ENGENY
WATER MANAGEMENT

WARATAH COAL

# Environmental Values Identification for Galilee Coal Mine

## Galilee Coal Project SEIS Technical Report

**October 2012**

M1700_005

www.engeny.com.au
P: 07 3221 7174 I F: 07 3236 2399
Lvl 11, 344 Queen st Brisbane QLD 4000 I PO Box 10183 Brisbane QLD 4000

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| REV | DESCRIPTION | AUTHOR | REVIEWER | APPROVED BY | DATE |
| Rev 0 | Final | Andrew Vitale | Ben Kiernan | Andrew Vitale | 10 October 2012 |
| Signatures | | | | | |

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# 1. INTRODUCTION

## 1.1 Project Description

Waratah Coal proposes to mine 1.4 billion tonnes of raw coal from existing tenements (EPC 1040 and EPC 1079) approximately 30 km north of Alpha within the Galilee Basin. The annual run-of-mine (ROM) coal production will be 56 Mtpa to produce 40 Mtpa of saleable export steaming coal to international markets. The processed coal will be transported by a new standard gauge railway system approximately 450 km in length that runs from the project site to the existing Port of Abbot Point.

The Galilee Coal Mine will consist of a combination of open cut mining and longwall underground mining. Open cut operations will involve dragline and truck and shovel operations producing 20 Mtpa ROM with coal delivered to the CHPP via heavy vehicle access roads. The underground mines will operate via continuous mines and longwall shearers producing 36 Mtpa ROM delivered to the CHPP via a conveyor system. The CHPP will be capable of producing 40 Mtpa of product coal which will be stockpiled adjacent to the CHPP for train load out. Co-disposal of coarse rejects and tailings will be utilised with disposal in the tailings dam and box cut spoil areas. Additional mine infrastructure will include:

- Mine infrastructure area consisting of administration buildings, parking areas workshop and lay down areas;
- Vehicle equipment and wash down facilities;
- A 2,000 person accommodation village and wastewater treatment plant;
- Light vehicle access roads and site access roads;
- Raw water storage for CHPP vacuum pumps, potable water supply and fire fighting;
- Environmental control dams, sediment dams, pit dewatering and underground dewatering dams and flood protection levees;
- Rail loop and train load out facilities.

## 1.2 Scope of Work

This report describes the identification of draft Environmental Values (EVs) for the receiving waters of the proposed Galilee Coal Mine. Environmental Values are the qualities of a waterway or groundwater system that make it suitable to support particular aquatic ecosystems and human water uses. The identification of Environmental Values is important to guide the selection of appropriate Water Quality Objectives (WQOs) for the mine's receiving waterways. Water quality objectives are long-term goals for water quality management for receiving waters to support and protect the designated EVs for those waters.

Draft Environmental Values have been identified for the proposed Galilee Coal Mine based on desktop review of:

- Water uses within the receiving waterways of the mine; and
- Previous Environmental Value identification studies for the Burdekin River basin.

# 2. RECEIVING WATERS FOR GALILEE COAL MINE

The mine exploration tenements (EPC 1040 and EPC 1079) cover an approximate area of 1,059 km² and are located in the south-east parts of the Barcaldine Regional Council local authority in Queensland. The majority of the proposed mine lease area is located within the Belyando River sub-basin within the Burdekin River basin. The western edge of EPC 1079 drains to the Cooper Creek Basin.

The primary drainage paths through the proposed Mining Lease Application area (MLA) consist of:

- Beta and Tallarenha Creeks which originate to the south of the MLA and flow in a generally northerly direction through the southern parts of the MLA; and
- Lagoon Creek which originates at the junction of Beta and Tallarenha Creeks and flows in a generally northerly direction through the northern parts of the MLA.

Lagoon Creek continues to flow in a northerly direction downstream of the proposed mine lease before joining with Sandy Creek which discharges into the Belyando River 70 km downstream of the mine lease. Downstream of the Sandy Creek confluence, the Belyando River flows in a generally northerly direction before discharging into the Suttor River approximately 200 km downstream. The Suttor River continues in a northerly direction before discharging into the Burdekin River within the reservoir area of Lake Dalrymple (Burdekin Falls Dam).

