7.5 Surface Water

7.5.1 Introduction

This section of the EIS identifies the potential risks to the surface water environmental values as a result of the proposed gas transmission pipeline. The gas transmission pipeline will extend through two river basins, Calliope and Fitzroy; commencing at the Fairview CSG field, travelling north-east for 435 km to the LNG facility on Curtis Island. The major rivers within the proposed gas transmission pipeline corridor include the Calliope River, Dawson River, and Brown River. Other tributaries include Larcom, Bell, Kroombit, Banana, Kianga, Callide, Mimosa, Conciliation, Zamia, Clematis, Sardine, Arcadia, Spring, Hutton and Baffle Creeks. The local and regional drainage patterns are presented in Figures 7.5.1 to 7.5.5. Although the reach of Curtis Island gas transmission pipeline is encompassed by the study area, no major watercourses were identified during the initial desktop review. As a result no watercourses within this region were assessed.

The majority of the proposed gas transmission pipeline corridor is within the Fitzroy Basin, the largest river basin on the east coast of Australia. The proposed gas transmission pipeline corridor is within the Boyne-Calliope and Dawson Sub-regions. Water resources in the Fitzroy basin have a number of important usages including farming, grazing, mining, recreational and urban activities. Refer to Appendix O2, for further details refer to Section 3.4. The gas transmission pipeline initially passes through the Calliope River Basin, which is located in the central coast region of the North East Coast Drainage division. Cattle grazing is the main land use in the area and is confined to the coastal plains. The upper ranges of the basin are still densely vegetated.

The following section provides a summary of the surface water assessment undertaken including an overview of the regulatory framework, description of existing environmental values, and potential impacts and mitigation measures. A full copy of the surface water report for the gas transmission pipeline is provided in Appendix O2. The impact to the surface water environment should be evaluated jointly with assessments of riparian vegetation (Appendix N2) and groundwater (Appendix P1).

7.5.2 Methodology

An assessment of the water resources of the gas transmission pipeline in the context of environmental values as defined by the *Environmental Protection (Water) Policy 1997* (EPP Water) was undertaken. *The Water Act 2000* (Water Act) and the *Integrated Planning Act 1997* are the principal legislation governing approvals and licensing of water supply schemes and associated structures. The Fitzroy Basin and Calliope Basin Water Resource Plans cover the management of all surface water in the basin including overland flow.

The assessment also included:

- A hydrological assessment considering the catchment characteristic and local stream gauge records, for a range of events were undertaken for each watercourse. A basic hydraulic assessment of the key watercourse crossing locations was also undertaken using hydraulic modeling software, HEC-RAS V3.
- A water quality assessment was undertaken using relevant water quality objectives for the area being identified from Queensland Water Quality Guidelines (QWQG) and compared with median values of various physico-chemical parameter data gathered from two sources.

Major planned activities for the gas transmission pipeline through the different stages of construction, commissioning, operation and decommissioning have been detailed in Section 3. The potential impacts are discussed and management measures to minimise those impacts are outlined. This was undertaken using a qualitative risk assessment approach.

7.5.3 Regulatory Framework

For key legislation relating to surface water refer to Section 6.5.3. In addition the following codes will be referred to during the construction and operation of the gas transmission pipeline:

- Australian Pipeline Industry Association Ltd; and
- AS2885 (Standards Australia, 2007).

These are discussed in Section 7.11 of the EIS.

7.5.4 Existing Environmental Values

Within the proposed gas transmission pipeline corridor there are a significant number of major watercourses and various minor tributaries that will be subject to protection under the EPP Water. A number of existing surface water users are located throughout the study area and are discussed in Appendix O2.

Specific environmental values for the watercourses within the study area are not defined within the EPP Water and there are no detailed local plans relating to environmental values for the catchments.

Using data gathered from URS site investigations and desk top studies, environmental values have been identified for watercourses within the study area (Table 7.5.1).

Table 7.5.1 Environmental Values for the Watercourses and Receiving Environment of the Gas Transmission Pipeline

Environmental Values	Calliope Basin	Fitzroy Basin
Protection of high ecological value aquatic habitat	X	X
Protection of slightly to moderately disturbed aquatic habitat	✓	✓
Protection of highly disturbed aquatic habitat	X	X
Suitability for primary contact recreation (e.g. swimming)	✓	✓
Suitability for secondary recreation (e.g. boating)	✓	✓
Suitability for visual (no contact) recreation	✓	✓
Suitability for drinking water supplies	X	x
Suitability for agricultural use	✓	✓
Suitability for aquaculture (e.g. red claw, barramundi)	X	x
Suitability for human consumers of aquatic food	✓	✓
Suitability for industrial use (including manufacturing plants, power generation)	✓	✓
Protection of cultural and spiritual values	✓	✓

Table Notes:

✓ River basin is suitable for the environmental value.

X River basin is not suitable for the environmental value.

Client

Project

GLADSTONE LNG PROJECT
ENVIRONMENTAL IMPACT STATEMENT

Title

MAJOR WATERCOURSES
MAP 1 OF 5

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Job No:	**4262 6220**	File No:	42626220-g-891c.wor		

