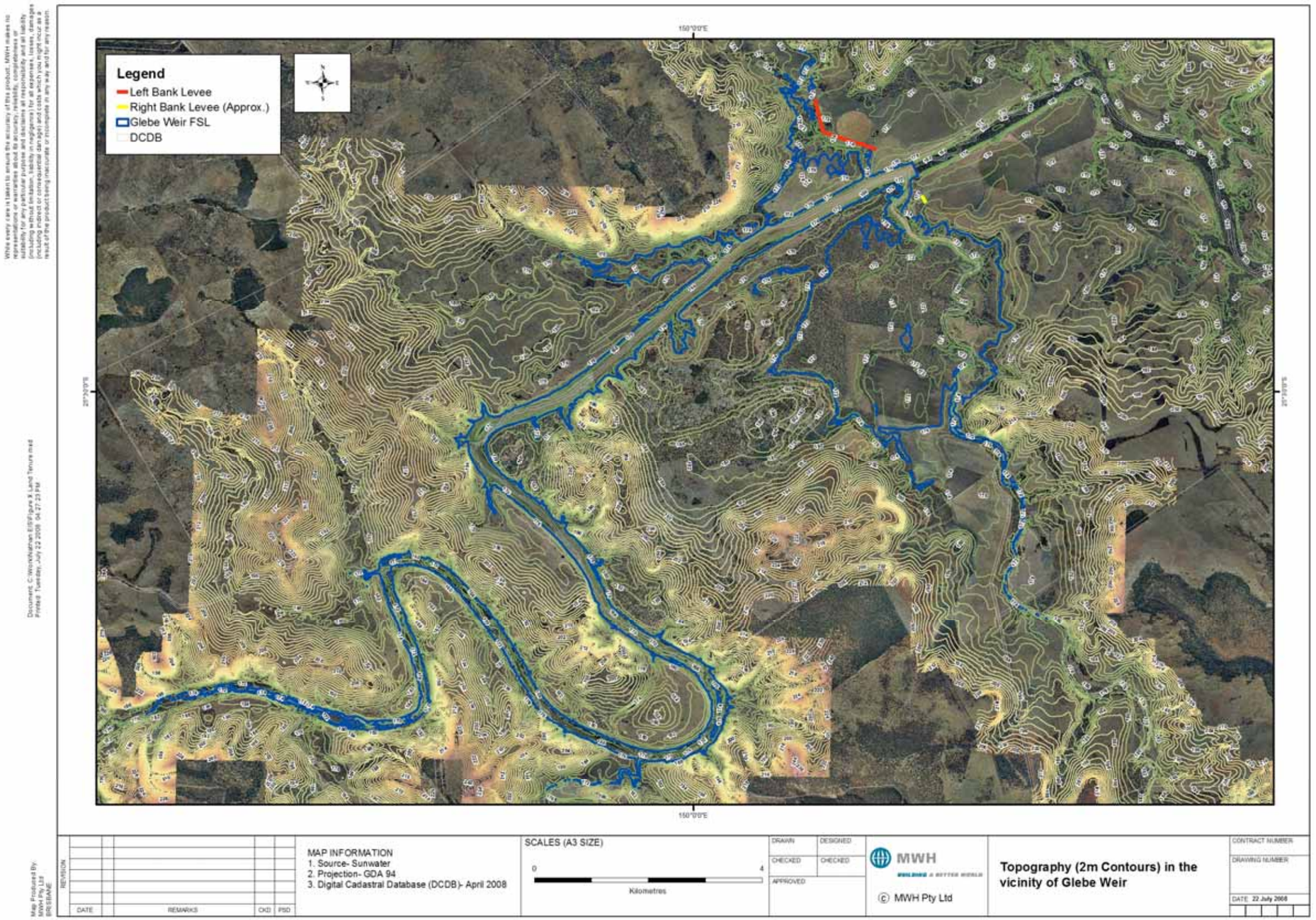


Figure 5-3. Topography (2 m contours) in the vicinity of Glebe Weir and location of proposed levees.

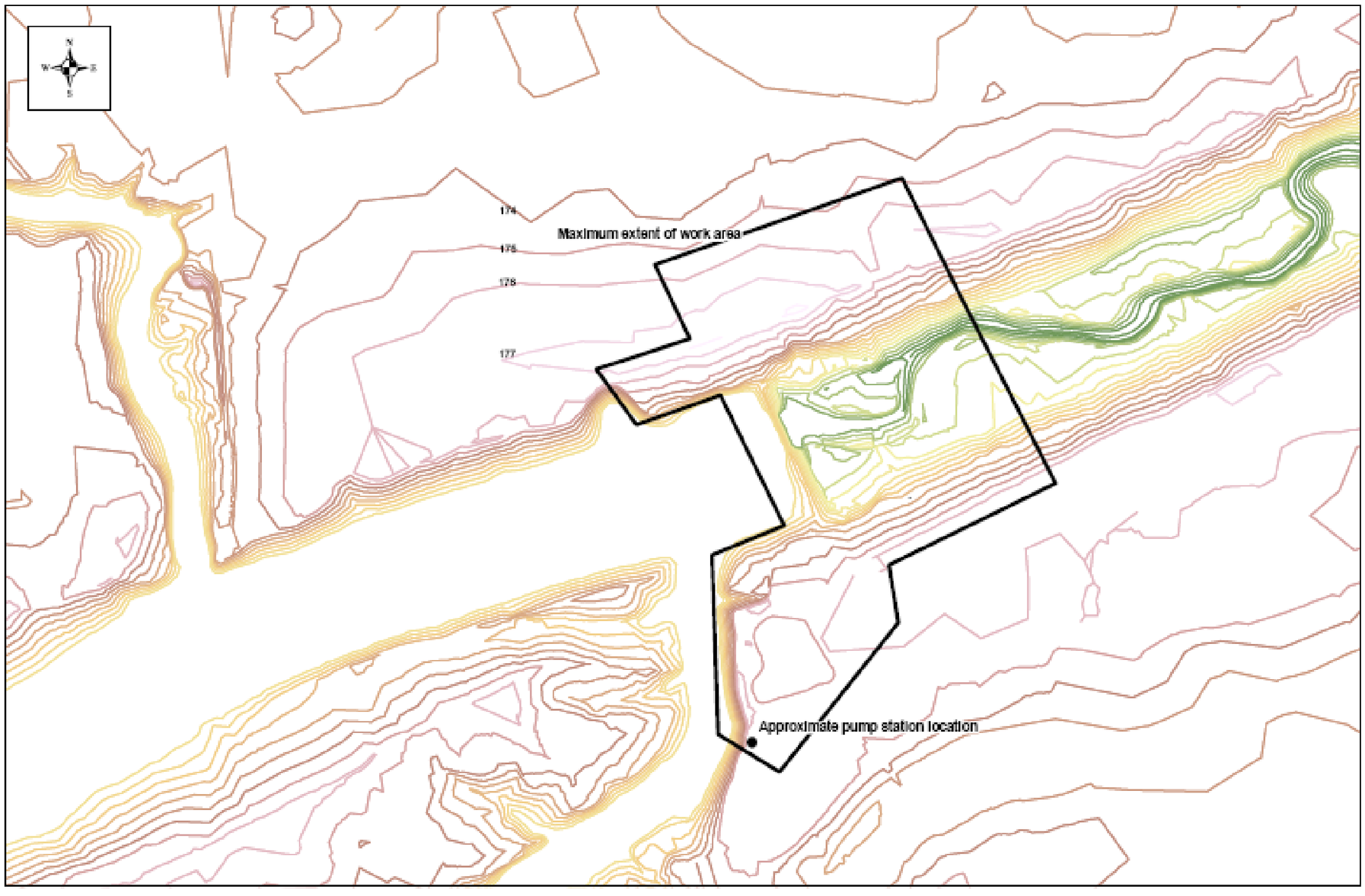
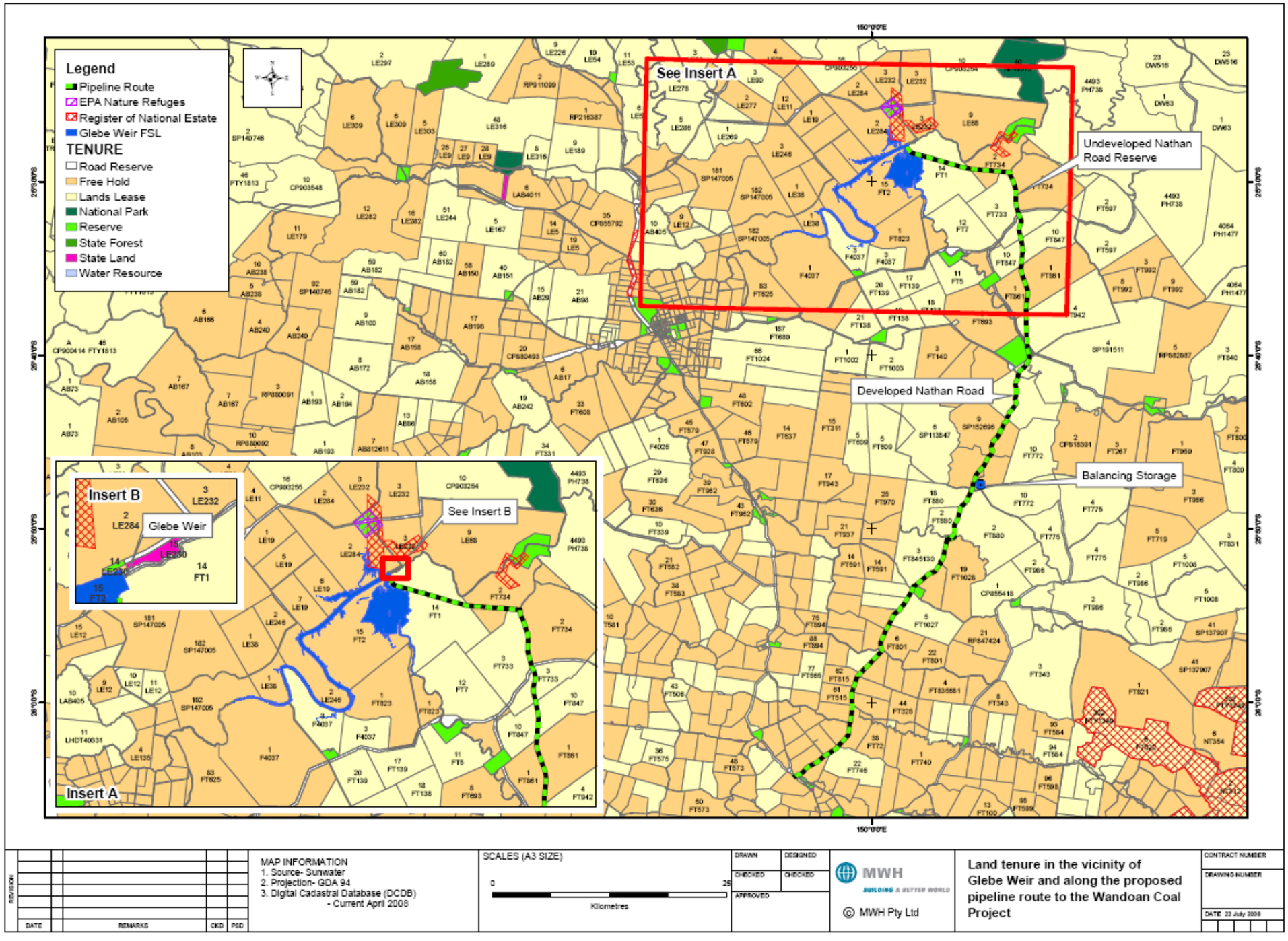


Figure 5-4. Topography (1 m contours) around the Glebe Weir site showing likely maximum extent of works site.



MAP INFORMATION
1. Source- Sunwater
2. Projection- GDA 94
3. Digital Cadastral Database (DCDB)
- Current April 2008

SCALES (A3 SIZE)
0 25
Kilometres

DRAWN DESIGNED CHECKED CHECKED APPROVED

© MWH Pty Ltd

Land tenure in the vicinity of Glebe Weir and along the proposed pipeline route to the Wandoan Coal Project

CONTRACT NUMBER
DRAWING NUMBER
DATE 22 July 2008

REVISION DATE REMARKS CKD PSD

Figure 5-5. Land tenure in the vicinity of Glebe Weir and along the proposed pipeline route to the Wandoan Coal Project.

5.3 Design

5.3.1 Water Storage Infrastructure

5.3.1.1 Existing Weir

Completed in 1971, Glebe Weir on the Dawson River at 326.2 km AMTD comprises a central mass concrete spillway crest section, approximately 58.5 m long, at the low flow channel of the river. This is supported by sheet piling upstream and by a second row of sheet piling downstream of the discharge apron (Figure 5-6). FSL is defined by the central ogee spillway crest at 170.54 m AHD. The spillway section is flanked on each side by stepped sheet piling abutments with the left abutment approximately 54.5 m long and the right abutment approximately 139.5 m long. There are up to five rows of sheet piling (four steps) in each abutment tied together with a system of timber wales and steel rods. The top row of sheet piling on each abutment is approximately 0.7 m above spillway crest level (Plate 5-1).

Plate 5-1. Glebe Weir showing central spillway crest flanked by stepped sheet pile abutments

The upstream faces of the abutments are protected with compacted selected impervious fill battered to 3:1 (horizontal: vertical). These batters are retained by a low row of steel sheet piling towards the toe and are protected by rock pitching at the crest. Erosion protection downstream of the abutments is provided by rockfilled mattresses and rip rap extending up the banks above abutment level (Plate 5-2). Material underlying the weir foundations generally consists of high plasticity clay overlying sandstone.

Downstream releases are made through a reinforced concrete intake structure approximately 15 m directly upstream of spillway monolith number 5. Trash screens are provided above 165 m AHD with a slot for dropboards extending to near river bed level. No provision is made for selective withdrawal of water released downstream. Outlet works comprise a single 1.2 m pipe eventually bifurcating to two parallel 0.7 m gate valves. These gate valves discharge towards the right bank of the river from the left side of the discharge apron downstream of the spillway. The gate valves are manually controlled from the deck over the valve pit (Plate 5-3).