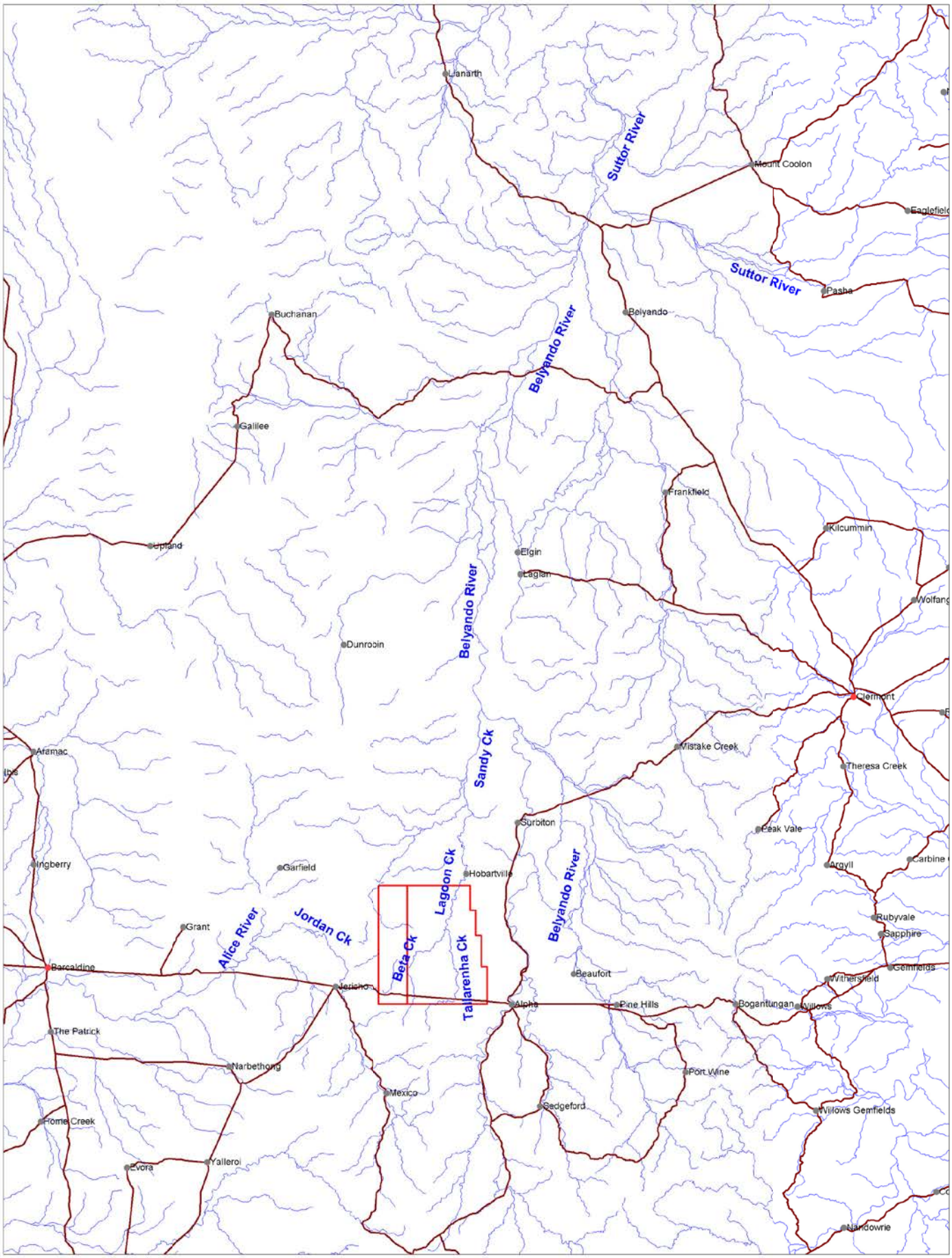
The south-western corner of the mine lease area drains to an un-named tributary of Jordan Creek which flows in a generally westerly direction into Jordan Creek approximately 10 km to the west of the proposed mine lease. Jordan Creek flows in a north-westerly direction and discharges into the Alice River approximately 40 km downstream of the mine drainage inflow location.

The waterways in the vicinity of the proposed Galilee Coal Mine are shown in Figure 2.1.

For the purpose of establishing draft Environmental Values, the receiving waterways of the Galilee Coal Mine are considered to be:

- Lagoon Creek downstream of the Galilee Coal Mine;
- Sandy Creek downstream of the Lagoon Creek confluence;
- Belyando River downstream of Sandy Creek confluence;
- Un-named tributary of Jordan Creek downstream of the Galilee Coal Mine; and
- Jordan Creek downstream of the Galilee Coal Mine.

It is unlikely that surface water discharges from the Galilee Coal Mine will have any impact on waterways downstream of these waterways.




GALILEE COAL PROJECT

Waratah Coal
THE NEW ENERGY IN COAL

Source: Roads & Waterways: Geoscience Australia 2010

Disclaimer: This plan is based on or contains data provided by others. Waratah Coal Pty Ltd (a) gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for direct marketing or be used in breach of privacy laws.

File: Waterway Plan.wor Date: 09/10/2012

N

0 10 20 30 40
Kilometres
A3 Scale: 1:1,000,000

Coordinate System: GDA 1994 MGA Zone 55 Projection: Transverse Mercator

Legend:
- Proposed Mine Lease
- Watercourse
- Highway/Main Road

**FIGURE 2.1**
Waterways in Vicinity of Galilee Coal Mine

# 3. METHODOLOGY FOR IDENTIFICATION OF ENVIRONMENTAL VALUES

Environmental Values are the qualities of waterways that need to be protected from the effects of pollution, waste discharges and other threats to ensure aquatic ecosystems are healthy and continue to provide essential ecosystem services, and waterways are safe for community use. Water Quality Objectives are long-term goals for water quality management for receiving waters to support and protect the designated EVs for those waters.

The establishment of EVs and WQOs for Queensland waters occurs under the Environmental Protection (Water) Policy 2009 and the supporting Queensland Water Quality Guidelines (DERM, 2009). These policies and guidelines help to achieve the objectives of the *Environmental Protection Act 1994* which are to protect Queensland's water environment while allowing for ecologically sustainable development.

The Queensland Government Guideline for Establishing Draft Environmental Values, Management Goals and Water Quality Objectives (DERM, 2011) provides a framework for the establishment of draft EVs and WQOs for Queensland waters. The Queensland water quality management framework is shown in Figure 3.1.

The potential Environmental Values of waters defined in the Environmental Protection (Water) Policy 2009 and the DERM Guideline for Establishing Draft Environmental Values, Management Goals and Water Quality Objectives are described in Table 3.1.