Figure: **7.5.1**

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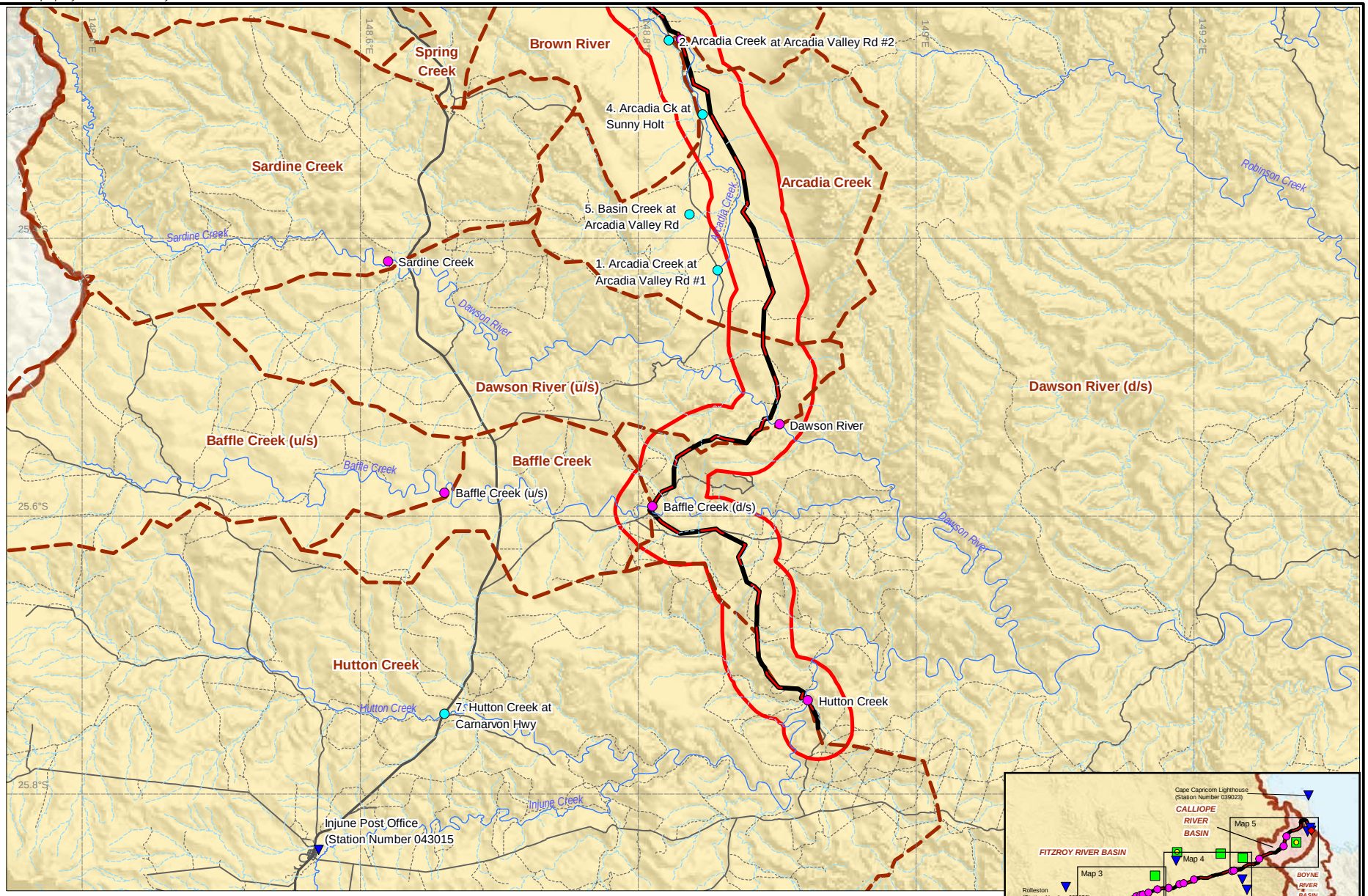

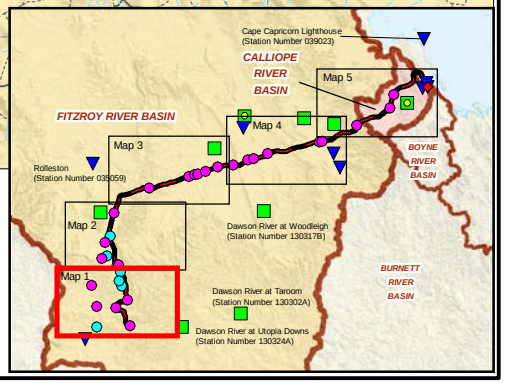

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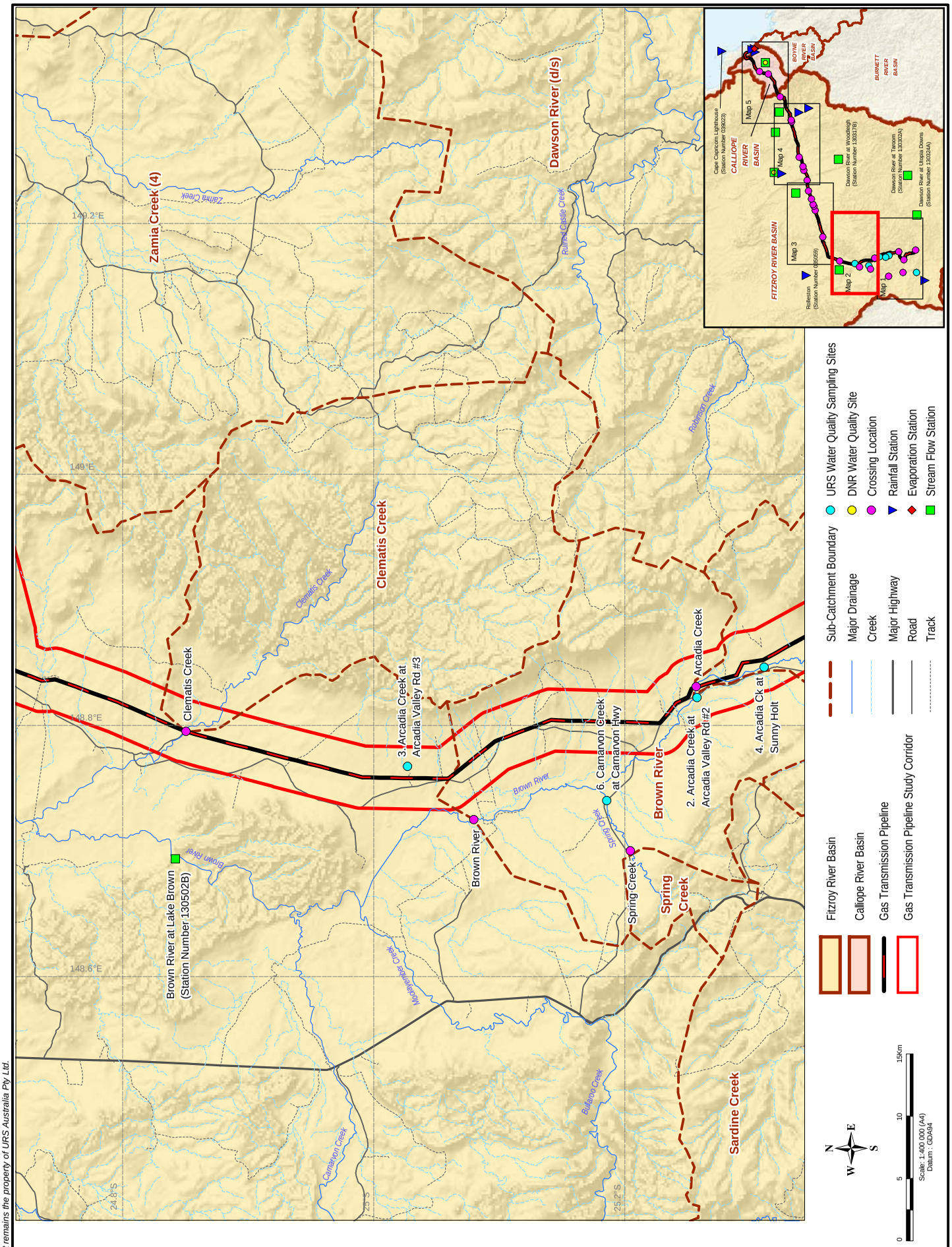
- Fitzroy River Basin
- Calliope River Basin
- Gas Transmission Pipeline
- Gas Transmission Pipeline Study Corridor
- Sub-Catchment Boundary
- Major Drainage
- Creek
- Major Highway
- Road
- Track
- URS Water Quality Sampling Sites
- DNR Water Quality Site
- Crossing Location
- Rainfall Station
- Evaporation Station
- Stream Flow Station