Plate 5-2. Left abutment of Glebe Weir showing rock pitching on upstream battered fill, downstream rockfilled mattresses, rip rap extending up the river bank and three rows of sheet piling

Plate 5-3. Releases from Glebe Weir discharging onto the apron downstream of the spillway with deck over valve pit in lower left

The existing Glebe Weir has no facilities that aid fish or turtle movement past the structure.

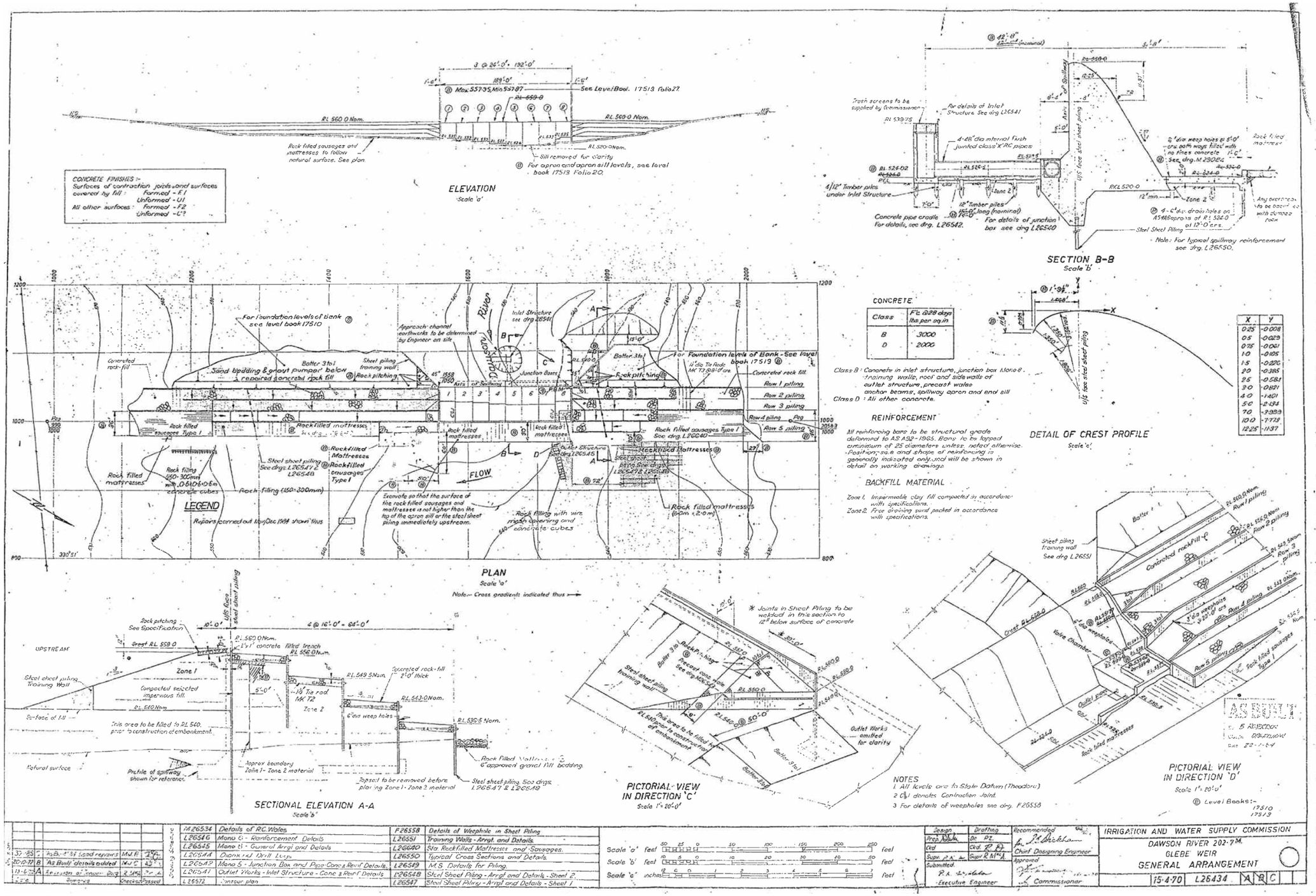


Figure 5-6. Existing arrangements for Glebe Weir ('As Built' drawing).

The weir drowns out (i.e. becomes completely submerged) in a flood with an average recurrence interval of 1 in 5 years.

Refurbishment work was carried out on Glebe Weir in 2001. A large amount of fill under the rock and concrete protection on the abutments was replaced and it was noted that some sections of sheet piling had large amounts of surface corrosion.

A preliminary assessment of the condition of Glebe Weir was undertaken by SunWater engineers in February 2008 and it was concluded that any deficiencies within the existing structure could be made good as part of the raising.

5.3.1.2 Raising Proposal

Design options considered for the raising of Glebe Weir included:

- fitting an inflatable rubber dam to the central spillway crest and raising both abutments with reinforced concrete;
- lowering the central concrete spillway section and fitting collapsible steel shutters or a large inflatable rubber dam with both abutments raised with reinforced concrete;
- widening the central concrete spillway and installing an inflatable rubber dam over this greater length with both abutments raised with reinforced concrete; and
- installing an inflatable rubber dam on the central spillway and smaller-diameter inflatable rubber dams on each abutment.

In addition, the option of an off-stream storage was considered but a review of the topography in the area revealed no suitable site.

Hydraulic modelling has revealed that the first weir-raising option was found to result in excessive overland flows before the weir drowned out. Drown out occurs when headwater and tailwater levels upstream and downstream of a structure are approximately equal. These excessive overland flows would require levees up to 3 m high across flood channels to contain them and reduce the risk of rapid headward erosion where floodwaters re-enter the river at lower levels downstream. Such a situation might lead to bypassing of the weir, thereby changing the path of the watercourse and rendering the weir useless.

The second and third weir-raising options were rejected because they would have unacceptable impacts on the operation of the storage during construction, as the weir would need to be drained thereby impacting the availability of water allocations to existing customers in the Dawson Valley Water Supply Scheme that rely on the weir for their water supply.

The assessment outlined above led to the exclusion of the first three options and selection of the fourth option involving inflatable rubber dams on the spillway and each abutment.

The preliminary design for raising Glebe Weir comprises adding mass concrete to the central concrete overflow section to increase its width, adding concrete to both abutments to provide wide, near-level crests, and then installing a total of four inflatable rubber dams on the new crests (Figure 5-7). The utilisation of inflatable rubber dams to increase the storage capacity of water impoundments is a relatively common practice throughout the world, with this technology having been successfully utilised by SunWater for a series of other raising projects in Queensland such as Bedford Weir on the Mackenzie River, Claude Wharton Weir on the Burnett River, Dumbleton Weir on the Pioneer River, and Koombooloomba Dam on the Tully River.

The inflatable rubber dams will provide a collapsible crest. The rubber dams are elongated bags that will be fixed to the modified concrete spillway and abutment crests. When filled with compressed air the rubber dams form a higher effective crest level that can be lowered by deflating them. The control system is linked to a headwater stream gauge in the storage so that the inflatable rubber dams commence to deflate when they are overtopped, with the rate of deflation depending on the rate of water level rise. Inflation commences at a controlled rate when the headwater level has fallen to a predetermined height. The rubber dam crests on Glebe Weir will be at 172.9 m AHD when fully inflated, an increase of 2.36 m over the current spillway crest height.

The existing concrete of the fixed crest will be lowered slightly and additional mass concrete added to the crest and downstream face to provide a flat fixed crest with a slight rise to the downstream edge at 170.68 m AHD (Figure 5-8). The flat crest will be approximately 7.5 m wide and of sufficient width to allow the inflatable rubber dam to lie on it when fully deflated to prevent damage during flood events. Additional concrete added to the downstream face will taper from approximately 7.5 m at the crest to approximately 3 m at the base and will be fixed to the existing face with anchor bars.

Additional support may be required for the modified spillway section and, if required, this will be provided by concrete or steel piles installed at the downstream toe of the spillway or the downstream toe of the discharge apron area.

Energy dissipation downstream of the spillway will be provided by a reinforced concrete discharge apron in the river bed similar to the existing structure. A physical hydraulic model of the proposed structure will be constructed and tested to determine the optimum arrangements to dissipate energy, reduce the risk of erosion undermining the downstream toe of the weir, and, in consultation with aquatic ecologists, minimise the risk of fauna suffering trauma during overflows. The need to attract fish to the fishway will also be considered.

A single inflatable rubber dam approximately 57 m long will be fitted towards the upstream side of the modified spillway. It will be 2.36 m high when fully inflated and will be set at a level such that its crest is at 172.9 m AHD, the FSL of the raised Glebe Weir. When fully deflated, it will lie on the flat spillway crest below the level of its downstream edge. Pipes placed in the new concrete work on the spillway and abutments will carry the air-lines and control systems for the inflatable rubber dams.

The abutments will be modified to allow for the fitting of inflatable rubber dams by adding a base of mass concrete between the two upstream rows of sheet piling (Figure 5-8). Like the spillway, the flat crest will be approximately 7 m wide with a slight rise to the downstream edge. Additional sheet piling will be added if required to provide support and downstream protection works will be enhanced to account for changes in the abutment crest design. A central pillar will be constructed on the right abutment to allow the fitting of the two inflatable rubber dams.

The ends of each abutment will be extended to the natural ground surface at a level approximately 0.3 m above that of the abutment rubber dams, with foundations and downstream erosion protection as required.

One inflatable rubber dam approximately 47 m long will be fitted to the left abutment and two inflatable rubber dams, each approximately 66 m long will be fitted to the right abutment, which is too long to be spanned by a single inflatable dam. These inflatable rubber dams will be approximately 1.8 m high when fully inflated and will be fitted in a similar manner to that on the spillway. They will be set such that their crests will be at or slightly above 172.9 m AHD when fully inflated.

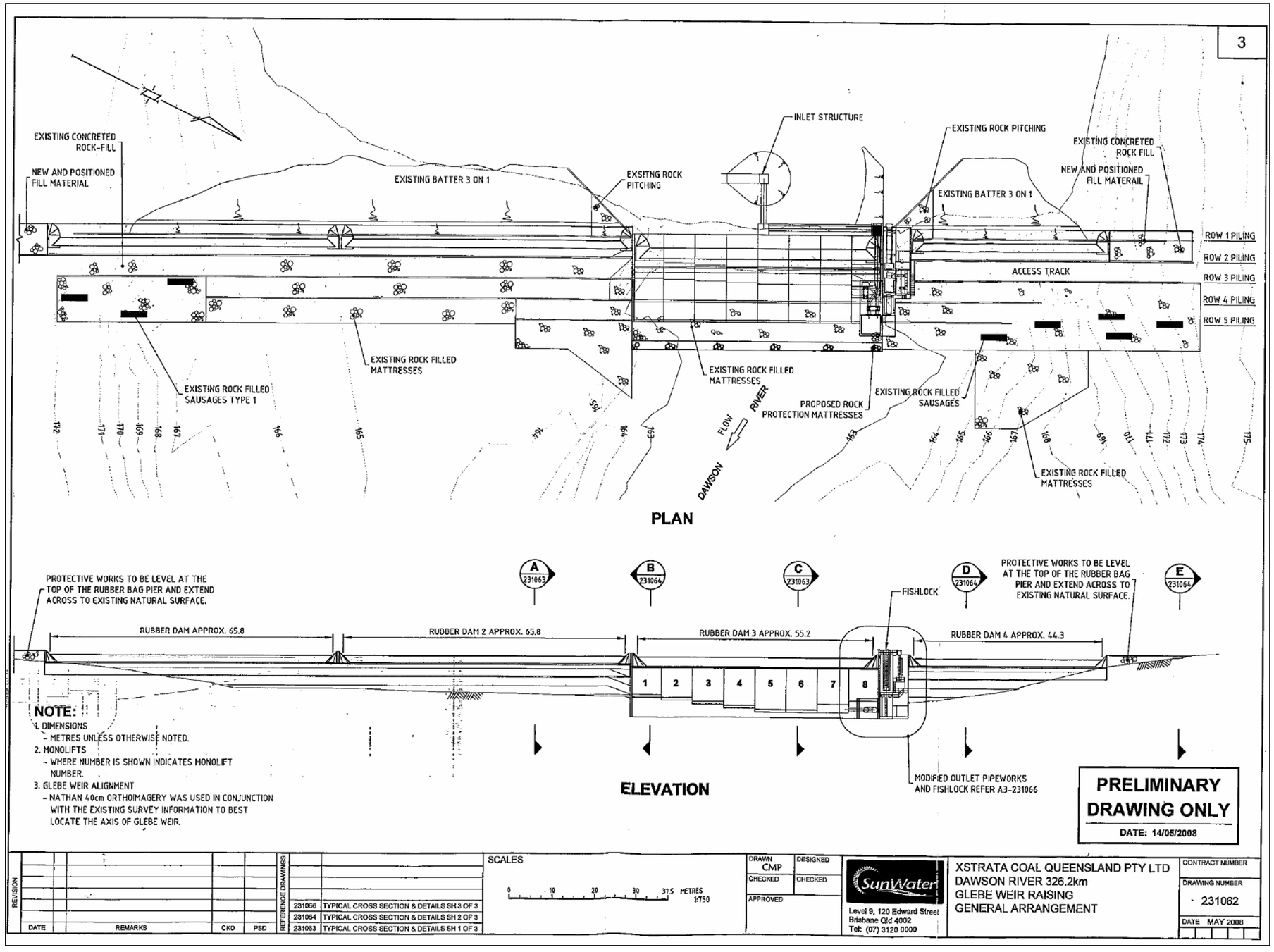
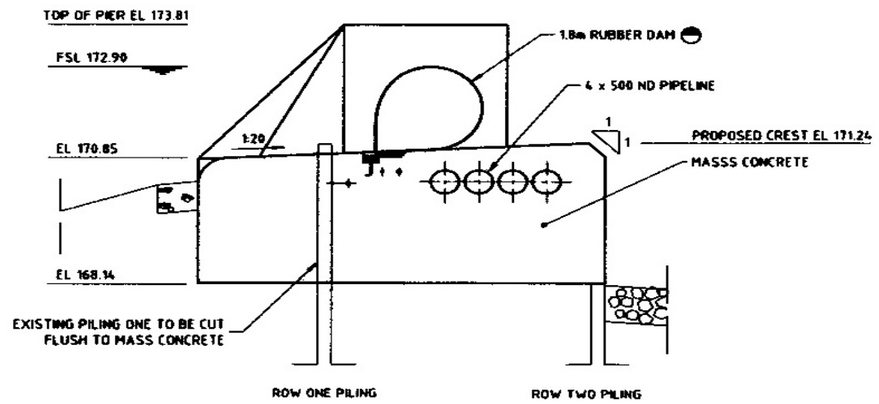
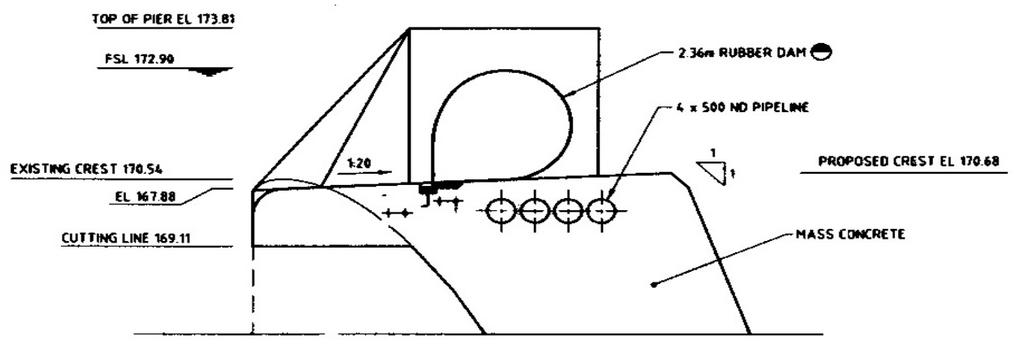