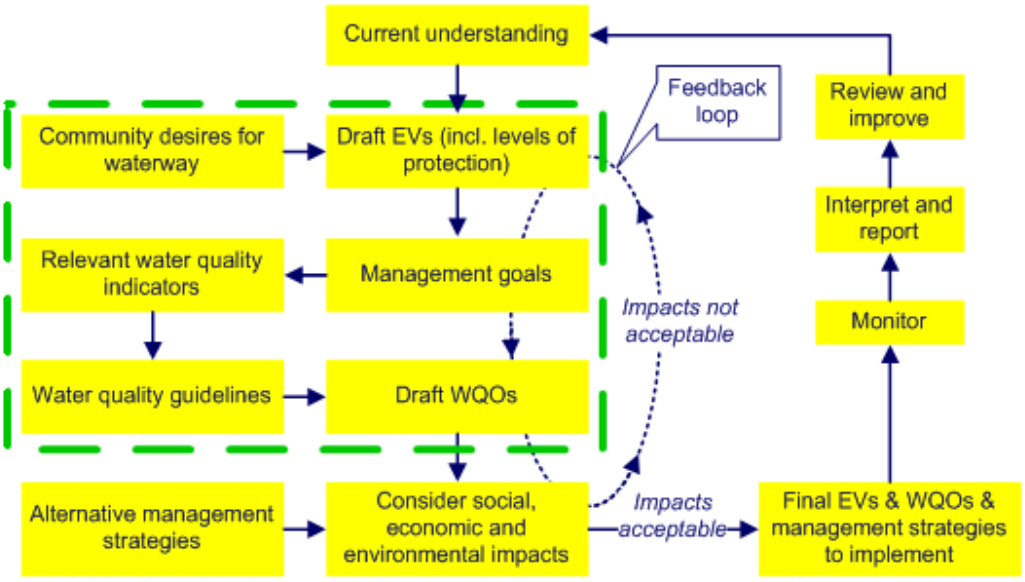



**Figure 3.1 Queensland water quality management framework (DERM, 2011)**

**Table 3.1: Potential Environmental Values for waters**

| Symbol | Environmental Value | Description |
|---|---|---|
|  | Aquatic ecosystems | The value of aquatic ecosystems, habitat and wildlife in or adjacent to waterways. |
|  | Irrigation | Suitability of water for irrigation of crops and pastures or watering of lawns, gardens and recreational areas. |
|  | Farm or property use | Suitability of water for farm use (e.g. milking sheds, piggeries, feedlots, fruit packing, vehicle and equipment wash-down) or property use other than drinking, irrigation or showers (e.g. laundry, toilet flushing, etc.). |
|  | Stock watering | Suitability of water for drinking by native animals and livestock. |
|  | Aquaculture | Suitability of water for aquaculture (e.g. fish, prawn or red claw farming). |
|  | Human consumption of aquatic foods | Water of such quality not to adversely affect the health of humans consuming aquatic foods (e.g. wild or stocked fish or crustaceans). |
|  | Primary recreation | Water of such quality not to adversely affect the health of humans during activities with direct contact of water (e.g. swimming, waterskiing, showers, etc.). |
|  | Secondary recreation | Water of such quality not to adversely affect the health of humans during activities with indirect contact of water (e.g. fishing, boating, canoeing, sailing, waterskiing, wading, etc.). |
|  | Visual appreciation | Aesthetic values of waterways for activities such as picnicking, bushwalking, sightseeing, camping, etc. |
|  | Drinking water | Suitability of water source for raw drinking water supply. |
|  | Industrial use | Suitability of water for industrial use (e.g. mining, power generation, manufacturing plants). |
|  | Cultural and spiritual values | Aesthetic, historical, scientific, social or other significance of water to past, present or future generations. |

The level of protection categories for aquatic ecosystems are defined in the Environmental Protection (Water) Policy 2009 as:

- High ecological value (HEV) – Waters in which the biological integrity of the water is effectively unmodified or highly valued. The management intent is to maintain natural values/condition.
- Slightly disturbed (SD) – Waters that have the biological integrity of high ecological value waters with slightly modified physical or chemical indicators but effectively unmodified biological indicators. The management intent is to maintain current condition and progressively improve towards HEV.
- Moderately disturbed (MD) – Waters in which the biological integrity of the water is adversely affected by human activity to a relatively small but measurable degree. The management intent is to maintain WQOs or improve current WQOs.
- Highly disturbed (HD) – Waters that are significantly degraded by human activity and have lower ecological value than high ecological value waters or slightly or moderately disturbed waters. The management intent is to progressively improve to achieve WQOs.

The Department of Environment and Heritage Protection (EHP) has a program for the development of EVs and WQOs for Queensland waterways. A number of waterway systems have had final EVs and WQOs adopted by the Queensland Government and these are included in Schedule 1 of the Environmental Protection (Water) Policy. The development of EVs and WQOs for the Burdekin River basin has commenced and is scheduled for completion by December 2013.

NQ Dry Tropics (natural resource management body responsible for the Burdekin Dry Tropics region) developed the Burdekin Water Quality Improvement Plan (Dight, 2009a,b) which included draft waterway EVs and WQOs for the 48 sub-catchments within the Burdekin River basin.