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Title
MAJOR WATERCOURSES
MAP 2 OF 5

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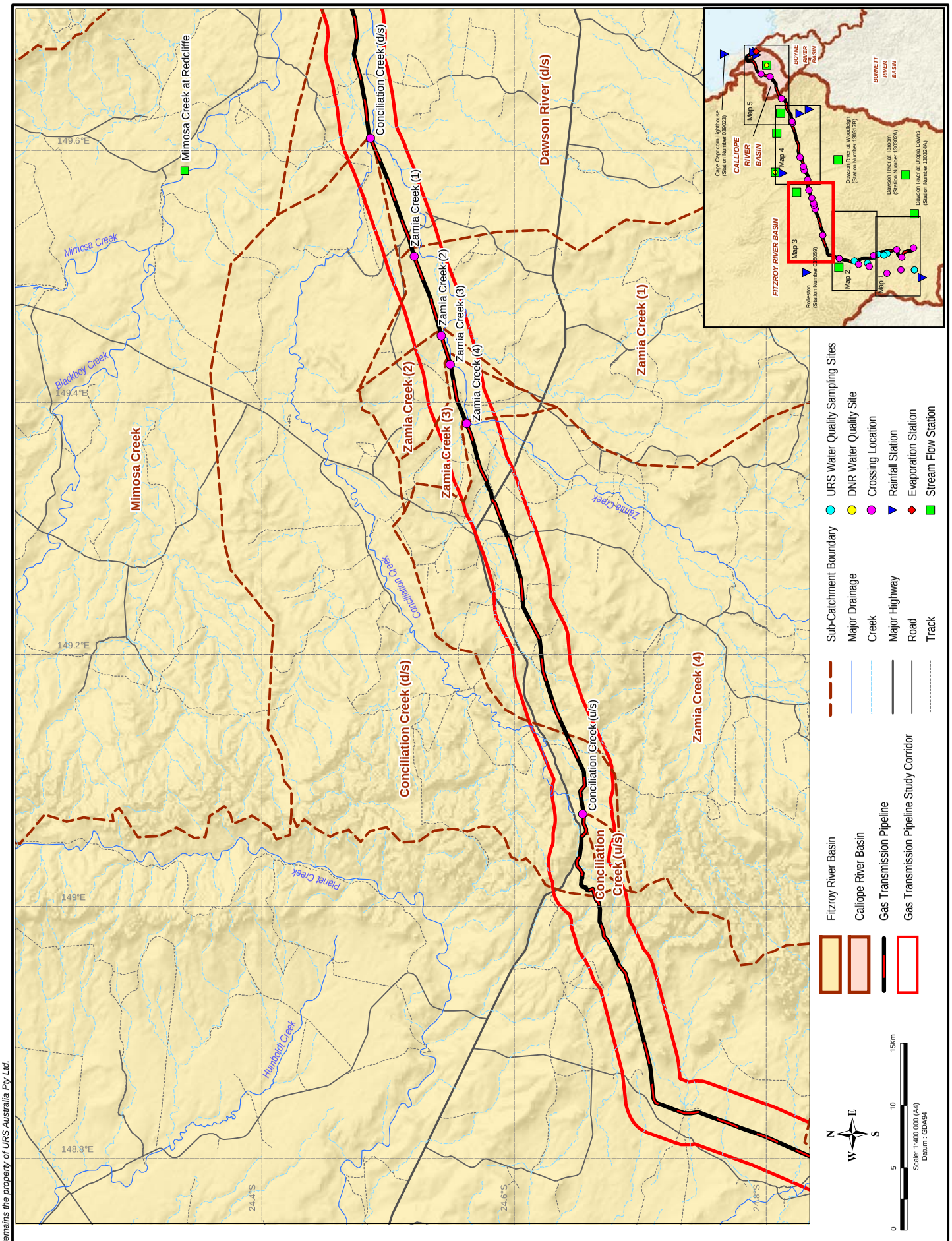

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MAJOR WATERCOURSES
MAP 3 OF 5

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Job No: **4262 6220**	File No: 42626220-g-893c.wor			**A4**

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GLADSTONE LNG PROJECT
ENVIRONMENTAL IMPACT STATEMENT

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Job No: 4262 6220 | File No: 42626220-g-894c.wor