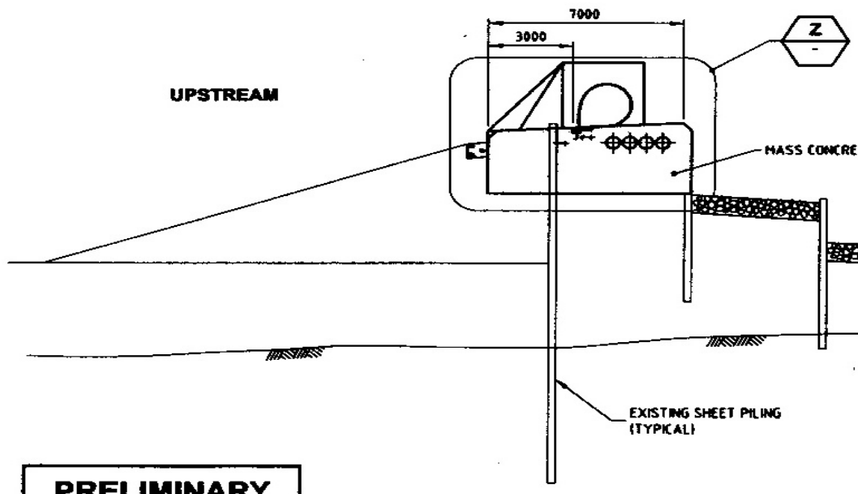
Figure 5-7. General arrangement for proposed Glebe Weir raising.



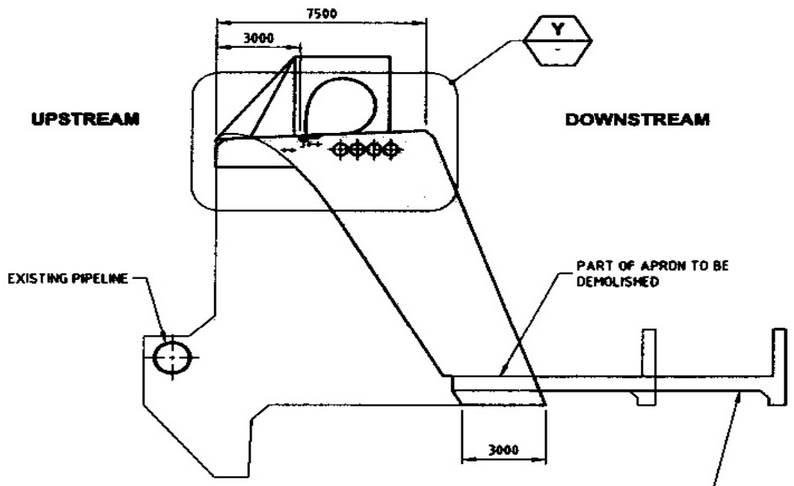
DETAIL Z
SCALE B



DETAIL Y
SCALE B



SECTION A 231062
SCALE A



MONOLIFT 6

SECTION C 231062
SCALE A
(FISHWAY & MONOLIFT 8 OMITTED FOR CLARITY)

PRELIMINARY DRAWING ONLY
DATE: 14/05/2008

NOTE:
1. DIMENSIONS
   - MILLIMETRES UNLESS OTHERWISE NOTED
2. DATUM
   - ALL LEVELS ARE TO (A H D) AUSTRALIAN HEIGHT DATUM
3. RUBBER DAM SIZES
   - RUBBER DAM SIZE INDICATED IS AN APPROXIMATE ONLY SIZE TO BE CONFIRMED ACCORDINGLY TO PROPOSED CREST EL AND FSL LEVEL BY SUPPLIER

REVISION	DATE	REMARKS	CKD	PSD

REFERENCE DRAWINGS	
231068	RAISED SPILLWAY & DETAILS SH 3 OF 3
231064	RAISED SPILLWAY & DETAILS SH 2 OF 3
231062	GENERAL ARRANGEMENT

SCALES
'A' 0 5000 10000 MILLIMETRES 1:200
'B' 0 1000 2000 3000 4000 5000 MILLIMETRES 1:100

DRAWN CMP | DESIGNED
CHECKED | CHECKED
APPROVED

SunWater
Level 9, 120 Edward Street
Brisbane Qld 4002
Tel: (07) 3120 0000

XSTRATA COAL QUEENSLAND PTY LTD
DAWSON RIVER 326.2km
GLEBE WEIR RAISING
RAISED SPILLWAY AND DETAILS
SH 1 OF 3

CONTRACT NUMBER
DRAWING NUMBER 231063
DATE MAY 2008

Figure 5-8. Sections through abutments and spillway showing proposed modifications to Glebe Weir.

Constructed earthen levee banks will be required on the left and right banks (Figure 5-3) to contain the storage up to the level at which the rubber dams start to deflate. The crests of the levee banks will be at 173.5 m AHD, 0.6 m above FSL and approximately 0.45 m above the storage level at which the inflatable rubber dams will commence to deflate so they will not be overtopped until the Dawson River is in full flood. By the time the levee banks overtop, tailwater level will be approximately 173.3 m AHD giving a drop of only 0.2 m over the banks. The downstream face of the levees will be designed and protected as necessary to withstand this flow. The northern levee near Boggomoss Ck will be approximately 1 km long while that near Cockatoo Ck will be just 200 m long. The levees will be up to 1.2 m high with a flat crest up to 4 m wide, batters of 3:1 and a base width of up to 12 m.

The existing Glebe Weir generates a number of environmental impacts in relation to the prevention of fish passage and occasional release of poor quality water downstream associated with thermal stratification (Chapter 8). SunWater recognises the opportunity to mitigate these impacts as part of the Glebe Option, and is proposing to provide a multiple level offtake that will facilitate selective withdrawal of water from various depths to ensure that the best quality water is released downstream, and the provision for a fishway. Both of these activities will require significant work to be undertaken to the outlet works of the weir, and will need significant capital investment. Subsequently, SunWater is proposing to defer the installation of the multiple level offtake and fishway until a decision has been made regarding the future of Nathan Dam, as the dam will inundate the weir should it proceed, and the existing impacts of the weir are unlikely to be substantially exacerbated by the raising.

Nevertheless, modifications to the outlet works will be undertaken to:

- take account of changes to the downstream face of the spillway and discharge apron; and
- minimise impacts on turtle species through changes to the intake screens.

Conceptual planning shows that it will be possible to fit a fishway that mimics a stream channel and has the required gradients to facilitate turtle movements. Detailed design will be produced in consultation with the DPI&F, EPA, and other relevant agencies and experts.

A comparison of key attributes of the present Glebe Weir and the weir after the raising proposed is given in Table 5-1.

Table 5-1. Present specifications for Glebe Weir and specifications after raising

Parameter	Existing specification	Proposed specification
Full supply level (m AHD)	170.54	172.90
Spillway crest level (m AHD)	170.54	170.68
Approximate abutment levels (m AHD)	171.14	171.24
Approximate maximum height of inflatable rubber dams (m)	Na	2.36
Approximate length of left abutment including extension to natural ground surface (m)	47	67
Approximate length of right abutment including extension to natural ground surface (m)	132	152

Parameter	Existing specification	Proposed specification
Approximate height of spillway above low flow channel bed (m)	10	10
Approximate height of FSL above low flow channel bed (m)	10	12.4
Approximate height of FSL above general streambed level (m)	8	10.4
Storage capacity (ML)	16,525	30,100
Dead storage (ML)	600	600
Approximate area of storage at FSL	593	1792
Approximate length of Dawson River impounded (km)	30.5	32.8
Approximate length of Cockatoo Creek impounded (km)	7.5	9

5.3.1.3 Design Review

Throughout this volume of the EIS, SunWater makes reference to the use of inflatable rubber dams, or fabridams, to raise Glebe Weir. Fabridams are a mechanism commonly used throughout Australia and indeed the world to augment the capacity of existing water storages.

Immediately prior to the release of this EIS, an incident involving a fabridam occurred on Bedford Weir, another SunWater storage located on the Mackenzie River, which utilises a fabridam in a similar nature to that proposed for the Glebe Weir raising.

The Glebe design will be reviewed in light of the findings from investigations into the Bedford incident and alternative options for raising Glebe Weir may be assessed. An alternative may include the replacement of the fabridams with collapsible steel shutters which are operated in a similar manner to fabridams. This design has been utilised by SunWater on two other water storages, these being Clare Weir on the Burdekin River, and Ben Anderson Barrage on the Burnett River.

Should SunWater decide to replace the fabridam option with an alternative such as steel shutters, the weir will be raised to an identical height to that currently outlined in this EIS. Subsequently whilst some minor changes may occur in relation to the construction process, the vast majority of impacts outlined in this document will remain unchanged

5.3.1.4 Dam Safety Management

The raised Glebe Weir is unlikely to be a referable dam in accordance with Queensland Dam Safety Management Guidelines (NRW, 2002) and the definitions given by the Australian National Committee on Lage Dams (ANCOLD) (ANCOLD, 2003). As a responsible weir owner, SunWater would implement a program to ensure the weir was designed, constructed, maintained and operated safely.

Issues likely to be addressed in the program would include:

- adequacy of design to pass large floods including the Probable Maximum Flood (PMF) (PMF at Nathan Gorge approximately 18 km downstream is 26,300 m^3/second);
- adequacy of design of levee banks and downstream protection works to withstand repeated smaller floods;
- adequacy of construction supervision to ensure the raising is carried out according to design specifications;
- adequacy of the monitoring and maintenance program to ensure that the structure continues to comply with specifications;
- adequacy of the inflatable rubber dam deflation systems when overtopped and supporting alarm systems ; and
- risks and assessment of consequences of unintended rapid deflation of the inflatable rubber dams (refer to Chapter 19).

5.3.2 Water Distribution Infrastructure

5.3.2.1 Glebe Weir Pump Station

The river pump station on Glebe Weir is proposed to be situated on the right bank of Cockatoo Creek within 0.2 km of its junction with the Dawson River. There is a natural levee with a steep bank at a uniform grade continuing to the bed of Cockatoo Creek all along this reach and the stream bed level is such that pumping can continue here until the volume in the weir is at or near the dead storage volume. This part of the weir has the advantage of remaining out of the main stream of the Dawson River during flood events so the pump intake is protected from flood debris from that source.

Based on the results of previous geotechnical investigations that were conducted during the construction of the weir, the foundations appear to be deep alluvial material and would be suitable for sheet piling and concrete foundations.

There will be two submersible electric pumps with associated pipework, each pump capable of delivering 25 ML/day, with a control and switch room situated above flood level. Capacity will be sufficient to supply the Project and, based on up to 8,500 ML/year demand, and 20 hrs/day operation to allow for maintenance and outages, capacity would be 325 L/second. Pump inlets will be protected by screens of sufficient area and mesh size to avoid entrapment of aquatic macro-fauna in the intake flow and designed to draw from depths where aquatic macro-flora will not cause blockages.

The pump station will have mechanisms in place to allow lifting of pumps for maintenance or replacement as necessary and will be controlled by an automated system integrated with that of the pipeline housed in a control room above flood level.

A temporary coffer dam may be required around the pump inlet site depending on the method of construction adopted.

5.3.2.2 Pipeline

The corridor for the pipeline (Figure 5-2 and Figure 5-5) from Glebe Weir to the Wandoan Coal Project area has been selected based on criteria including:

- minimising route length
- possible redundancy of a section if the Nathan Dam Project proceeds;
- minimising maximum elevations along the route;

- avoiding crossing the Dawson River or Cockatoo Creek within the Glebe Weir reservoir area; and
- maximising the use of existing road reserves and co-locating with existing or proposed infrastructure as far as possible (including the planned SBR corridor).

The option to co-locate within the proposed SBR corridor was assessed but:

- the location of the alignment was not well defined within a broader planning corridor;
- the Nathan Road reserve represented a more direct route with fewer impacts to private property; and
- other services were already co-located within the reserve (power and telecommunications as well as the road itself).

Another option was assessed which was shorter than the Nathan Road reserve option and was of reduced elevation at the high point, both attributes which reduced capital and operating costs. However the approximate 6 km saving in route length required easements across 46 km of private property, as opposed to approximately 12 km. This also necessitated construction of a maintenance access track which was served by Nathan Road for the majority of the road reserve option. Much of the land to be traversed was heavily timbered and this would require clearing. As a lower elevation route, the major creeks to be crossed were larger and more likely to be holding water during construction.