Draft EVs for the receiving waters of the Galilee Coal Mine have been identified based primarily on the findings of the Burdekin Water Quality Improvement Plan. A desktop review of known water uses has been undertaken to validate the draft EVs from the Burdekin Water Quality Improvement Plan.

# 4. BURDEKIN WATER QUALITY IMPROVEMENT PLAN

## 4.1 Overview

NQ Dry Tropics (natural resource management body responsible for the Burdekin Dry Tropics region) developed the Burdekin Water Quality Improvement Plan (Dight, 2009a,b). The Burdekin Water Quality Improvement Plan (BWQIP) represents a strategy that aims to reduce the loss of sediment, nutrients and pesticides from agricultural land within the Burdekin River catchment.

The BWQIP included the identification of draft waterway EVs for the 48 subcatchments within the Burdekin River basin. The draft EVs were identified through:

- Literature review and collation from other sources of information.
- Surveys and workshops involving community groups, traditional owners, scientists and resource managers.
- Community engagement activities.

The subdivision of the Burdekin River basin into 6 river sub-basins and 48 subcatchments is shown in Appendix A. The 6 sub-basins are:

- Upper Burdekin Basin;
- Cape Campaspe Basin;
- Belyando Basin;
- Suttor Bain;
- Bowen Broken Bogie Basin; and
- Lower Burdekin Basin.

## 4.2 Draft Environmental Values Specific to Galilee Coal Mine

The BWQIP identified draft EVs for the 48 subcatchments within the Burdekin River basin. The sub-catchments that are relevant to the receiving waterways of the Galilee Coal Mine are located within the Belyando River sub-basin and are:

- Sandy Creek (Subcatchment 27): Includes Lagoon Creek and Sandy Creek.
- Belyando Floodplain (Subcatchment 22): Includes Belyando River downstream of Sandy Creek.

The draft EVs identified for these subcatchments in the BWQIP were as follows:

**Sandy Creek:**

*The aquatic ecosystem values of the Sandy Creek subcatchment are poorly known and, while considered to be Slightly to Moderately Disturbed (SMD) as a consequence of the surrounding land use for cattle grazing, the biological communities are thought to remain in a healthy condition and ecosystem integrity is likely to be largely retained. No High Ecological Value (HEV) waters have been identified in the subcatchment. Little is known about the human use Environmental Values of the subcatchment, which are thought to be limited to use for stock watering, and the cultural and spiritual values of the Bidjara traditional owners.* (Dight, 2009b)

**Belyando Floodplain:**

*The aquatic ecosystem values of the Belyando Floodplain subcatchment are poorly known and, while considered to be Slightly to Moderately Disturbed (SMD) as a consequence of the surrounding land use for cattle grazing, the biological communities are thought to remain in a healthy condition and ecosystem integrity is likely to be largely retained. No High Ecological Value (HEV) waters have been identified in the subcatchment. Little is known about the human use Environmental Values of the Belyando Floodplain subcatchment, which are thought to be limited to use for irrigation, stock watering, drinking water, and the cultural and spiritual values of the Jangga traditional owners.* (Dight, 2009b)

Figures from the BWQIP showing the land use and draft EVs for these subcatchments are provided in Appendix A.

# 5. ENVIRONMENTAL VALUES

## 5.1 Uses of Water

A desktop assessment indicated the following water uses within the receiving waterways of the Galilee Coal Mine:

### 5.1.1 Aquatic Ecosystems

The receiving waterways of the Galilee Coal Mine are ephemeral in nature and provide seasonal habitat for aquatic fauna and flora. Wetlands mapping for the receiving waterways is provided in Appendix B and indicates the presence of wetlands or remnant ecosystems that may contain wetlands along sections of all receiving waterways.

The receiving waterways are considered to be slightly to moderately disturbed from current grazing activities and do not contain any High Ecological Value waters.

### 5.1.2 Irrigation

Surface water licenses within the Belyando and Suttor River basins were mapped for the Alpha Coal Project Supplementary EIS (Parsons Brinckerhoff, 2011) and are shown in Appendix C. The Alpha Coal Mine is proposed to be developed by Hancock Coal immediately to the north of the Galilee Coal Mine.

There are no surface water licenses along Lagoon Creek or Sandy Creek. There are a number of surface water licenses attached to properties along the Belyando River up-gradient of the Galilee Coal Mine. The surface water licenses along the Belyando River downstream of the Galilee Coal Mine are listed in Table 5.1. These licenses include water extraction for irrigation use.

**Table 5.1: Surface water licenses along Belyando River downstream of the Galilee Coal Mine**

| License Number | License Type | Purpose | Property Description |
|---|---|---|---|
| 48434F | License to take water | Domestic Supply | L1/PER207046 |
| 55005A | License to take water | Irrigation | L3/SP112964 |
| 55006A | License to interfere by impounding – Embankment or Wall | Impound Water | L3/SP112964 |
| 96640A | License to take water | Irrigation, Waterharvesting | L3/SP112964 |

### 5.1.3 Farm or Property Use

With cattle grazing as the dominant land use in the catchments of the receiving waterways, it is unlikely that water is extracted from the waterways for farm uses such as milking sheds, piggeries, feedlots or fruit packing.

### 5.1.4 Stock Watering

With cattle grazing as the dominant land use in the catchments of the receiving waterways, it is likely that stock have access to the receiving waterways for watering purposes.

### 5.1.5 Aquaculture

No commercial aquaculture activities are known to occur along the receiving waterways.