Title

MAJOR WATERCOURSES
MAP 4 OF 5

Figure: 7.5.4

Rev:C

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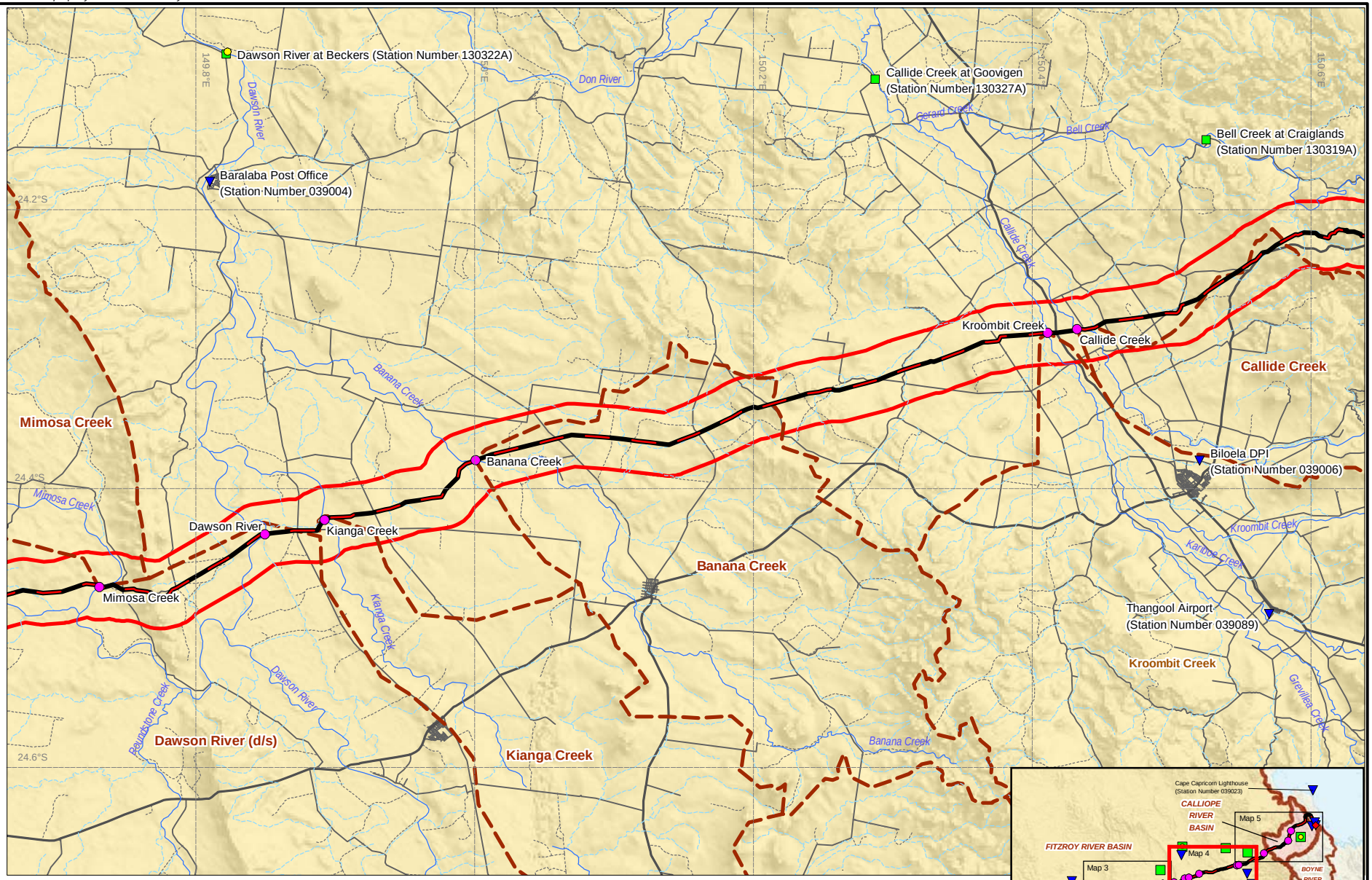

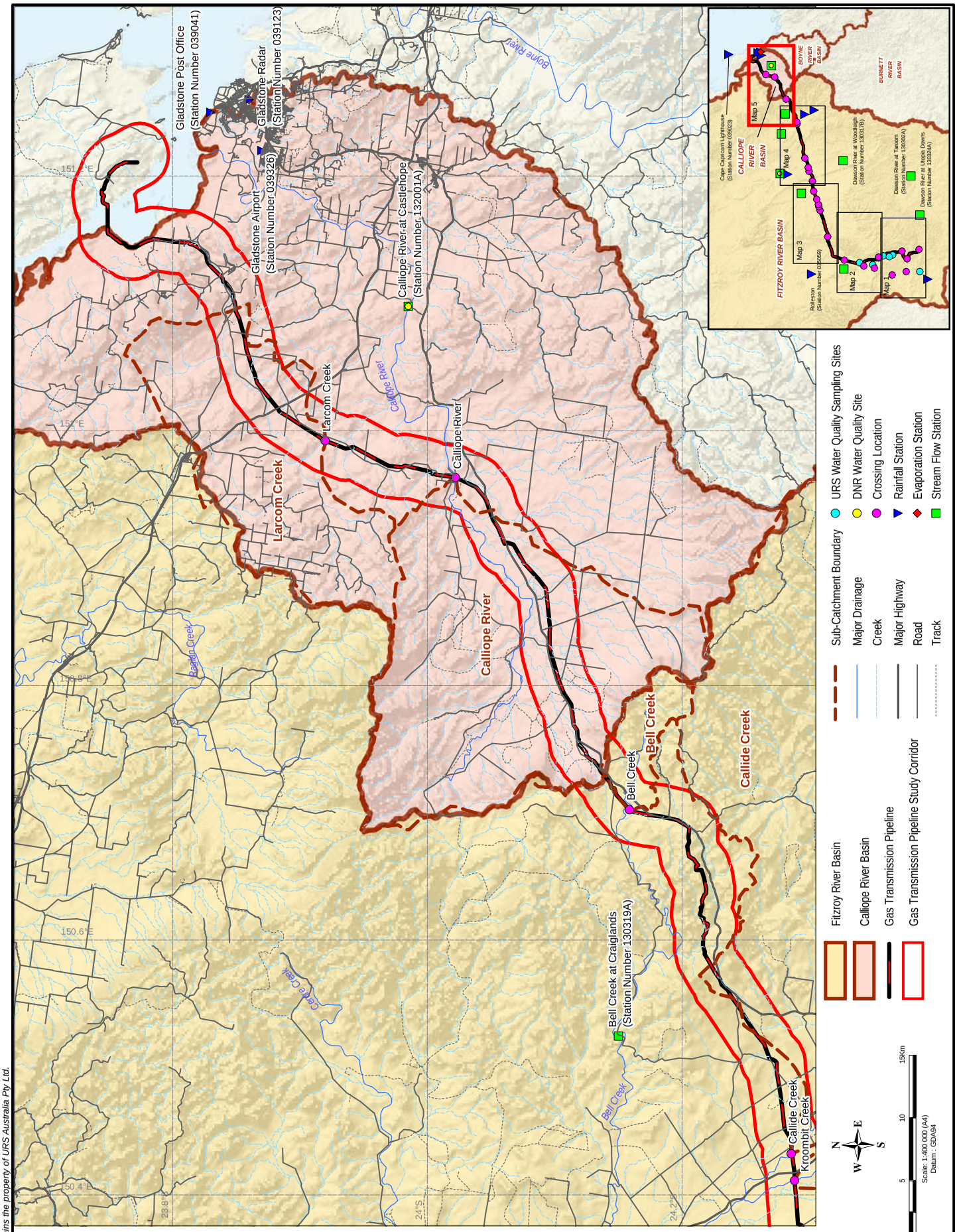

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Project
GLADSTONE LNG PROJECT
ENVIRONMENTAL IMPACT STATEMENT

Title
MAJOR WATERCOURSES
MAP 5 OF 5

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Job No: 4262 6220	File No: 42626220-g-895c.wor			A4

7.5.4.1 Regional Context of Watercourses

All watercourses except for the Dawson River from Fairview downstream are ephemeral. Flows in these watercourses are generally short and limited to periods during and immediately after rainfall.

Designated wetlands within the broad study area have been identified as the “Palm Tree” and “Robinson Creeks”, the “Boggomoss Springs” and Lake Nuga Nuga (refer Figure 7.5.6). The proposed alignment of the gas transmission pipeline crosses none of the above designated wetlands; however crossings of upstream tributaries are proposed of all three wetlands. A description of the wetlands in relation to the proposed gas transmission pipeline alignment follows.