As a result, the Nathan Road reserve route was assessed as being the preferred option.

The preferred alignment within the broader corridor has been selected to:

- minimise the number of, and area within, private properties affected;
- minimise the extent of clearing of relatively undisturbed vegetation (even when that vegetation is not mapped as remnant within a State planning context);
- achieve the best alignments for crossing creeks and drainage lines; and
- reduce the highest elevation on the route by by-passing high points.

The route crosses Lot 14 CP FT1, and Lot 2 CP FT734 before reaching the undeveloped Nathan Road reserve north of the Taroom-Cracow Rd. It follows this reserve till it meets the developed Nathan Road then runs south essentially in, or at times adjacent to the Nathan Road reserve to the Wandoan Coal Project site west of the Leichhardt Highway near Wandoan.

Proposed pipe sizes are 500 mm nominal diameter (ND) for the first 11 km from the Glebe Weir pump station. From this point there are two options: the first is to continue this diameter pipeline to the Wandoan Coal Project site, and the second is a larger pipeline (for example 1,000 mm or 1,200 mm ND). The larger-diameter pipe option would be used to avoid the need for duplication if the Nathan Dam Project proceeds and water is to be piped further south. Its selection will be dependant on SunWater developing a business case that would support this larger capacity in view of the risk of Nathan Dam not proceeding. The pipeline will be constructed from ductile iron cement lined (DICL) pipe. The diameter of the pipe has little bearing on impact assessment as the required easement width and construction procedures are the same. It does however impact on the amount of bedding sand required, with the larger pipe requiring nearly twice as much as the smaller pipe. Impact assessment has assumed the larger volume may be required.

The pipeline will be buried approximately 1 m below the ground surface with a trench depth of approximately 1.7 m, and bedded in sand or similar inert material throughout its length. Burying pipes at this depth prevents them from floating or being subject to external loads. Surrounding the pipes with sand will provide increased protection from damage.

Based on concept designs, the following infrastructure will be required along the pipeline:

- one balancing storage with a control system, near the highest point on the route at an elevation of approximately 325 m AHD (Latitude 25º 47' 13.4" S Longitude 150º 5' 58.5" E), approximately 45 km from Glebe Weir and 38 km from the Project site (Plate 5-4);
- control and reflux valves to stop back-flow and minimise loss of water from the pipe in the event of unplanned shutdown (Plate 5-5);
- surge tanks and air cushion standpipes to assist in the control of water hammer (Plate 5-6);
- scour outlets to dewater the pipeline for maintenance purposes (Plate 5-7);
- swab insertion and removal stations for internal pipe cleaning purposes;
- cathodic protection systems; and
- thrust blocks to prevent pipe movement.

(Note the accompanying plates are from the recently completed Eungella pipeline southern extension project and are presented by way of example only).

Plate 5-4 Balancing storage

Plate 5-5 Control valve

Plate 5-6 Surge tank

Plate 5-7 Scour outlet

Access roads will be required for construction and maintenance of all sections of the pipeline that cannot be accessed from existing roads. These are likely to be a minimum of 3 m wide and surfaced with gravel as required. Temporary stockpiles along the route will be required for pipe, bedding sand, and machinery. The exact location of these will be determined when the detailed construction plan is developed however they are generally no more than 10 km apart. Delivery of materials may be impeded following rain as local unsealed roads and work sites may be inaccessible for varying periods. The construction timeline currently allows for an almost complete shutdown over the likely wet season.

5.3.3 Other Infrastructure

5.3.3.1 Bulk Materials Sources

Raising Glebe Weir will require sufficient sand and aggregate to batch approximately 7,350 m^3 of concrete and it is proposed to source this from existing licensed quarries. Rock for downstream protection works will also be sourced from licensed quarries. However, it would be preferred if local sources could be identified as this would reduce transport costs and associated impacts.

As there are no existing licensed quarries for the various materials in Banana Shire, a number of local sources are being investigated. Coarse sand for pipeline bedding material can probably be sourced from a deposit in Cockatoo Creek / Sandy Creek approximately 30 km south-east of Glebe Weir, 9 km east of Nathan Road. The site was apparently used for the original construction of Glebe Weir. Licences will be applied for under separate applications. The area has been assessed for impacts as part of this study. It is unlikely that this site will be able to provide the volume required, particularly if the larger pipe option is selected. The coarse sand may require mixing with a finer sand to make it suitable for use. If a local source of supply for fine sand or for a further volume of coarse sand is found this would likely be preferred to sourcing from a distant licensed site. If this constitutes a new extraction site, the appropriate approvals will be sought.

The material required for surfacing of new gravel roads and maintenance tracks is estimated at 7,500m^3. There is an existing extraction area which could supply crushed ferruginised sandstone adjacent to the Taroom-Cracow Road near the Glebe turnoff. This location is very near to the area of intended use but it is not currently a licensed quarry. The appropriate approvals will be sought upon completion of investigations.

5.3.3.2 Access Roads and Bridges

- Glebe Weir Access Road

Primary access to the weir construction site will be via the Leichhardt Highway and Glebe Weir Road (Figure 5-2). The Leichhardt Highway is a major highway linking the western Darling Downs to Central Queensland. As such, it carries a considerable volume of traffic, including heavy commercial vehicles, and the additional traffic volume associated with the Glebe Option is unlikely to have an impact on the pavement (Chapter 9).

Glebe Weir Road is a single lane sealed and paved road accessing the site from the north that currently carries:

- traffic associated with weir operations and maintenance;
- cattle trucks (heavy vehicles);
- school buses;
- visitors to the weir; and
- light and commercial vehicles associated with farming and grazing enterprises in the area.

There will be an appreciable increase in traffic volumes on Glebe Weir Road during the construction period so a dilapidation survey will be carried out before and after construction is completed, and repairs carried out to return the road to its initial standard. Road condition will be monitored during construction with maintenance arranged as needed. A detailed traffic assessment is provided in Chapter 9 of the EIS.

- Glebe Weir pump station access road

All-weather road access to the pump station will be required and this is proposed to be constructed from Glebe Road west of Cockatoo Creek (Figure 5-2). In addition, this road will be needed to carry the concrete aggregate required for construction works on the weir, some of the plant, material, and personnel for pump station construction and traffic associated with operation and maintenance of the pump station.

The new access road to the pump station will be approximately 7 km in length and will be constructed to two-lane gravel standard according to the specifications applying in Banana Shire. It will follow the existing private access track to Lot 14 CP FT1 (upon which the proposed pump station is located) for most of its length. It will cross Cockatoo Creek with a bridge or culvert system at the present crossing because adjacent topography makes this the most practical place to access the pump station. The existing culvert will be raised by 2.4 m to maintain the existing level of clearance across the creek, as per the property owner's request. The route from this point on will be developed in consultation with the landholder, but will follow existing tracks to minimise disturbance to soils and vegetation.

Structural work for the Glebe Weir raising will be carried out on both sides of the low flow channel of the Dawson River and aggregate will need to be transported across the river so it will be necessary to construct a temporary crossing, utilising a box culvert system. Access to the weir for construction works will be required from both banks. Wherever possible, tracks and crossings established during weir construction in 1971 or for more recent maintenance will be reinstated. No river diversion will be required for works to establish this crossing.

An access track will be required within the construction easement of the pipeline route from the Glebe Weir pump station until it intersects the developed Nathan Road. The access track is likely to be a minimum of 3 m wide and surfaced with gravel if required. Short sections of similar track may be required where the pipeline cannot be accessed from Nathan Road or existing farm access roads from Nathan Road.

Grids will be installed at fence lines on the pump station access road because this will carry heavy vehicles carting aggregate. These will be fitted with gates, carrying reflective signage, and will be locked outside construction working hours where required by the landholder.

Gates at fence lines crossed by the pipeline will be locked outside construction working hours and at all times during pipeline operation.

5.3.3.3 Road Upgrades

Transport of construction material will result in additional heavy vehicle traffic on sections of Glebe Road, the Taroom — Cracow Road, Red Range Road, and Nathan Road. Sections of these roads will be upgraded to two lane gravel standard according to Banana Shire specifications and in consultation with Banana Shire (Figure 5-2).

Approximately 15 km of Nathan Road and 10 km of Red Range Road to the Cockatoo Creek / Sandy Creek sand deposit will be upgraded as necessary to carry the required traffic volumes safely.

Road condition will be monitored during and at the end of construction. Maintenance will be arranged as necessary to ensure that road condition at the end of the construction period is at least equal to that at the start.

5.3.3.4 Extension of Power and Communication Facilities

While temporary power and telecommunication facilities may be provided during the early phases of construction, the extension of permanent services will be implemented soon after access to the site has been completed. The following service extensions are proposed:

- construction of approximately 14 km of 11 kV power line from the nearest existing power transmission line running at this voltage and with sufficient capacity to supply construction works, the proposed pump station and supplement the existing single wire earth return line servicing Glebe Weir; and
- installation of telephone and data services from the nearest existing facilities with adequate capacity (confirmed during final design).

These works will be arranged in collaboration with service providers and will be subject to separate environmental assessments. It is expected that existing routes and poles will be used for the majority of the service.

5.3.3.5 Weir Infrastructure Relocations

Public and private infrastructure is located in the area of inundation between the present FSL of 170.54 m AHD and the proposed FSL of 172.9 m AHD, and along the proposed pipeline route. This study has identified the following infrastructure that may be affected by the raising of the weir FSL:

- Ergon Energy power distribution lines serving the camping area on Lots 14 and 15 CP LE230 and continuing to serve the homesteads on Lot 14 CP FT1 , Lot 15 CP FT2 and Lot 2 CP LE246 (Figure 5-9);
- Telstra underground cable beneath the bed of Cockatoo Creek leading to the homestead on Lot 14 CP FT1;
- a boat launching ramp in the Reserve on the left bank of the Dawson River adjacent to the weir (Lots 14 and 15 CP LE230), (this will need to be extended);
- a crossing on Cockatoo Creek that provides access to Lot 14 CP FT1;
- low-lying parts of the existing private road access to the homestead on Lot 15 CP FT2;
- a diesel-driven irrigation pump on the right bank of Cockatoo Creek on Lot 14 CP LE FT1;
- a diesel-driven irrigation pump on the left bank of Boggomoss Creek on Lot 2 CP LE284;
- a petrol-driven portable pump extracting stock water from the weir on Lot 3 CP LE4037;
- Glebe Weir headwater stream gauging station;
- a farm crossing over Boggomoss Creek on Lot 2 CP LE284; and
- fences on a number of properties riparian to the proposed storage area including some restricting stock access to the weir reservoir and 'give and take' boundary fencing.

There may be other pumps in the area in addition to those identified during this study. Most pumps are movable so that they can be raised above flood levels or lowered to allow pumping when water levels in Glebe Weir are low so they may require little modification (Plate 5-8).

Plate 5-8. Movable irrigation pump drawing water from Glebe Weir on Lot 14 CP FT1

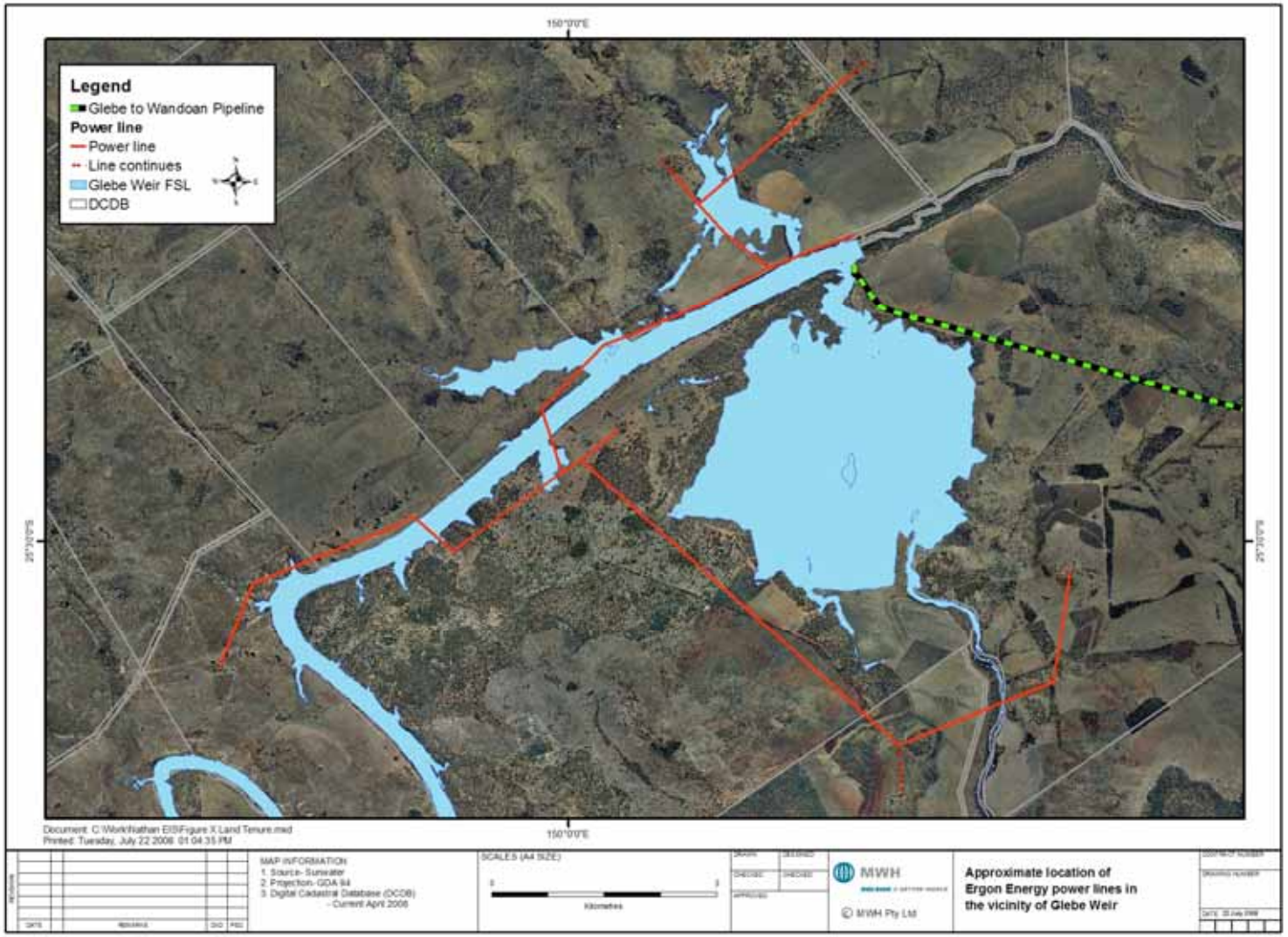


Figure 5-9. Ergon Energy power lines in the vicinity of Glebe Weir.