### 5.1.6 Human Consumption of Aquatic Foods

It is unlikely that human consumption of aquatic foods sourced from the receiving waterways occurs to any significant degree.

### 5.1.7 Primary Recreation

There are no known recreational facilities along the receiving waterways where primary contact with water is likely to occur frequently (e.g. swimming, waterskiing, etc.). Stormwater discharges from the mine will flow into Jordan Creek downstream of the township of Jericho and primary recreational uses of this section of the waterway are not expected.

### 5.1.8 Secondary Recreation

Given the ephemeral nature of the receiving waterways and the limited public access to the waterways, secondary recreational uses of the waterways (e.g. fishing, boating, etc.) is not expected to occur to any significant degree.

### 5.1.9 Visual Appreciation

Given the ephemeral nature of the receiving waterways and the limited public access to the waterways, there is expected to be limited community appreciation of the aesthetic values of the receiving waterways. Activities such as bushwalking, sightseeing, picnicking, and camping are not common along the receiving waterways.

### 5.1.10 Drinking Water

It is relatively common for riparian pastoral landholders to supplement normal drinking water supplies (i.e. rainwater tanks) during dry periods by accessing groundwater contained in river bed sands/gravels using spear pumps. The extraction of water from

river bed sands/gravels is most likely to occur along the Belyando River. License Number 48434F authorises the license holder to extract surface water from the Belyando River for domestic purposes.

### 5.1.11 Industrial Use

There a number of new coal mining projects proposed within the Galilee Basin. These include the Alpha Coal Mine and Kevin's Corner Coal Mine which are proposed to be developed by Hancock Coal to the north (downstream) of the Galilee Coal Mine. The extraction of water from the receiving waterways (Lagoon Creek and Sandy Creek) for industrial use is not proposed for any of the downstream mining projects.

### 5.1.12 Cultural and Spiritual Values

The Burdekin Water Quality Plan identified the cultural and spiritual values of the receiving waterways by the Bidjara and Jangga traditional owners.

## 5.2 Draft Environmental Values

The desktop review of waterway uses for the receiving waterways of the Galilee Coal Mine confirmed the suitability of the draft Environmental Values identified in the Burdekin Water Quality Improvement Plan for the Sandy Creek and Belyando Floodplain subcatchments. These EVs are summarised in Table 5.2. Draft EVs for the receiving waterways in the Cooper Creek basin are assumed to be the same as those identified for the Sandy Creek subcatchment.

**Table 5.2: Draft Environmental Values for receiving waterways of Galilee Coal Mine**

| Symbol | Environmental Value | Lagoon Creek & Sandy Creek[1] | Belyando River[2] | Jordan Creek and Tributary[3] |
|---|---|---|---|---|
|  | Aquatic ecosystems (slightly to moderately disturbed) | ✓ | ✓ | ✓ |
|  | Irrigation | X | ✓ | X |
|  | Farm or property use | X | X | X |
|  | Stock watering | ✓ | ✓ | ✓ |
|  | Aquaculture | X | X | X |
|  | Human consumption of aquatic foods | X | X | X |
|  | Primary recreation | X | X | X |
|  | Secondary recreation | X | X | X |
|  | Visual appreciation | X | X | X |
|  | Drinking water | X | ✓ | X |
|  | Industrial use | X | X | X |
|  | Cultural and spiritual values | ✓ | ✓ | ✓ |

[1] Draft EVs for Sandy Creek subcatchment in Burdekin Water Quality Improvement Plan.

[2] Draft EVs for Belyando Floodplain subcatchment in Burdekin Water Quality Improvement Plan.

[3] Draft EVs assumed to be the same as those identified for the Sandy Creek subcatchment.

# 6. CONCLUSIONS

Draft Environmental Values have been identified for the following receiving waterways of the Galilee Coal Mine:

- Lagoon Creek downstream of the Galilee Coal Mine;
- Sandy Creek downstream of the Lagoon Creek confluence;
- Belyando River downstream of Sandy Creek confluence;
- Un-named tributary of Jordan Creek downstream of the Galilee Coal Mine; and
- Jordan Creek downstream of the Galilee Coal Mine.

The Department of Environment and Heritage Protection is currently performing an Environmental Values identification study for the Burdekin River basin which is due for completion in December 2013. Draft Environmental Values for the Burdekin River basin were established by NQ Dry Tropics in 2009 as part of the Burdekin Water Quality Improvement Plan. A desktop review of water uses within the receiving waterways of the Galilee Coal Mine has confirmed the suitability of the draft Environmental Values identified in the Burdekin Water Quality Improvement Plan.

The draft Environmental Values identified for the Galilee Coal Mine are:

- Lagoon Creek, Sandy Creek, tributary of Jordan Creek and Jordan Creek: aquatic ecosystems (slightly to moderately disturbed), stock watering, and cultural and spiritual values.
- Belyando River: aquatic ecosystems (slightly to moderately disturbed), stock watering, irrigation, drinking water, and cultural and spiritual values.

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# 8. REFERENCES

Dight, I (2009a). *Burdekin Water Quality Improvement Plan*. NQ Dry Tropics. Townsville. 2009.

Dight, I (2009b). Burdekin Water Quality Improvement Plan Catchment Atlas. NQ Dry Tropics. Townsville. 2009.

DERM (2009). *Queensland Water Quality Guidelines*. Version 3. ISBN 978-0-9806986-0-2. Department of Environment and Resource Management. September 2009.