Within the upstream catchment of the Dawson River, lies the Palm Tree and Robinson Creeks designated wetland. It is the largest designated wetland in the vicinity of the gas transmission pipeline with a total area of 500 square kilometres.

The Environmental Protection Agency (EPA) designated wetland Boggomoss Springs also lies in the upstream catchment of the Dawson River. Flows from the upper Dawson River, including the two crossings on Baffle Creek, Sardine Creek, Dawson River (downstream) and Hutton Creek feed into the wetland.

The downstream reaches of the Brown River enter the EPA designated wetland of Lake Nuga Nuga. Upstream of the wetland, crossings are located at the Brown River, Spring Creek and Arcadia Creek.

7.5.4.2 Climatic Data

The Fitzroy and Calliope basins are subject to a range of climatic regimes. The region as a whole is described as subtropical to semi-arid, with a summer-dominant but variable rainfall pattern.

Rainfall and evaporation data was obtained from the Bureau of Meteorology (BOM). Climatic data was sourced from two gauging stations; Gladstone Airport and Thangool Airport.

Rainfall averages suggest a distinct wet and dry season, with the wet generally October to April and the dry May to September. Mean monthly evaporation rates are greatest in December and January and lowest in June and July.

The location of each gauging station in relation to the study area can be seen in Figures 7.5.1 to 7.5.5.

Refer to Section 7.2 for a more detailed description of climate.

7.5.4.3 Streams Flows

The Fitzroy Basin is characterised by large variations in river flows. Most of the region's rainfall occurs during October to April, causing most stream flows to occur in summer. Prolonged dry periods in the winter mean many of the waterways are ephemeral.

Mean monthly flow volumes for various watercourses within the study area were obtained from the Department of Natural Resources and Water (DNRW). The locations of each stream flow gauging station can be seen in Figure 7.5.1 to 7.5.5. Each gauging station has varying data periods on record.

Analysis of the data indicates large seasonal variations in flow with notable high flows between October and April. The watercourses with the highest flows were Dawson River (d/s) and Calliope River with little flow occurring in Bell Creek. This is consistent with their respective upstream catchment sizes.

7.5.4.4 Soils and Geology

The proposed gas transmission pipeline route crosses varying soils types and land formations. Soil type is dominated by sandy-surfaced soils and cracking and non-cracking clay soils.

Refer to Section 7.3 for a more detailed description of soils and geology along the proposed gas transmission pipeline corridor.

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Title

DESIGNATED WETLANDS OF THE LNG PIPELINE ALIGNMENT STUDY AREA

Figure: **7.5.6**

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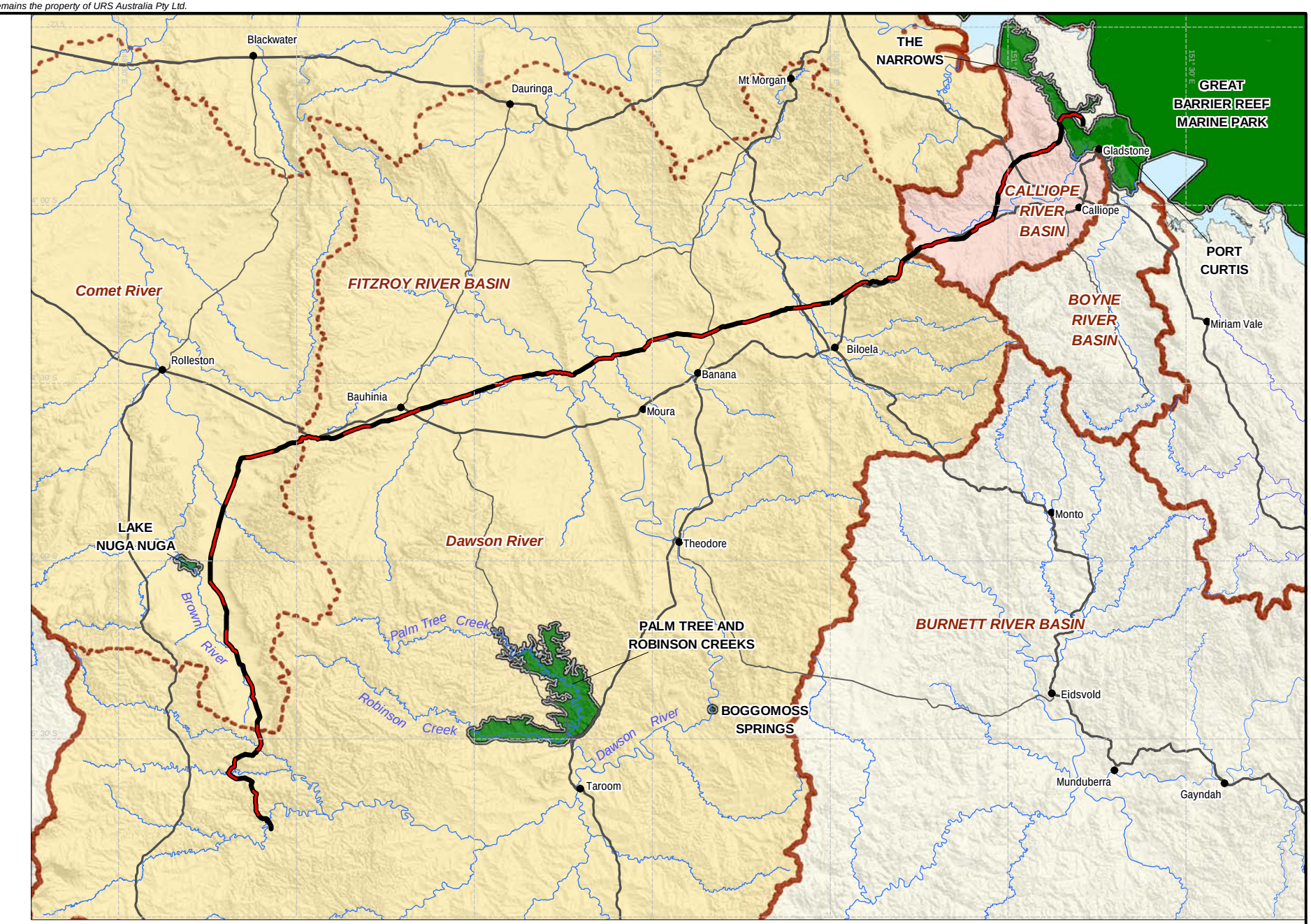

7.5.4.5 Existing Flood characteristics

Assessment of existing flood characteristics has been focused on watercourses where significant environmental risk could occur from inappropriate design or construction. Desk top analysis identified 24 key watercourse crossing locations (refer Figures 7.5.1 to 7.5.5).