The Ergon and Telstra infrastructure will be relocated by the infrastructure owner according to their standard procedures. Other infrastructure in the vicinity of the weir will be relocated or modified as necessary, to account for the higher FSL, in consultation with owners.

5.3.3.6 Pipeline Route Infrastructure

Nathan Road and much of the private land along the proposed pipeline route between Glebe Weir and Nathan Road were investigated during this study (Appendix 5A — *Pipeline Observations*). Items of private and public infrastructure that are located within the pipeline construction area include:

- an underground irrigation main, a centre pivot irrigation system, a stock bore, and associated distribution pipes on Lot 14 CP FT1;
- two stock water supply bores and farm stock and domestic water distribution pipelines crossing Nathan Road approximately 9.2 km and 9.5 km south of the intersection of Nathan Road and the road to Eidsvold via Deearne;
- five public roads leading east from Nathan Road;
- numerous catch drains and diversion drains controlling runoff from and along Nathan Road;
- numerous property access roads and farm tracks;
- numerous fence lines;
- at least one set of cattle yards;
- a telecommunications tower east of the Nathan Road reserve approximately 4.1 km north-east of the Leichhardt Highway junction;
- Ergon Energy power lines in the Nathan Road reserve and in the paddocks to the east with a number of substation poles (Figure 5-10); and
- Telstra underground communications cabling (Figure 5-11).

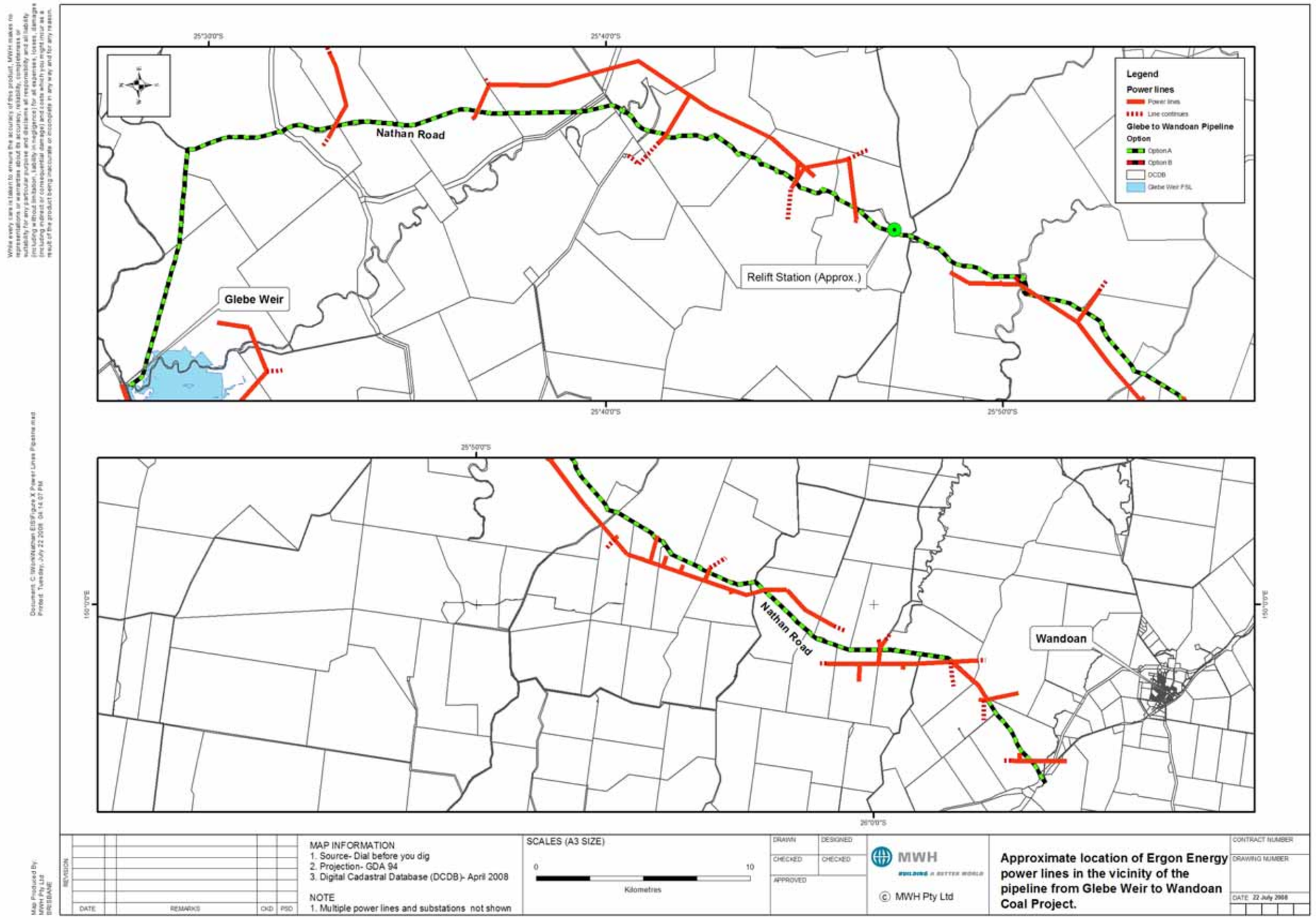


Figure 5-10. Approximate location of power lines in the vicinity of the pipeline route.

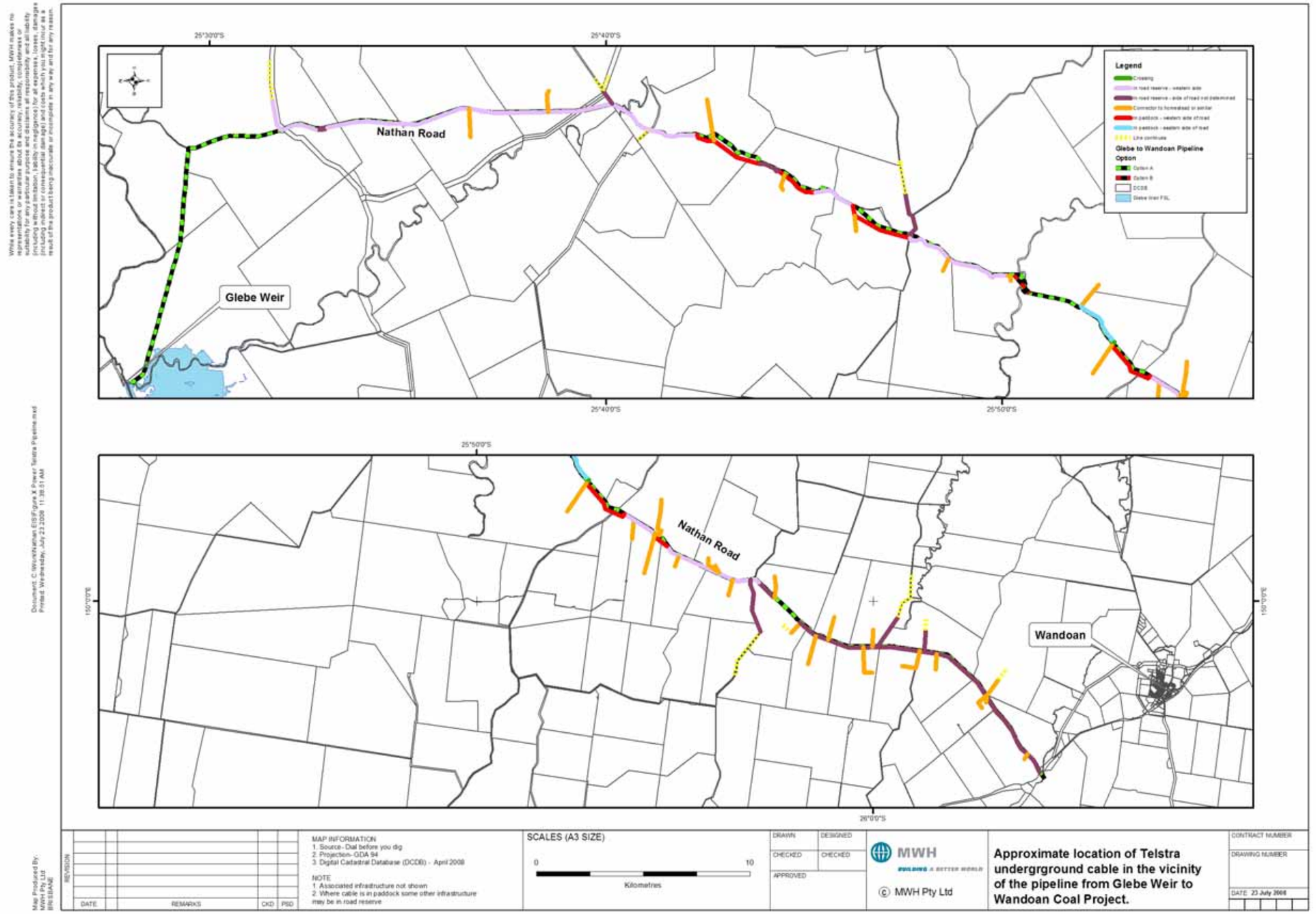


Figure 5-11. Approximate location of telecommunication cables in the vicinity of the pipeline route.

The pipeline will have no direct impacts on infrastructure on private land where it is situated in the Nathan Road reserve and on completion, the proposed pipeline will have no long-term impacts on access as it will be unfenced. Nevertheless, it will be necessary to minimise impacts during construction using strategies such as the following:

- accurately locating all infrastructure in the field;
- liaising with landholders over issues such as:
  - locations of their private pipelines,
  - temporary access,
  - fence openings, reinstatements, and any new gates required for access to the pipeline,
  - erosion control, and
  - disposal of excess excavated material;
- liaising with local authorities over issues such as:
  - temporary road closures,
  - roadside drainage, and
  - erosion control; and
- avoiding underground infrastructure or placing the pipeline above or below it without interruptions to services.

5.4 Construction

5.4.1 Pre-Construction Activities

Pre-construction activities include:

- installation of appropriate construction work signage;
- acquiring the necessary land or access to land (Chapter 7);
- clearing vegetation (progressively) (Chapter 12);
- upgrading and constructing access roads (above);
- extending power and communications facilities to the weir and pump station sites (above);
- establishing site office facilities and a secure compound; and
- transporting construction materials to stockpile at the weir site.

5.4.1.1 Land Acquisition

SunWater is committed to treating all landholders affected by the Glebe Option fairly and with respect. SunWater's preferred approach to acquiring the land, or an interest in, or access to the land required for the Glebe Option is to negotiate with landholders and their representatives to purchase the required land, or interests in, or access to land.

As a company government owned corporation, SunWater will require title to additional land to be inundated at the proposed FSL, the land to be occupied by the levees, plus a buffer of 50 m to either FSL or the levees, the land occupied by the Glebe Weir pump station, and land occupied by the balancing storage along the pipeline route. Easements will be required for the pipeline to the Wandoan Coal Project and all permanent access tracks. Interests in land may be required for temporary access tracks (Table 5-2). The majority of property ownership of affected tenures rests with the State of Queensland (Table 5-2 and Chapter 7).

Table 5-2. SunWater requirements to acquire land or interest in land or access to land for the Glebe Option.

Real Property Description	Tenure and Ownership and Control	Areas Affected	Preferred Land Acquisition Approach
Lot 182 SP147005	Freehold — Privately held	Dawson River bed and banks only	NA
Lot 1 CP LE38	Freehold — State of Queensland with short-term lease for rural use	Dawson River Bed and Banks plus gully bed and banks	Define area required and negotiate release of relevant parts of DNRW lease with existing leaseholder, and acquire new lease from DNRW. Fence off after discussion with leaseholder
Lot 2 CP LE246	Freehold — State of Queensland with short-term lease for rural use	Dawson River bed and banks plus gully bed and banks	Define area required and negotiate release of relevant parts of DNRW lease with existing leaseholder, and acquire new lease from DNRW. Fence off after discussion with leaseholder
Lot 7 CP LE 19	Freehold — State of Queensland with short-term lease for rural use	Dawson River bed and banks only	NA
Lot 6 CP LE19	Freehold — State of Queensland with short-term lease for rural use	Dawson River Bed and Banks plus gully bed and banks	Define area required and negotiate release of relevant parts of DNRW lease with existing leaseholder, and acquire new lease from DNRW. Fence off after discussion with leaseholder
Lot 2 CP LE284	Freehold — State of Queensland with short-term lease for rural use covering land outside inundation area of Glebe Weir at proposed FSL of 172.9 m AHD	Dawson River bed and banks plus Boggomoss Creek and gully bed and banks and low-lying floodplain and flood runners	Define area required and negotiate release of relevant parts of DNRW lease with existing leaseholder, and acquire new lease from DNRW. Fence off after discussion with leaseholder
Lot 14 CP LE230	State of Queensland — Reserve with Banana Shire Council as Trustee	Dawson River bed and banks only	NA
Lot 15 CP LE230	State of Queensland — Reserve under the control of DNRW	Dawson River bed and banks only	NA
Lot 1 CP F4037	Freehold — Privately held	Dawson River bed and banks only	NA

Real Property Description	Tenure and Ownership and Control	Areas Affected	Preferred Land Acquisition Approach
Lot 3 CP F4037	Freehold — State of Queensland with short-term lease for rural use	Dawson River bed and banks, and bed and banks of Bentley Creek	Define area required and negotiate release of relevant parts of DNRW lease with existing leaseholder, and acquire new lease from DNRW. Fence off after discussion with leaseholder
Lot 1 CP FT823	Freehold — Privately held	Dawson River and Cockatoo Creek bed and banks, plus gully bed and banks	Define area required and negotiate appropriate form of tenure with landholder
Lot 15 CP FT2	Freehold — State of Queensland with short-term lease for rural use	Dawson River and Cockatoo Creek bed and banks, plus gully bed and banks and low-lying floodplain, flood runners, and anabranches	Define area required and negotiate release of relevant parts of DNRW lease with existing leaseholder, and acquire new lease from DNRW. Fence off after discussion with leaseholder
Lot 14 CP FT1	Leasehold — Privately held	Cockatoo Creek bed and banks, plus gully bed and banks and low-lying floodplain, flood runners, and anabranches plus Glebe Weir pump station site, approximately 7.5 km of access track to pump station and approximately 8.5 km of pipeline route and access track	Define area required and negotiate: ▪ purchase of land over inundated areas and pump station site ▪ short-term sublease or other arrangement for use of a works area around the pump station and weir ▪ easement for pipeline and access tracks, with locked gates
Lot 2 CP FT734	Freehold — Privately held	Approximately 8 km of pipeline route and access track	Negotiate easement for pipeline and access track
Nathan Road reserve and or SBR corridor	Reserve tenures - DRNW	Approximately 68.2 km of pipeline route, and some access tracks, land for balancing storages, and possibly land for auxiliary pump stations	Negotiate conditions of use with DNRW in consultation with Banana Shire Council, Dalby Regional Council and others controlling land required
Properties adjacent to Nathan Road reserve	Freehold, Leasehold and Reserve	Minor areas where the pipeline or associated infrastructure cannot be accommodated within Nathan Road reserve or the SBR corridor	Negotiate to acquire the required land or easement.