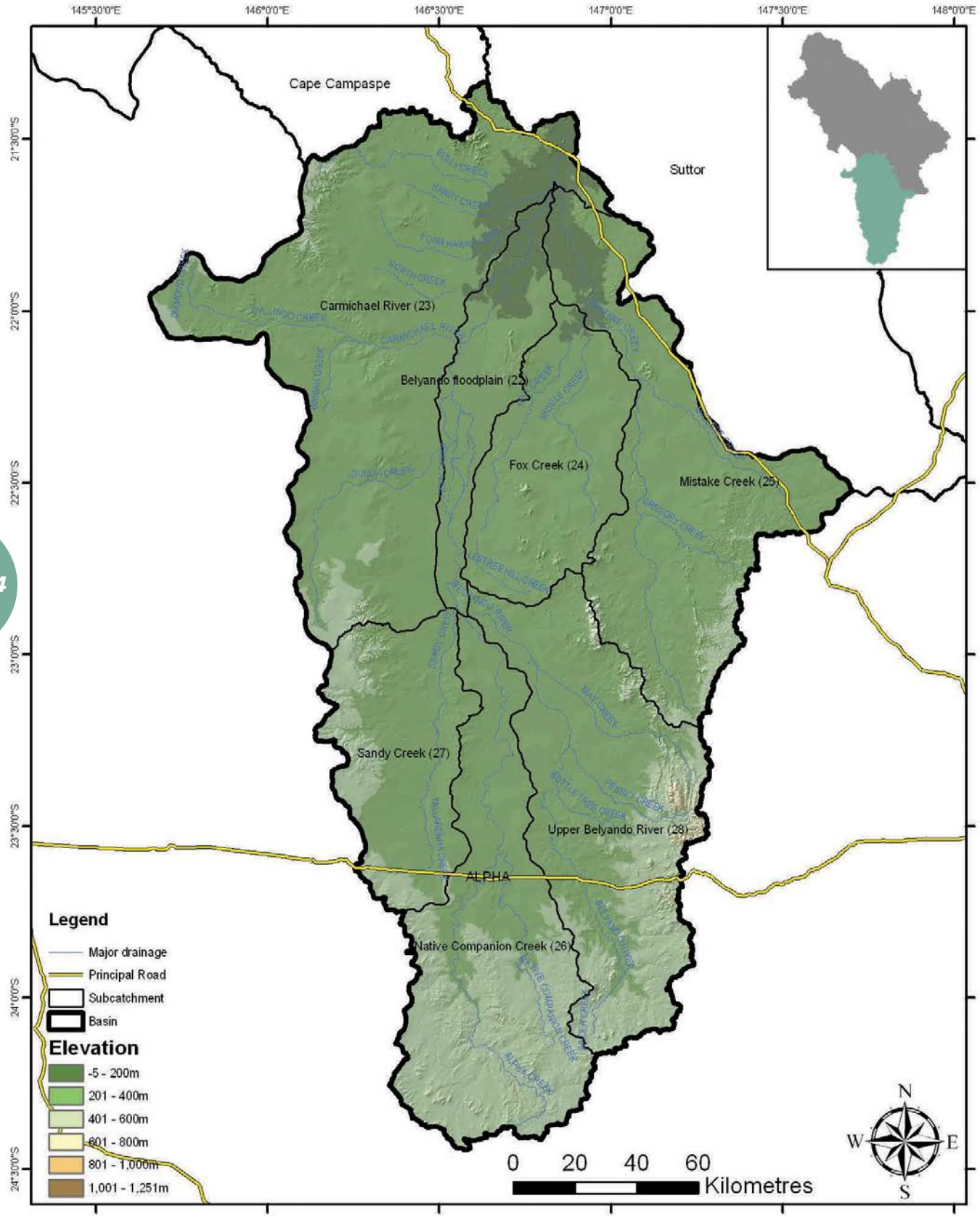
DERM (2011). *Establishing Draft Environmental Values, Management Goals and Water Quality Objectives*. Guideline: Resource Assessment. Department of Environment and Resource Management. 28 March 2011.

Parsons Brinckerhoff (2011). *Alpha Coal Project – Site water management system and water balance technical report.* Appendix L of Alpha Coal Project Supplementary Environmental Impact Statement. Report to Hancock Coal Pty Ltd. 11 April 2011.