For each of the 24 key watercourse crossings, hydrological estimates were undertaken using either regional flood frequency regression equations or the rational method based on Weeks (1991). Design peak flows were then derived for a range of probabilities (average recurrence intervals, ARI) using the appropriate method. Estimates of flood flows were derived using hydrological methods in Australian Rainfall and Runoff (AR&R) (IEAust, 1987). The assessment considers probable design floods, a theoretically derived flood which has a certain likelihood of occurrence, expressed as an average annual recurrence interval (ARI).

To approximate the flood extents at each watercourse crossing, a basic hydraulic assessment of the 24 key watercourse crossing locations has been undertaken using the industry accepted software, HEC-RAS. HEC-RAS, is a one-dimensional hydraulic estimation model, produced by U.S Army Corps of Engineers (USACE) Hydrologic Engineering Centre (HEC).

7.5.4.6 Existing Water Quality

Relevant water quality objectives for the proposed gas transmission pipeline corridor were identified from the EPA's QWQG 2006 to support and protect different environmental values for waters in the Fitzroy Central River Catchment. The physico-chemical indicators were obtained from the Central Coast Region upland stream values. Salinity guidelines were obtained from Appendix G of the QWQG.

Baseline water quality in the vicinity of and in receiving waters of the proposed gas transmission pipeline corridor was assessed to characterise the existing water quality conditions. The assessment included a review of relevant water quality data from:

- NRW gauging stations located on four major watercourses in the area including Dawson River (Station No 130322A), Calliope River (Station No 132001A), Baffle Creek (Station No 134001B) and Mimosa Creek (Station No 130316A); and
- Water quality monitoring activities undertaken by URS at seven locations in close proximity to the proposed gas transmission pipeline corridor (these included Arcadia Creek, Basin Creek, Carnarvon Creek and Hutton Creek).

The review showed that:

- Total Nitrogen (TN) and Total Phosphorus (TP) exceeded the water quality objectives in the majority of watercourses sampled;
- Large annual sediment load was evident through on-site investigation;
- Acidity/alkalinity (pH) readings, in most cases complied with the water quality objectives; and
- Electrical conductivity (EC) levels were within the water quality objectives at the majority of sites, with elevated levels only noted within the Calliope River.

Seasonal variation observations included:

- Generally, EC is higher in the dry season due to lower flows available to dilute the salts present;
- Dissolved oxygen (DO) would be expected to be lower in the dry season, which is the case for some sites; although others show DO to be lower in the wet season; and
- The Arcadia Creek sites generally have a lower median pH in the wet season compared to the dry, whilst all other sites analysed do not show seasonal variation and remain constant at around pH 7.0 to 8.0.

For further detail and discussion on water quality results, refer to Appendix O2.

7.5.5 Potential Impacts and Mitigation Measures

The key potential impacts and their proposed mitigation measures are summarised below.

7.5.5.1 Construction Phase

Potential impacts from the gas transmission pipeline are expected to be of higher significance during the construction phase.

Sediment Exposure and Mobilisation

Potential Impacts

Sediment mobilised during construction activities (such as trenching or drilling of the gas transmission pipeline) may enter surface water runoff during rainfall events and discharge to drainage lines leading to deleterious effects on water quality and aquatic habitats. Sediment exposed or generated during construction may also be blown by wind into surface water bodies.

Mitigation Measures

These impacts will be minimised by using erosion and sediment control measures detailed in the Environmental Management Plan (EMP) such as:

- Concentrating work to as small an area as possible and progressively expanded to reduce the area potentially at risk;
- Minimising the number of passes by heavy earth moving equipment;
- Stripping and stockpiled usable topsoil away from drainage lines to protect it from erosion;
- Implementing sediment limitation devices (e.g. settlement/evaporation ponds, drainage ditches);
- Constructing bunds to restrict flow velocities across the project site;
- Limiting vegetation clearing work during heavy rainfall;
- Adopting stormwater controls and upstream treatment, such as infiltration devices and vegetation filters;
- Locating vehicle wash bays away from watercourses;
- Revegetating and/or using of other stabilisation techniques, considering seasonal influences, upon completion of works;
- Minimising vegetation disturbance, especially riparian vegetation;
- Implementing dust suppression measures including irrigation and/or covering of stockpiles;
- Adopting erosion control, energy dissipation and scour protection, such as matting, riprap and gabions; and
- Preparing a Stormwater Management Plan (SWMP) for the construction of the gas transmission pipeline.

Gas Transmission Pipeline Crossing of Water Courses

Potential Impacts

Erosion and sediment entering water ways during construction of the gas transmission pipeline across waterways.

Mitigation Measures

- Where pipelines or other buried services are required to cross water courses, these areas will be directionally drilled, where practicable, to reduce surface area disturbance and minimise environmental impact;
- In other drainage lines, a 50 m vegetative buffer will be retained, if required, until construction across the streambed is imminent;
- Streambed and bank materials will be graded away (upslope) from the streambed and placed in temporary stockpiles, a minimum of 50 m beyond the bank and protected on the down-slope side by a silt fence;
- Where it is necessary to divert water flow around the crossing site, it will be pumped into a geofabric-lined containment area and control released a suitable distance downstream of the crossing site;
- Temporary earth banks will be installed across the approach slopes to the drainage line to divert upslope surface runoff down stream of the crossing site;
- When the gas transmission pipeline installation is complete the stream bed will be re-instated using material consistent with the existing streambed material. Stream banks will be re-established to a stable slope consistent with the existing bank slopes both upstream and downstream of the crossing site. Topsoil will be replaced and the area revegetated as soon as practicable. In places it may be necessary to place jute matting or use rock armouring for erosion control purposes; and
- Stabilisation of these sites may be assisted by pushing disturbed riparian vegetation back over the re-instated area to provide seedstock and to help stabilise the area. This will also help restrict cattle from accessing the area; otherwise it may be necessary to install temporary fencing.

Contaminant Mobilisation and Pollution

Potential Impacts

Contaminant mobilisation through the use of fuels and chemicals onsite including diesel and other petroleum-based fuels, lubricants and drill mud could enter into drainage lines and receiving waters, altering the physical and chemical quality of the water and waterway.