Should SunWater be directed by the CG to undertake works as described in Chapter 3, the CG has compulsory acquisition powers that can be exercised for works to be undertaken by a local body or other person if the local body or person cannot voluntarily acquire the land. The extent to which recourse may be made to the SDPWOA Act and to the powers of the CG to assist the project will be considered along with other approval processes.

Prior to construction, interest in or access to land will be required by way of:

- negotiating with the current leaseholders of DNRW owned properties to release a portion of their leases for the area of land impacted by the raising and the required buffer, and negotiating a new lease for these areas from DNRW ;
- leases from DNRW where land has been acquired by the State of Queensland and leases to existing occupants provide for the Glebe Option;
- obtaining necessary resource entitlements from the State for any necessary development permits on land over a State resource;
- purchase through negotiation with private landholders around Glebe Weir and the balancing storage site, or failing this consideration of other options available for the acquisition of the land; and
- negotiation of easements to accommodate:
  - the underground pipeline;
  - minor associated above-ground infrastructure; and
  - access roads and tracks; and
- obtaining permits to occupy over road reserves where necessary.

The current Glebe Weir reservoir has no buffer area and is unfenced, except where landholders have installed fencing at their own cost as part of a 'give and take' boundary arrangement with a neighbour across the Dawson River or Cockatoo Creek, or to prevent unrestricted cattle access to the reservoir. It is proposed to establish a 50 m wide buffer area to the raised reservoir in order to allow revegetation and potentially other protective works. Irrigation pumps will be allowed to be placed within this buffer but at the owner's risk. It is proposed to improve fencing of the reservoir to minimise impacts from cattle access. SunWater will negotiate modified fencing arrangements for the altered FSL and buffer with impacted landowners as part of the tenure negotiation process. Alternative water supplies to paddocks that have, to date, relied on access to the weir for stock water would be provided if this access is impacted by the raising.

□ Consultation

SunWater is aware of the disruption that uncertainties over land requirement and processes for acquisition of land for projects such as the Glebe Option can cause to landholders and will endeavour to minimise these.

Key elements of the SunWater policy regarding acquiring the land required for the Glebe Option include:

- engaging in open and meaningful dialogue and negotiations with landholders concerning requirements for the Glebe Option, and the requirements and preferences of landholders;
- ensuring that landholders are paid fair market value for land acquired;
- ensuring that landholders are paid fair value for interests in or access to land based on permanent or temporary loss of productivity and disruption to on-going farm operations;
- meeting costs of surveys necessary to delineate the areas required for purchase or areas where interest or access is required;
- meeting costs of independent valuations of the land or interest in or access to land required;
- meeting reasonable costs, including legal costs, stamp duty, disturbance costs, and general expenses incurred by landholders in arranging sale of land or interests in or rights of access to land;
- finalising land acquisitions as expeditiously as possible to give landholders certainty of their position; and
- ensuring security and preventing public access to land which the landholder retains, or retains an interest in.

SunWater has contacted all impacted landholders and is in ongoing discussions.

5.4.1.2 *Vegetation clearing and fauna relocation*

The additional area to be inundated by the raised weir includes cleared cropping and grazing land, grazing land carrying regrowth or highly disturbed natural communities, and limited areas of relatively intact natural communities. Cleared land will be left undisturbed. Tree and shrub vegetation will be cleared to FSL within the inundation area, except in the riparian zone of tributaries or where significant vegetation is within 1 m vertical of FSL in the Dawson River. In these cases, it will be left in place as trees and shrubs may survive, depending on inundation frequency and duration.

Vegetation clearing for the weir will be staged, commencing with the area required for construction works. The remainder will be cleared progressively until the water storage is ready to fill with the bulk of clearing occurring shortly before construction is completed.

The Glebe Weir pump station will require very little vegetation clearing because land at the site is already cleared to the top of the bank of Cockatoo Creek.

The first 15 km of the pipeline route is largely cleared but limited clearing will be required where the route passes through small areas of regrowth or standing timber. The developed Nathan Road reserve is largely cleared to the point where the Surat Basin Rail corridor becomes aligned to the east but there are variable amounts of timber in the Nathan Road reserve from this point on. Mostly these are thin strips of vegetation too small to be discernible on current RE maps, but nonetheless the alignment has been selected to avoid the more significant areas (based on advice from a botanist). Refer to chapter 11 for a detailed assessment of vegetation impacts.

A clearing vegetation management plan will be required under the VM Act and in accordance with the State Policy for Vegetation Management, November 2006 (DNRW, 2006). Measures to be incorporated into the plan are specified in the Environmental Management Plan (EMP) (Chapter 21) and discussed in Chapter 12.

5.4.1.3 *Worksite Establishment*

The main weir work site will be established on the elevated levee on the left bank of the Dawson River in the vicinity of the existing camping and recreation area at Glebe Weir. A second, smaller work site will be established on the right bank of Cockatoo Creek at the pump station site. Both areas will be security fenced. Both areas are almost entirely cleared.

Pipeline construction will be a mobile activity and, at the discretion of the contractor, a number of temporary work depots / material stockpiles will be established within the construction easement. Many of the issues to be addressed before construction commences are similar to those for the sites at Glebe Weir. Site establishment activities common to all sites will include:

- preparing a Site Environmental and Safety Plan and developing and implementing a site induction program setting out requirements and procedures in relation to issues including:
  - cultural heritage,
  - personal protective equipment,
  - emergency procedures including communications, first aid, and site evacuation,
  - standard communications procedures,
  - fire, flood and storm safety and procedures,
  - traffic management on-site,
  - environmental protection including fauna management,
  - workplace health and safety issues particularly any unique to the site, including snake bite and skin cancer protection, and
  - monitoring compliance and consequences of non-compliance by personnel;
- establishing contact with landholders and setting out procedures for ongoing liaison;

- establishing temporary site offices and crib facilities with toilet and shower facilities — toilet waste to pump-out facilities for disposal at a licensed facility and grey water for use for dust suppression;
- establishing emergency aid and medical facilities according to Occupational Health and Safety requirements;
- arranging delivery and storage of potable water;
- arranging security measures;
- establishing electricity generation facilities if required;
- establishing machinery parking areas;
- establishing a runoff and wastewater capture system with sedimentation ponds to capture and store washdown water and any contaminated runoff for treatment and when appropriate, use for dust suppression;
- arranging waste removal for recycling or disposal with Banana Shire or private contractors;
- developing a traffic management plan for use of local roads for the delivery of materials and workforce access;
- developing traffic safety procedures for the worksite and construction areas including pedestrian safety; and
- commencing to stockpile bulk materials required for construction.

Establishment activities required only for the Glebe Weir sites will include:

- arranging temporary closure of the camping area at Glebe Weir with the Banana Shire Council and erecting signs at the Leichhardt Highway turnoff to inform potential visitors of the temporary closure;
- refurbishing shower and toilet facilities at the camping area at Glebe Weir to supplement temporary facilities;
- arranging a system to draw construction water from Glebe Weir;
- establishing the concrete batching plant with raw materials storage facilities as required;
- arranging fuel storage, refuelling, and maintenance areas with hardstand and bunding as required;
- reinstating access tracks to the river bed downstream of the weir and the temporary river crossing used during construction or repair works or establishing new routes; and
- clearing regrowth from the area immediately downstream of the weir to allow for safe operation of machinery such as cranes.

Power supply from on-site generation and on-site fuel tanks may be required at the weir, in addition to mains supply. Large temporary supply tanks that would also supply machinery will be located above the future inundation and frequently flooded areas. Sub contractors will have to demonstrate how energy use has been minimised during all stages of the works. Expected options would include using solar power at the site offices (to supplement demand), choice of high efficiency lighting and devices in all locations, and ensuring all machinery using liquid fuel is in good working order. Energy conservation in relation to Government policies is discussed in Chapter 3.

The task of constructing the Glebe Weir pump station will be small in relation to that of raising the weir. Much of the temporary supporting infrastructure and many of the procedures may be integrated with weir raising at the discretion of the contractor or contractors. Any machinery refuelling required would be carried out at the facilities put in place for weir construction or using local suppliers providing mobile services. This will require secure and appropriate bunding, particularly for those volumes stored on-site. If refuelling is undertaken by a licensed contractor, portable bunding and appropriate work method statements will be employed.

Machinery refuelling for works along the pipeline will be carried out using mobile facilities.

5.4.2 Construction Works

5.4.2.1 Weir Construction

The raised Glebe Weir will comprise a single integrated structure with constructed levee banks downstream of the two adjacent creeks (Figure 5-3). Weir works will comprise three main components (Figure 5-7 and Figure 5-8):

- left abutment with a 1.8 m high inflatable rubber dam, with provision for installation of a fishway and a multiple level offtake, and access facilities for the main overflow section spillway, intake facilities, and outlet controls;
- central section with 2.36 m high inflatable rubber dam and discharge apron; and
- right abutment with two 1.8 metre high inflatable rubber dams.

A general outline of the proposed work procedures is as follows:

- sequencing — The general sequence will be to work from downstream to upstream and from the abutments to the centre of the river with downstream protection works completed first, then right and left abutment concrete works, then centre spillway section concrete works and finally installation of the inflatable rubber dams.
- foundations — Foundation areas will be excavated then trimmed to line and level and mass concrete placed directly.
- concrete supply — Concrete will be batched on-site with water from the Dawson River pumped to storage tanks and treated through a mobile water treatment plant if necessary.
- concrete delivery — Concrete will be trucked from the batch plant to the work face where it will be poured directly using a mobile concrete pump or a crane and kibble.
- mass concrete — Mass concrete will be placed in monoliths with joints approximately 7 m apart to correspond with existing joints.
- levee bank construction — The levee banks downstream of Cockatoo and Boggomoss Creeks will be of compacted earth construction, keyed in to the present land surface.
- downstream releases — Downstream releases from Glebe Weir will continue through the construction period with temporary pipework where necessary to by-pass uncompleted work and the spillway will not be blocked.
- weir levels — The Site Supervisor will liaise with SunWater to operate the weir at a reduced water level for the duration of upstream works with as much water as possible stored in existing weirs downstream on the Dawson River.
- weir spills and flooding — The critical period for flood damage during construction will be when foundation areas are exposed. The bulk of this work will be scheduled for the April to September (inclusive) period when weir spills and flooding are least likely. Most downstream protection works will be completed first to provide protection from erosion. The Site Supervisor will liaise with SunWater to, as far as possible, manage water levels in Glebe Weir to reduce the probability of spills at times when damage may result. Also, the Site Supervisor will monitor Bureau of Meteorology daily weather forecasts and the extended outlook, and will take steps to minimise damage to work completed, the downstream environment and plant and equipment if flooding appears likely.
- construction water — Generally, construction water will be drawn from the Dawson River under permit. Water for dust suppression will be drawn from the runoff and waste water capture system wherever practicable. Screened areas surrounding pump intakes from the Dawson River will be sufficient to prevent entrapment of aquatic fauna and screen size will ensure that macro-flora are excluded. Potable water will be sourced externally and delivered to holding tanks by tanker.
- sedimentation ponds and similar structures in the immediate vicinity of the site will be pumped out regularly to minimise breeding habitat for biting insects. Water will be re-used on site.
- road and infrastructure relocations or modifications — The private access road to the homestead on Lot 15 CP FT2 will be relocated or raised in consultation with the landholder. Additional concrete will be added the weir boat launching ramp. Private pumps will be relocated or modified in consultation with owners. Existing fencing that will become redundant as a result of the Glebe Option will be dismantled and the materials re-

used in replacement fencing provided that they are in good enough condition. Power and telecommunications lines will be modified or relocated under arrangements made with the infrastructure owners.

- hours of work — It is proposed that work will be undertaken on a day shift schedule only with normal shifts up to 10 hours per day six days per week. Work would normally commence no earlier than 6 am and finish no later than 6 pm. Should any work be required outside these hours (e.g. large concrete pours or pours during extremely hot weather requiring night time work) the few nearby landholders will be notified accordingly.
- work site decommissioning and reinstatement — Temporary facilities established for the work including the crossing over the Dawson River will be dismantled and removed and disturbed areas revegetated. The grounds of the camping area will be landscaped and the associated facilities reinstated, or upgraded depending upon condition.