# APPENDIX A

## Figures from Burdekin Water Quality Improvement Plan

# TERRAIN OF THE BELYANDO BASIN



CATCHMENT ATLAS

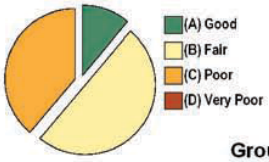
# Sandy Creek
## SUBCATCHMENT 27

**Total area:**
3,187 sq km
9% of Belyando Basin
2.4% of Burdekin WQIP region

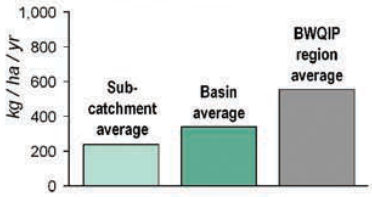
### Vital Statistics


**Total Soil Loss**
*73,676 t / yr **

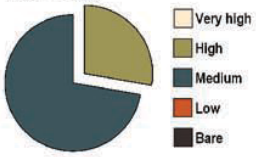

**Land Condition**
*2004 - 2007*




**Rate of Soil Erosion**
*239 kg / ha / yr **




**Ground Cover**
*2004 - 2007*




* Estimated from SedNet modelling by CSIRO

## RESOURCE CONDITION SUMMARY

Sandy Creek is a medium sized subcatchment where land use is dominated by grazing on natural and modified pastures[1]. Approximately 5% of the land area is set aside for conservation and minimal use. The condition of riparian habitat in this subcatchment has undergone a major decline over the last 30 years, principally as a result of widespread floodplain and riparian clearing along the main channel, anabranches and headwater streams, and is currently assessed to be very poor (D)[2]. Very little is known about the ecology and condition of aquatic habitats in the subcatchment, with even basic knowledge on the number and location of permanent or significant water bodies not recorded. The waterways are understood to include numerous channel and off-channel water bodies that are likely to be highly and persistently turbid[3].

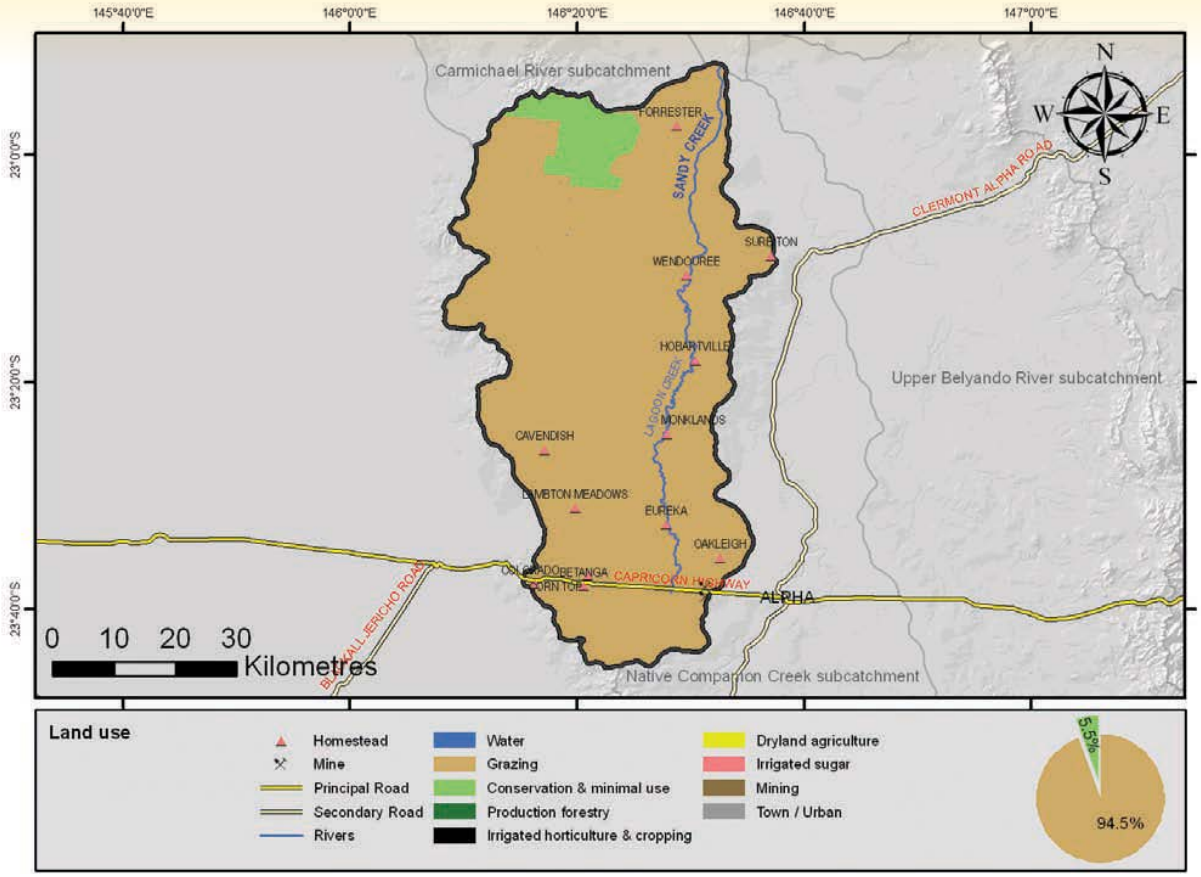
Hillslope erosion is identified by models as the major source of sediment and particulate nutrients affecting water quality within Sandy Creek subcatchment, while gully erosion is also identified as a significant contributor to the total sediment load[4]. The rate of soil erosion is predicted to be quite low and below the Basin average, while the total soil loss to subcatchment waterways is also comparatively low. Field surveys of grazing land identify high proportions in fair (B) and poor (C) condition, while good (A) condition land is also apparent[5,6]. This is also reflected in the rapid ground cover assessment (2004-07). Analysis of ground cover from satellite imagery[7] identifies areas of vulnerable and marginal 'D' condition land in the southern half of the subcatchment. The mean ground cover across the entire subcatchment declined substantially from 89% in 1997 to 53% in 2004, and had only recovered to 67% in 2006 when areas of poor ground cover were common[8].

Water quality in the Sandy Creek subcatchment is predicted by models to have only slightly elevated suspended sediment concentrations and loads during wet season event flows[4]. There are no water quality monitoring data with which to compare the modelled concentrations and loads.