Mitigation Measures

These potential impacts may be mitigated by:

- The construction of bunded storage areas for contaminants are recommended with spill cleanup kits in accordance with Australian Standards (AS1940 and AS3780) to prevent the contamination of surrounding surface runoff;
- The transfers of fuels and chemicals controlled and managed to prevent spillage outside bunded areas;
- Implement control so significant leakage/spillage is immediately reported and appropriate emergency clean-up operations implemented to prevent possible mobilisation of contaminants;
- Bunds and sumps are frequently drained, and effluent is treated appropriately; and
- Contaminants or major spillages of stored material in the bunded areas are collected by licensed waste collection and transport contractors for disposal off site at a licensed facility.

Flooding

Potential Impacts

The possibility of out-of-bank/flash flood rainfall events during construction, present a risk to workers' health and safety, and may cause erosion and damage to erosion and sediment control infrastructure.

Mitigation Measures

- Appropriate scheduling of works (or designated packages of works) will occur during the wet season (i.e. from October to April);
- Stormwater management measures such as drainage diversions and flood defence bunds (designed to provide an appropriate level of protection – recommended at AEP 0.01 or ARI 100 yr) may be implemented before construction commences; and
- Emergency response procedures (including evacuation procedures) and a flood warning system will be established and incorporated into the site's Health, Safety and Environment Plan to protect on-site personnel.

Impact on Local Water Supply

Potential Impacts

Due to the ephemeral nature of the majority of the watercourses along the alignment, it is assumed that local sources such as rivers will not be used however in the case that there are construction activities these could potentially impact on local water supply.

Mitigation Measures

As a primary mitigation measure it is recommended that the water supply strategy is developed and may include:

- A permit for the taking of water from watercourses for water use. This may include a review of current uses of water supply and the potential impact of removing water;
- Discussion of requirement for an on-site inspection of potential impacts on watercourse bed, banks and vegetation at the chosen location to take/discharge waters. Cultural heritage clearances are also required; and
- Local authorities to identify potential impacts of large volumes of water extracted from local water supplies;

A site assessment of the wetland was not undertaken, however it is anticipated that the crossing locations will not impact upon the hydrological regime of the three designated wetlands with the adoption of the proposed construction technique (trenching of pipeline) at crossing locations, and appropriate sediment and pollution controls, as detailed in Appendix O2.

Sanitary Waste

Potential Impacts

It is anticipated that package sewage treatment facilities will be installed at both of the workforce accommodation facilities and the relevant approvals will be obtained by Santos. Treated effluent will generally be disposed of by irrigation.

Mitigation Measures

Where sewage effluent absorption beds and/or irrigation fields are used, they will be located and designed to ensure that:

- Sensitive areas are avoided;
- Soil erosion and soil structure damage is avoided; and
- There is no surface ponding or runoff of effluent.

Effluent treatment systems will be designed to include alternate measures for effluent storage and/or disposal. There will be no discharge of treated effluent from wet weather storage to any waters.

Disposal of Hydrotest Water

Potential Impacts

Improper disposal of hydrotest water may impact surrounding environment and receiving waters.

Mitigation Measures

To ensure hydrotest water is disposed of in a proper manner, disposal will be in accordance with the environmental authority.

7.5.5.2 Operational Phase

Following the reinstatement and revegetation of the construction right-of-way (ROW), minimal above-ground infrastructure should be visible. Above ground infrastructure may be limited to marker posts to identify the location of the pipeline and the pumping/receiver stations including maintenance access tracks.

A routine operation and maintenance program may be implemented, which could potentially include leak detection surveys, ground and/or aerial patrols, repair or replacement of faulty pipe or other equipment, pigging and cleaning of the gas transmission pipeline, corrosion monitoring and remediation and easement and lease area maintenance.

Aerial and/or ground inspections may include checking vegetation for discolouration which can be indicator of a leak, detection of erosion, monitoring of rehabilitation success and detection of weed species. Low level maintenance for erosion, subsidence and weeds is likely to be necessary particularly during the first 12 months following construction. These actions should be in accordance with the EMP and inline with the APPEA Code (2008).

The proposed pipe is to be thick walled pipe at watercourse crossings and areas of significant inundation to protect the external coating and to prevent the pipe 'floating' once in place.

Refer to the EMP for mitigation measures of the above impacts.

7.5.5.3 Decommissioning Phase

In the future when the gas transmission pipeline is no longer required it will be decommissioned, with the most likely options discussed in Section 7.16.

It is anticipated that there will be no impacts to surface water from the options identified in Section 7.16 however; the following mitigation measures will be implemented:

- Regular monitoring for erosion with corrective action taken as required will minimise erosion and sediment entering the surrounding waterways; and
- The implementation of appropriate rehabilitation measures outlined in the rehabilitation management plan will minimise contaminated runoff from entering surrounding waterways.

7.5.5.4 Cumulative Impacts

Section 1 identifies other proposed gas transmission pipelines associated with other potential CSG projects. There is limited information available as to the planned development or timing of these projects, however a qualitative assessment can be made of the possible cumulative impacts.

Some sections of the proposed gas transmission pipeline corridor may be located within an area where these other pipelines are proposed to be located in the future. Within these areas there would be an

increased disturbed area and possible impacts on surface water. The anticipated impacts of the gas transmission pipeline installation are considered to be the same for the other envisaged pipelines. Earthmoving activities, works adjacent to/within drainage lines, contaminant mobilisation, pollution and flooding will each impact on the waterways.

It may be considered that where pipeline alignments coincide consideration should be made, where appropriate, for multiuse corridors or parallel ROW.

In the event that the “Yarwun Neck” in the Gladstone State Development Area (GSDA) contains multiple pipelines, cooperation between the relevant pipeline development proponents and regulatory agencies will be required to minimise impacts to surface water.

The Queensland Government has advised that its preference is for the gas transmission pipelines for all LNG facilities proposed for Curtis Island to be located in a common pipeline corridor across the GSDA, including the Port Curtis Crossing and Curtis Island pipeline sections to minimise potential impacts in this area.

It is expected that the other gas transmission pipeline development projects would include some or all of the proposed mitigation measures in relation to surface water described in this section. By utilising the mitigation methods the expectation is the minimisation of the cumulative impacts on the receiving environment.

Table 7.5.2 provides a summary of potential surface water impacts and mitigation measures for gas transmission pipeline.