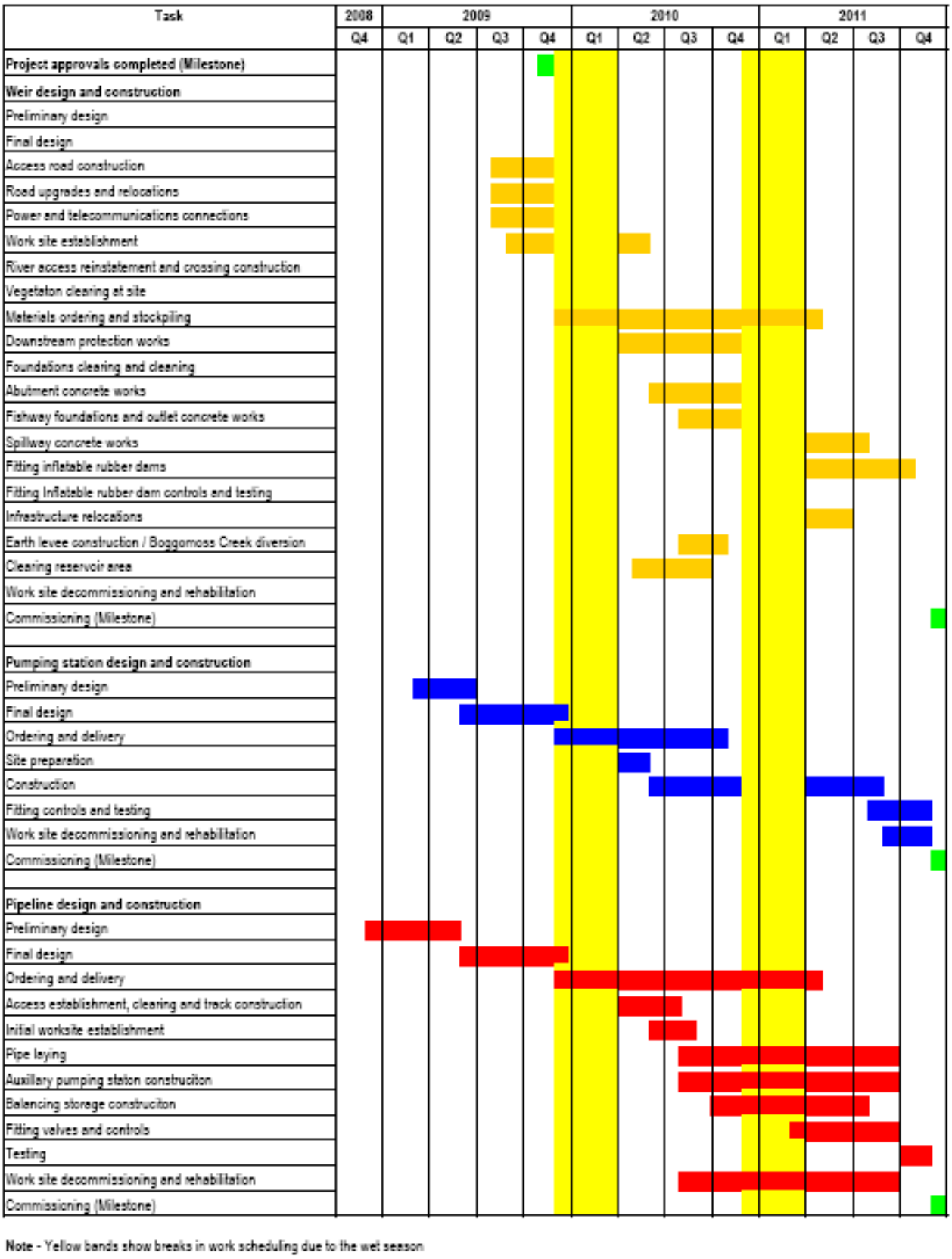
The overall Glebe Option including final design and construction is estimated to take approximately two years (Figure 5-12). Actual construction work on the weir is expected to take approximately 15 months. Site shut-downs over the wet season have been included in order to reduce safety risks and risk to roads, works and machinery related to rain or flash flooding. Some activities may continue during this period depending on the associated risks to those particular tasks.

Approximately 7,350 m^3 of concrete will be required for the raising of Glebe Weir (Table 5-3) and the raw materials required for this and their likely sources include:

- coarse aggregate —from existing licensed sources;
- coarse sand — A deposit in Cockatoo Creek / Sandy Creek junction area approximately 30 km south-east of Glebe Weir, and / or other local sources to be confirmed or an existing licensed source outside the shire;
- fine sand — from existing licensed sources and / or from a local deposit to be confirmed;
- fly ash — Callide Power Station near Biloela;
- cement — Brisbane or Gladstone; and
- water — Glebe Weir under a permit for extraction.

Table 5-3. Summary of principal concrete quantities required for Glebe Weir raising.

Concrete Placement	Volume (m^3)
Left abutment	930
Central section	3,000
Right abutment	2,700
Outlet works and provision for fishway	700
Minor associated works	20
Total	7,350



Note - Yellow bands show breaks in work scheduling due to the wet season

Figure 5-12. Indicative work schedule for final design and construction for the Glebe Option (time lines do not necessarily imply continuous work)

Other materials required and likely sources will include:

- rock for rock-filled mattresses and rip rap — existing licensed sources;
- clay for levee banks — Material excavated from the weir foundations, excess material from pipeline excavations and from the immediate area of the levees (these are largely black soil areas)
- topsoil for revegetation – areas under new structures and roads or the land to be inundated adjoining Cockatoo Ck;
- reinforcing steel — Brisbane or Gladstone;
- four inflatable rubber dams made to specification with associated specialised control equipment — Australian manufacturers; and
- building materials for a control room — Local.

In addition, sheet piling and metal or concrete piles may be required and these could be sourced from Brisbane or Gladstone.

5.4.2.2 Glebe Weir Pump Station Construction

Construction works for the Glebe Weir pump station will include:

- site preparation involving any vegetation clearing required and grading of the Cockatoo Creek bank for placement of the pumps;
- installation of a coffer dam to protect the construction site;
- placement of concrete and sheet pile foundations;
- installation of the pumps and pipework;
- connection to the upgraded electric power supply;
- fitting and testing the control system; and
- removal of temporary facilities and revegetation of disturbed areas.

Materials required will include steel sheet piling, concrete, two pumps of the required capacity, pipes, and an electronic control system. The pumps and control system will be specialised items supplied from Brisbane or Gladstone but the small quantities of other materials are similar to those required for the Glebe Weir raising and / or the pipeline to the Wandoan Coal Project.

5.4.2.3 Pipeline Construction

After access track construction where required, temporary worksite establishment and progressive clearing, work procedures will include:

- accurately locating and avoiding existing in-ground and above-ground infrastructure;
- liaising with Banana Shire Council, Dalby Regional Council, and landholders concerning temporary road closures or part closures and property access options during pipe laying;
- trenching for the pipeline with temporary fencing where required and topsoil stockpiling for reuse;
- laying, joining the pipe, and bedding it in sand or similar material;
- back-filling the trench and reinstating infrastructure such as road spur drains and fences;
- constructing the balancing storage;
- connecting power to pumps from the nearest available supply;
- revegetation and erosion control on all disturbed areas;
- fitting valves and controls and integrating controls with those of the Glebe Weir pump station; and
- final reinstatement of work sites and areas.

Appropriate liaison will be maintained with landholders to coordinate work activities along the pipeline so as minimise interference with normal property management activities such as mustering of stock. Work will be

progressive along the line so that most reinstatement and erosion control will be progressive as each segment is completed.

The main materials required for the pipeline will include:

- bedding sand — sourced from a deposit in Cockatoo Creek / Sandy Creek, other local sources yet to be identified or from existing licensed sources;
- pipe — sourced from Brisbane or Gladstone; and
- pump equipment, air valves, control valves, standpipes, surge tanks, flow control structures, and specialised electronic control equipment — sourced from Brisbane or Gladstone.

The size and type of balancing storage required will depend on final design.

5.4.2.4 Plant and Machinery Requirements

A preliminary assessment of vehicles, machinery, and heavy equipment that may be required for the major tasks involved in construction for the Glebe Option is shown in Table 5-4. Depending on scheduling and contractors' convenience, there is considerable scope for one item of machinery to be used on multiple tasks.

Requirements for smaller tasks that will be undertaken in association with service providers such as connection of electric power, power line relocations, and connection of telecommunications infrastructure have not been considered.

Table 5-4. Likely requirements for plant and equipment for the Glebe Option.

Work item	Anticipated plant requirement
Access road construction, road upgrades and relocations	▪ 6 x Tippers/semi-tippers ▪ 2 x Water trucks ▪ 2 x 825 Compactors ▪ 2 x graders
Clearing (sub-contract)	A variety of excavators with attachments including: ▪ Tree-grabs, ▪ Hooks and mulchers, ▪ Horizontal tub grinders, ▪ Broad acre mulchers, ▪ Tippers and Semi-tippers, ▪ Transport vehicles.
Site establishment	▪ 2 x Excavators (tree mulchers, pullers, pincers) ▪ 2 x Horizontal tub grinders ▪ 4 x 6x6 Dump trucks ▪ 1 x Concrete batch plant ▪ 1 x Transportable water treatment package plant ▪ 1 x Sand screening plant ▪ 2 x Excavators ▪ 2 x Graders ▪ 1 x Compactor ▪ 2 x Water trucks
Sand extraction and transport	▪ 2 x excavators ▪ 1 x tipper ▪ 1 x water truck ▪ 8 x Truck and trailer combinations carrying 30 tonnes per load
Foundation excavation	▪ 2 x Excavators ▪ 2 x Dump trucks

Work item	Anticipated plant requirement
Concrete works	▪ 3 x Concrete delivery trucks ▪ 1 x Concrete pump ▪ 1 x Mobile crane ▪ 1 x Lighting tower
Rubber dam installation	▪ 2 x Mobile cranes ▪ 1 x Low loader
Outlet works and fishway fit-out	▪ 1 x Mobile crane ▪ 1 x Low loader ▪ 2 x Welding machines
Weir pump station	▪ 1 x Sheet pile driver (may be required for weir as well) ▪ 1 x Crane ▪ 1 x Excavator
Pipeline to Wandoan Coal Project	▪ 2 x Heavy dozers ▪ 2 x Excavators ▪ 1 x Rock cutter (if required) ▪ 2 x Graders ▪ 2 x Mobile cranes ▪ 2 x Pipe welders
Site reinstatement	▪ 2 x Graders ▪ 2 x Water trucks ▪ 1 x Dozer ▪ 1 x Excavator ▪ 3 x Body trucks ▪ 1 x Hydro-mulching rig

5.4.2.5 Waste Disposal

Waste disposal will be based on the principles of avoidance, reuse, recycling, and energy recovery with disposal as a last resort. Some of the waste streams from the Glebe Option will be handled as follows:

- grey water, water from wash down facilities, and water from sedimentation ponds will be re-used for dust suppression or similar purposes where appropriate;
- construction wastes will be sorted for reuse on site, recycling or disposal;
- oils and similar products will be collected for recycling;
- contaminated soil will be remediated on site or through a dedicated facility;
- toilet wastes will be pumped out and treated at the Taroom wastewater treatment plant;
- vegetation wastes will be used as millable timber, artisans' raw material, fauna habitat, mulch for site reinstatement or other revegetation, firewood or, as a last resort, will be burnt on site;
- excess soil material from weir foundation excavations, the pipeline trench or diversion works will be used for site reinstatement, levee bank construction, SBR embankment construction, road works or shaped to fit in with the landscape, covered with topsoil, and revegetated.

Waste streams not re-used, recycled or permanently stabilised on site will be disposed of through the nearest waste handling facility licensed to accept the types of waste involved using contractors or Banana Shire Council transport vehicles. Waste management strategies are set out in Chapter 15.

Handling of waste from the construction phase of the Glebe Option will be according to EPA requirements and the *Environmental Protection (Waste Management) Regulation 2000* (EPR Waste)(EPA, 2000a).

5.4.3 Site Reinstatement and Rehabilitation

The strategies and guidelines that will underpin rehabilitation at all construction sites including stabilisation of the landscape around the Glebe Weir, the weir pump station, the pipeline, and all roads are set out in Chapter 7. A detailed landscaping and revegetation plan will be developed during detailed design. Every effort will be made to:

- minimise the areas disturbed during construction;
- provide temporary erosion control and water quality control wherever needed;
- progressively reshape and revegetate with native or naturalised species as work phases are completed; and
- ensure that water leaving the sites is of similar or higher quality than the receiving waters.

During construction site stripping, any quality topsoil will be stockpiled for later use for site landscaping or other identified opportunities. This includes topsoil recovered from the area near Cockatoo Creek that will be inundated by the raised FSL. Mulch produced from cleared timber at the site will be treated similarly. Care will be taken to ensure that mulch piles are so managed as to avoid the risk of spontaneous combustion or exposure to bushfire.

The area cleared for the weir will initially be limited to the required works area and the internal haul roads.

Within the construction area (Figure 5-4) sections below FSL will be drained, reshaped to a smooth profile, and revegetated with grasses pending filling of the weir. Areas outside the inundation area will be reshaped and revegetated in accordance with current land use as appropriate or in order to reinstate the fauna movement corridor as recommended in Chapter 12. This will require revegetation of a band of native vegetation up to 50 m wide. Temporary erosion control measures will be installed as needed and as specified by the final EMP.

Sites within the construction footprint that may require specialised attention including decontamination, during rehabilitation include:

- concrete batch plant;
- concrete raw materials stockpiles;
- construction water storage tank facilities;
- water treatment plant;
- construction offices;
- workshops;
- ablutions facilities;
- storage areas;
- bulk fuel supply tanks; and
- refuelling areas.

The final treatment of potential areas of contamination including areas used for workshops, where spills of fuel, oil, and lubricants are likely to be at the discretion of the contractor but will be in accordance with the controlling regulations.

As the need for work in areas below FSL ceases, the areas will be re-contoured to avoid the presence of isolated hollows in the base of the reservoir area. Any excavated areas such as borrow pits (not within the river channel) will be filled with the excess spoil from the pipeline route, covered with topsoil, re-contoured, and revegetated. Revegetation of any disturbed areas within the reservoir area will be limited to grass establishment. Riparian zone re-establishment within the buffer zone above FSL will be planned in accordance with strategies discussed in Chapter 12.

Rehabilitation of the disturbed areas downstream of the weir should be completed as the work in the surrounding areas has been completed and should include both the temporary and final scour and erosion control measures.

Erosion control measures will be required around the perimeter of all work areas listed above and will remain around areas restored following the completion of the weir and roads for an establishment and maintenance period.