Table 7.5.2 Potential Surface Water Impacts and Mitigation Measures

Aspect	Potential Impact	Mitigation Measures	Objective
Construction			
Erosion and Sediment Mobilisation	Sediment from earth moving and stockpiling can enter surface water runoff during rainfall events or blown by wind and discharge to watercourses leading to deleterious effects on water quality and aquatic habitats.	• Undertake monitoring and maintenance programs as required. • Develop, implement and maintain a stormwater management plan (SWP) following site impact assessment process. This may include: – Erosion control and energy dissipation; – Stormwater controls and upstream treatment; – Stabilisation techniques; – Appropriate scheduling of construction activities during wet season; – Crossings (pipelines and bridges) to be as close as possible right angles to direction of flow; – Stockpiling of topsoil located away from watercourses; – Vehicle wash bays to be located away from watercourses; – Minimise vegetation disturbance; and – Routine inspection. • Identify and avoid other environmentally sensitive areas (e.g. highly erodible soils etc). • Develop and implement a water quality monitoring program during the planning phase, including telemetry and event based grab water samples, to further refine mitigation measures.	Minimise erosion and sediment release

Section 7

Gas Transmission Pipeline Environmental Values and Management of Impacts

Aspect	Potential Impact	Mitigation Measures	Objective
Pollution	Oily waste water (from miscellaneous plant and equipment wash water); Contaminated runoff from chemical storage areas; Potentially contaminated drainage from fuel oil storage areas; Environmental and public health and safety issue.	All fuel, oil and chemical storage facilities to be bunded. • All industrial waste storage tanks to be bunded • Bunds to be inspected regularly for evidence of leakage. • Spills to be reported and immediately contained • Contaminated soil to be removed and remediated • Contaminated water (e.g. stormwater in bund) to be treated; • All vehicles, plant and equipment to be checked regularly for integrity of fuel tanks; • Monitoring and maintenance programs to be undertaken as required; • Spill cleanup kits (AS1940 and AS3780) to be located in convenient locations and in all vehicles on site; and • Refuelling to occur in bunded areas away from watercourses (> 50 m).	Ensure contaminants do not enter watercourses.
HDD drill mud spillage and seepage	Drill mud may enter watercourses and increase turbidity and sediment loads causing an adverse impact to receiving waters.	• Develop, implement and maintain a drilling procedure. • Ensure as far as practicable that mud is contained and disposed of as per a waste management plan should a spill occur (Appendix K).	Ensure drill mud do not enter watercourses.
Improper disposal of all construction wastes	Litter and other construction waste can be washed into watercourses during rain events and impact receiving waters.	• Develop, implement and maintain waste management plan (Appendix K).	Ensure control of litter and construction wastes appropriately.

Section 7 Gas Transmission Pipeline Environmental Values and Management of Impacts

Aspect	Potential Impact	Mitigation Measures	Objective
Works adjacent to/within drainage lines and watercourses	Trenching at watercourse crossings and vehicle access crossings can alter flow characteristics.	• Divert watercourse either by low flow diversion or coffer dam with pumping. • Implement suitable stormwater management infrastructure and control measures before undertaking construction activities that will affect existing drainage channels . • Minimise disturbance by heavy earth moving equipment. • Design vehicle crossings appropriately for a range of flow conditions, including under-road drainage.	Ensure works adjacent to/within drainage lines and watercourses do not alter flow characteristics.
Flooding	Possibility of out-of-bank/flash flood rainfall event during construction causing erosion and damage to erosion and sediment control infrastructure.	• Schedule construction activities appropriately during wet season to reduce flooding risk. • Install stormwater management facilities e.g. drainage diversions and bunding. • Facilitate emergency response procedures and flood forecasting.	Manage risk of out-of-bank/flash flooding.
Lack of water supply	Inadequate dust suppression, soil compaction and washdown.	• Identify and secure alternative water supplies.	Ensure an adequate amount of water is available during the construction phase.
Contaminant Mobilisation	Oxidation of acid sulfate soils (ASS) producing runoff with high acidic levels detrimental to surrounding environment.	• Manage ASS in accordance with EMP.	Minimise risks associated with disturbance of ASS.
Disposal of hydrotest water	Improper disposal of hydrotest water which may impact on the surrounding environment and receiving waters.	• Dispose in accordance with environmental authority.	Ensure water is disposed of in the proper manner.

Section 7 Gas Transmission Pipeline Environmental Values and Management of Impacts

Aspect	Potential Impact	Mitigation Measures	Objective
Sanitary Waste	Improper disposal of sanitary waste which may impact on the surrounding environment and receiving waters.	• Where sewage effluent absorption beds and/or irrigation fields are used, they will be located and designed to ensure that: – Sensitive areas are avoided; – Soil erosion and soil structure damage is avoided; and – There is no surface ponding or runoff of effluent. • Effluent treatment systems will be designed to include alternate measures for effluent storage and/or disposal. There will be no discharge of treated effluent from wet weather storage to any waters.	Ensure sanitary waste is disposed of in the proper manner.
Operation			
Erosion and Sediment Mobilisation	Permanent structures and minor earth disturbance can result in localised erosion and sediment mobilisation leading to deleterious effects on water quality and aquatic habitats.	• Implement localised erosion control and energy dissipation measures. • Introduce appropriate stabilisation techniques, i.e. revegetation. • Conduct routine inspection and maintenance of existing erosion and sediment control measures.	Minimise erosion and ensure sediment does not enter watercourses.
Disposal of water	Improper disposal of water used following pigging operations impacting surrounding environment and receiving waters.	• Dispose only in accordance with environmental authority.	Ensure water is disposed of correctly.
Decommissioning			
Incomplete rehabilitation	Erosion and movement of sediment. Turbid and sediment laden runoff into watercourses.	• Implement regular monitoring for erosion and corrective action as required.	Minimise erosion and ensure sediment does not enter watercourses

Aspect	Potential Impact	Mitigation Measures	Objective
Construction accommodation facilities.	Improper rehabilitation of construction accommodation facilities.	• Implement appropriate rehabilitation measures as per the rehabilitation management plan to ensure contaminated runoff does not enter the surrounding receiving waters.	Ensure proper rehabilitation of construction accommodation facilities to minimise impact on the surrounding environment and receiving waters.

7.5.6 Summary of Findings

A hydrological assessment found flood depths varying from 1.5 m in a 2 yr ARI flood on small ephemeral watercourses, to 16 m to 20 m in a 100 yr ARI flood on major watercourses such as the Dawson River. Results gathered from URS water quality monitoring activities and DNRW data indicated that nitrogen and phosphorous readings in the receiving environment already exceeded water quality guidelines. This is considered to be attributed by the high annual sediment loads and potentially high loads of organic matter established by the industrial and agricultural catchment land uses.

The project has the potential to impact on the fresh water quality of the immediate and receiving environment. Potential impacts from the gas transmission pipeline development are expected to be of higher risk during the construction phase. These include earth moving activities, works adjacent to/within drainage lines, contaminant mobilisation, pollution and flooding risks.

The seasonal timing of construction works should be scheduled with consideration to the flood risk, and alternate methods (such as HDD) should be considered for major watercourses such as the Dawson and Calliope Rivers. The application of the proposed mitigation measures outlined in this section will reduce the likelihood and/or consequences of the identified impacts of the project, to an adequate level.