Rehabilitated areas will be monitored to ensure that vegetation cover is maintained, weeds do not establish, any minor erosion is repaired, and the area stabilised.

The camping area facilities will be returned to their previous condition following completion of construction activities. Only the boat ramp will be impacted by inundation so it will be extended to maintain boat access to the river.

All areas disturbed along the pipeline route will require reinstatement. The approach will depend on current land use and situation. Native or naturalised pastures may be established in cleared grazing lands while a mix of native trees, shrubs, and native grasses may be established in temporary work site or access track areas on road reserves. Trees or shrubs will not be established directly over the pipeline.

Particular attention will be paid to land shaping in areas where the pipeline and / or access track run down slope and are likely to concentrate or divert flows.

All revegetated areas will be monitored to ensure adequate establishment so that any required remedial works can be attended to promptly.

5.4.4 Workforce and Accommodation

5.4.4.1 On-site facilities

A typical allowance for weir construction site personnel for a project of this size would be of the order of 20 to 30 people during the peak construction period. Additionally, a professional work force of 10 to 12 including senior and junior engineers, clerical staff, supervisors, foremen, soil technicians, environmental officer/s, and their support staff would be required. This workforce would be increased further should shift operations be required.

This estimated workforce does not include the people working off-site such as on infrastructure, in quarries, or material suppliers.

The construction work sites will be day-use only, that is, no accommodation will be provided on site. Crib rooms and toilet and shower facilities will be provided in demountable buildings to supplement facilities serving the present camping area. Grey water will be re-used where feasible and toilet waste will go to pump-out facilities. Cleaning and domestic staff will be employed to maintain these facilities. Site offices will be air-conditioned, meet all occupational health and safety requirements, and be regularly audited for compliance, including for vector and vermin control, and fire safety. All facilities will be capable of being securely locked and site security will be provided to avoid vandalism and theft.

Construction work for the Glebe Weir pump station is likely to require up to eight people at peak times though this demand is likely to be restricted to one or two periods of two to five days. If the same contractor is carrying out both weir and pump station construction, it is likely that only two or three additional specialised people would be required. Limited portable facilities will be provided on-site as those at the weir site will be adequate.

Pipeline construction may involve up to approximately 50 people at any one time. Because of the nature of the task, work bases will use mobile facilities that will relocate as the laying of the pipe progresses. The facilities provided will meet, and be maintained to comply with, all occupational health and safety requirements. Multiple work sites along the route may be required for line clearing, pipe laying, rehabilitation, pump station construction, and other works depending on contractor preferences.

The Glebe Option will require a labour force with skills in a number of areas including:

- plant, machinery, and crane operation;
- truck driving;
- form work construction and reinforcement setting;
- concrete pouring and finishing;
- general labouring;
- trenching, pipe laying, and joining;
- clerical and record keeping;
- construction engineering supervision;
- environmental supervision; and
- vegetation clearing and re-establishment.

Opportunities for training through longer formal schemes such as apprenticeships will be limited by the short construction period but the project will provide scope for considerable on-the-job training and skills development.

The proportion of the workforce that may be drawn from the local area and the training to be provided to workers is addressed in Chapter 17 Social and Chapter 18 Economic.

5.4.4.2 Off site accommodation

Accommodation for the construction work force will be off-site with the weir workforce accommodated in Taroom and the pipeline workforce accommodated in Wandoan. This may alter depending on further discussions with Council. At present, Banana Shire Council has indicated an area currently zoned “industrial” may be suitable for the camp in Taroom as access to the town facilities is likely to be available and the camp would suit the planning intent of the area. In Wandoan, Mac Group has lodged an application to develop a camp outside of town. This will be available to any contractors. Council has suggested it prefers camps to be close enough to town to access the town’s facilities. Both Councils foresee no fundamental problems related to camp establishment but ongoing consultation is required and will be undertaken.

The camps would be operated by the Contractor and comprise demountable facilities including sleeping areas, showers and toilet, laundry, rest area and a kitchen. The facilities provided will meet, and be maintained to comply with, all occupational health and safety requirements. Discussions with Council and service providers will result in detailed plans covering management of the camps, parking, security, access to town services and facilities and potential interactions with local residents, businesses and service providers (further developed in Chapters 17 and 18).

5.4.5 Commissioning

Commissioning the Glebe Option will involve the operation of the weir itself and the pump station, pipeline, and associated infrastructure.

On completion of construction, the inflatable rubber dams on the weir, their control systems, and backup systems will be thoroughly tested as will any changes to the downstream release system. The raised weir will commence operation on completion of this testing. Nevertheless, the Glebe Weir headwater stream gauge will be closely monitored during the first over-topping event to ensure that the rubber dams deflate automatically as intended. If this does not occur, over-ride systems will be used to initiate deflation. The area immediately downstream of the weir will be monitored after overtopping events during initial operations to ensure that protection works are functioning as intended.

The water distribution infrastructure and control systems will be thoroughly tested on completion. First filling of the pipeline and balancing storage will be closely monitored to ensure that valves and controls all operate in the correct sequence. Pumping will be stopped and started until operators are confident that all control systems and

valves are operating and that the system will function correctly under unintended stoppages such as those resulting from power failures. Pumping to the Wandoan Coal Project will then commence subject to mine requirements and the availability of water. All components will be regularly inspected for leaks during initial operations. The water used in these stages will be sourced from the Dawson River and discharged to the Wandoan Coal Project storage.

5.5 Glebe Option Operation

5.5.1 Weir Operation and Management

The objectives for the operation of the raised Glebe Weir are to:

- have the capacity to divert an anticipated 2,000 ML/annum by 2012 and 8,500 ML/annum by 2014 (Chapters 2 and 8);
- meet the requirements specified in the *Water Resource (Fitzroy Basin) Plan* (NRW,1999) and the associated WRP including Environmental Flow Objectives (EFOs) and Water Allocation Security Objectives (WASOs);
- maintain existing upstream flood levels for any given flood discharge;
- safely pass flood flows so that the integrity of the weir is not compromised;
- minimise environmental impact in and around the storage and downstream;
- provide for effective operation of any fish transfer system required;
- minimise impacts on landholders in the areas around the storage and downstream; and
- minimise impacts on the community.

Though many monitoring and control mechanisms will be automated or linked controls, operation of the raised weir and pipeline to the Wandoan Coal Project will require one dedicated operator. Part-time or contract assistance may be required for tasks such as slashing grass. Back-up and support for operations will be provided by SunWater staff based at Theodore. Electric power and telecommunications services, with appropriate backup, will be required for monitoring equipment and the compressors maintaining air pressure in the inflatable rubber dams.

On completion of construction, the reservoir area will be available for recreational use in a similar manner to the present. Facilities for public use will be equivalent to or better than those currently provided. Also, the public will be excluded from areas near the weir wall and control rooms for safety reasons). Areas open to the public will require services such as refuse removal and cleaning of facilities and it is likely that these functions will be carried out by Banana Shire Council, as they are at present.

The storage area will require routine inspection to identify and manage issues that might affect attributes such as water quality or shoreline stability. Assessments would include macrophyte growth, noxious species, wave erosion, or slumping. In addition, rehabilitation work will require monitoring for a number of years to ensure permanent establishment of vegetation and landscape stability. Areas used for recreation will require monitoring to maintain public safety.

Regular maintenance tasks will include:

- slashing grass around control rooms to reduce fire risk;
- slashing grass in areas subject to high public use to maintain public safety;
- painting of metal work such as baulks and gates;
- lubricating moving parts in compressors, valves, controls, and the fishway (if fitted);
- planned replacement of components in the inflatable rubber dam;
- replacing baulks, trash racks, and screens in the outlet system as required; and
- handling waste according to EPA requirements and the EPR Waste.

Responsibility for removal and proper disposal of any wastes generated through maintenance work will rest with the staff or contractors undertaking the work.

5.5.1.1 Operation of the Inflatable Bags

The inflatable rubber dams will be arranged to deflate once overflow reaches 0.15 m above FSL. Discharge, when the spillway rubber dam commences to deflate, will be 25 m^3/sec. Deflation will be at a controlled rate to prevent a surge flow downstream.

Because the rubber dams will deflate as flood flows rise, and lie flat on the spillway and abutment crests at flows when the existing abutments would have been overtopped, the raised weir will have negligible impact on upstream flood levels compared with levels for the existing weir (Chapter 8).

Maintenance requirements for the rubber dams are limited, requiring patch repairs for bullet hole punctures and the like if and when required, quarterly servicing of blowers, and removal of debris from the weir crest after flood events. The expected life of a rubber bag is in the order of 20 to 25 years.

The Bureau of Meteorology operates a flood monitoring system in the Dawson River. The flood monitoring system consists of a network of radio and telephone telemetry gauges owned and operated by local councils, DNRW, SunWater and Bureau of Meteorology. Data from these stations are linked in real time to the same model used in the design hydrology study. The model has been successfully used for forecasting flood levels in the Dawson and Fitzroy Rivers for many years and this real-time data may be used to deflate the inflatable rubber dams before they are overtopped by 0.15 m when large flood events are anticipated.

In addition, the real-time flood data may be used to initiate inflation of the rubber dams earlier than would be the case based on headwater levels when rapid falls in river level are anticipated.

On completion of the Glebe Option, water required for downstream users and to meet EFOs would be released through the outlet as at present while water required for the Wandoan Coal Project would be drawn off through the pump station on Cockatoo Creek. The increased storage capacity relates solely to the new high priority requirement of Wandoan Coal Project with the concomitant aim that existing users retain all rights in accordance with the WRP.

The system of storages along the Dawson River is managed by SunWater under the Resource Operations Licence (ROL) for the Dawson Valley Water Supply Scheme to provide users with their water allocations at or above the WASOs while meeting EFOs. Glebe Weir is the largest and furthest upstream storage in the series of weirs that, together with the Moura Offstream Storage, supply water to the scheme.

For the Wandoan Coal Project to be granted a water entitlement from the raised Glebe Weir, approval will be required through a ROP submission to DNRW. Under the *Water Resource (Fitzroy Basin) Plan* (NRW, 1999), SunWater would be issued with a modified ROL. Conditions attaching to this licence will specify how the infrastructure is to be operated to ensure that water sharing and environmental flow rules for the relevant parts of the plan area are met. Monitoring and reporting components are also mandatory. Under their current ROP, SunWater monitors:

- water quality, including temperature, biological and physical parameters, in storage, releases, and deliveries;
- stream flows;
- water levels; and
- operation of Glebe Weir and the outlet works.

5.5.2 Pump Station and Pipeline Operation and Maintenance

SunWater would also operate the pipeline to Wandoan Coal Project. Much of the operation of the Glebe Weir pump station and the pipeline to the Wandoan Coal Project, with its associated balancing storage, will be automated. This automation will ensure that pumps (one operation and one standby) start again quickly, and in the correct start up sequences, after unforseen stoppages such as power failures. Shut down sequences will be automated as well. The automated control system has the added advantage of being able to shut the pumps down quickly in the event of a major failure detected by sensors along the route.

After the testing and commissioning phase, overall pump and pipeline operations will be controlled by water levels in a large-capacity storage on the Wandoan Coal Project site and in one smaller balancing storage along the pipeline route. The system will operate to maintain water level in the Wandoan Coal Project storage at a predetermined level.

Monitoring of the pipeline will be required to:

- detect minor leaks;
- ensure the effectiveness of landscape shaping, revegetation and weed control;
- ensure that valves and sensors are functioning;
- ensure that above ground infrastructure is maintained in a safe and secure condition; and
- ensure the efficiency of water flow.

Regular maintenance will be required to lubricate pumps and associated infrastructure and to slash grass in areas at risk of damage from fire.

If monitoring indicates declining flow efficiency, sections of the pipeline may require scouring through dedicated valves to remove sediment accumulations or “pigging” wherein a specially designed slug is forced through the line by water pressure to clear the pipe walls of slimes and similar accumulations. Water released from the line would be contained in scour pits (Plate 5-7).

5.6 Decommissioning

The nominal engineering design life of the Glebe Option is expected to be 100 years, though it is likely to be maintained after that period provided that it continues to meet safety requirements and remains an integral part of the regional water supply strategy.

The Glebe Option may be decommissioned during or after initial engineering design life if:

- it becomes redundant as a result of developments such as construction of Nathan Dam;
- it suffers significant damage that cannot be remedied to meet safety standards; or
- it is no longer needed to provide water.

Current practices for decommissioning are established by ANCOLD. ANCOLD (2003) identify two principal alternatives when decommissioning. Both alternatives involve completely abandoning the storage, with its removal to the extent that it no longer retains water. While this is best achieved by complete removal of the wall and reinstatement of the bed and banks, in some situations it may be appropriate to only partially remove the structure.

Environmental issues associated with decommissioning must also be addressed. These include:

- treatment and / or removal of silt sediments that may be anoxic or otherwise pose a threat to water quality and ecosystem health at the site and downstream of the site;
- treatment of stratified water layers that may be low in oxygen and have other chemical characteristics that may be harmful to downstream ecosystems;
- stabilisation and reinstatement of the river bed and banks at the weir site; and
- stabilisation and reinstatement of lands formerly inundated by the water storage.

When decommissioning, owners at the time should prepare a decommissioning plan. The decommissioning plan should:

- include a time sequence of studies and works associated with the decommissioning; and
- address all issues associated with the decommissioning including:
  - impacts of sudden loss of remaining embankments or other sections for a range of flood events in compliance with the Guidelines for Failure Impact Assessments of Water Dams,
  - provision of safe release of stored water,
  - assessment of altered hydraulic character of spillways and streams,
  - provision to minimise impact on the downstream residents, and
  - provision for consultation with downstream residents and landholders.

A decommissioning date for the Glebe Option has not been determined at this stage. The most likely reason for the decommissioning of Glebe Weir in the foreseeable future would be as a result of the construction of Nathan Dam. If Nathan Dam is constructed approximately 11 km downstream of the weir, the weir will be relatively low in the storage and will be inundated for most of the time. A decommissioning strategy will be presented in the EIS for Nathan Dam. The current EIS for raising of Glebe Weir assumes it will have a long usable life so a detailed plan is not necessary.