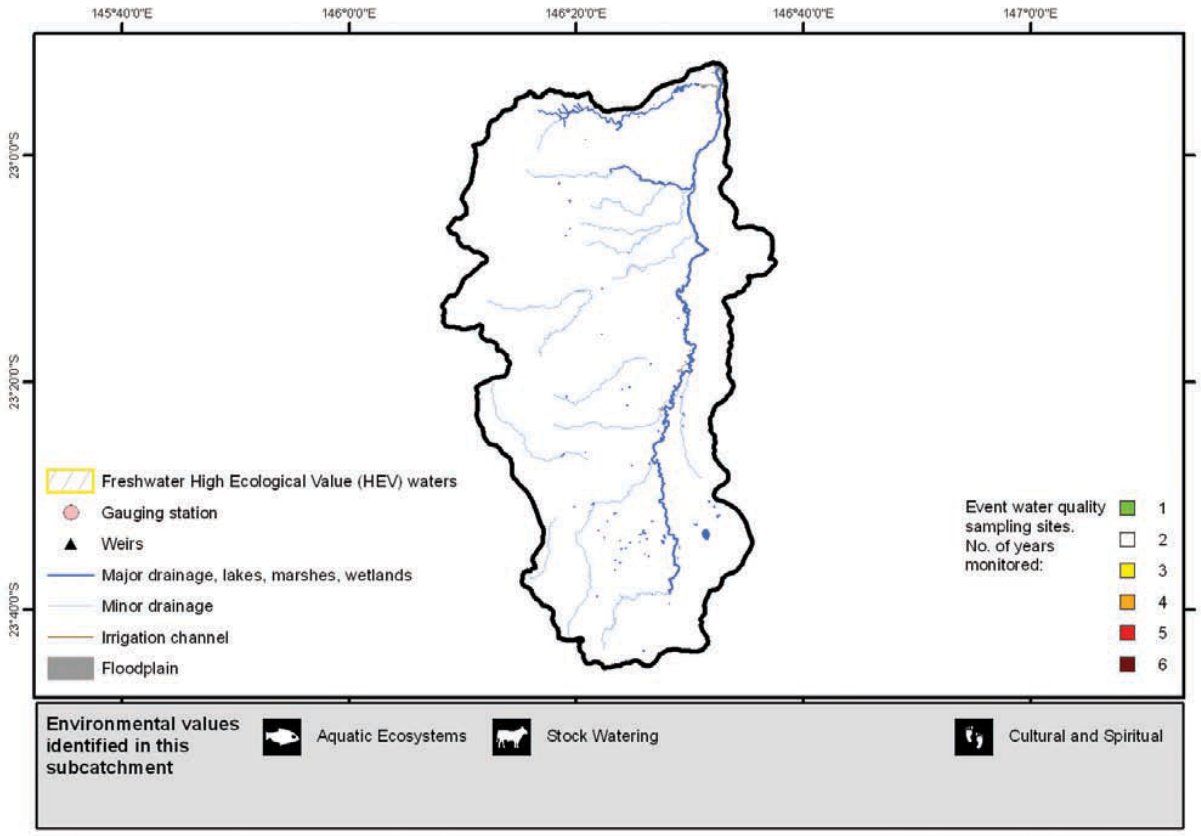
### Draft Environmental Values

The aquatic ecosystem values of the Sand Creek subcatchment are poorly known and, while considered to be Slightly to Moderately Disturbed (SMD) as a consequence of the surrounding land use for cattle grazing, the biological communities are thought to remain in a healthy condition and ecosystem integrity is likely to be largely retained. No High Ecological Value (HEV) waters have been identified in the subcatchment. Little is known about the human use Environmental Values of the subcatchment, which are thought to be limited to use for stock watering, and the cultural and spiritual values of the Bidjara traditional owners.

## LAND USE




## DRAFT ENVIRONMENTAL VALUES OF WATER



CATCHMENT ATLAS

# Belyando Floodplain

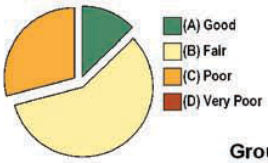
## SUBCATCHMENT 22

**Total area:**
2,029 sq km
5.7% of Belyando Basin
1.5% of Burdekin WQIP region

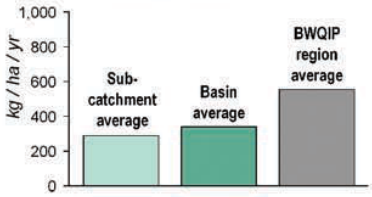
### Vital Statistics


**Total Soil Loss**
*142,015 t / yr **

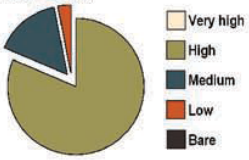

**Land Condition**
*2004 - 2007*




**Rate of Soil Erosion**
*289 kg / ha / yr **




**Ground Cover**
*2004 - 2007*




* Estimated from SedNet modelling by CSIRO

## RESOURCE CONDITION SUMMARY

Belyando Floodplain is a relatively small subcatchment where land use is exclusively grazing on both native and modified pastures[1]. The condition of riparian habitat in the subcatchment has deteriorated over the last 30 years, principally as a result of clearing along the main and anabranching channels, and is currently assessed to be in poor (C)[2]. The subcatchment is a multiple channel, low velocity floodplain which contains many off-channel, turbid water bodies. Very liattle is known about the ecology and condition of aquatic habitats; no known aquatic studies have been conducted in this subcatchment[3].

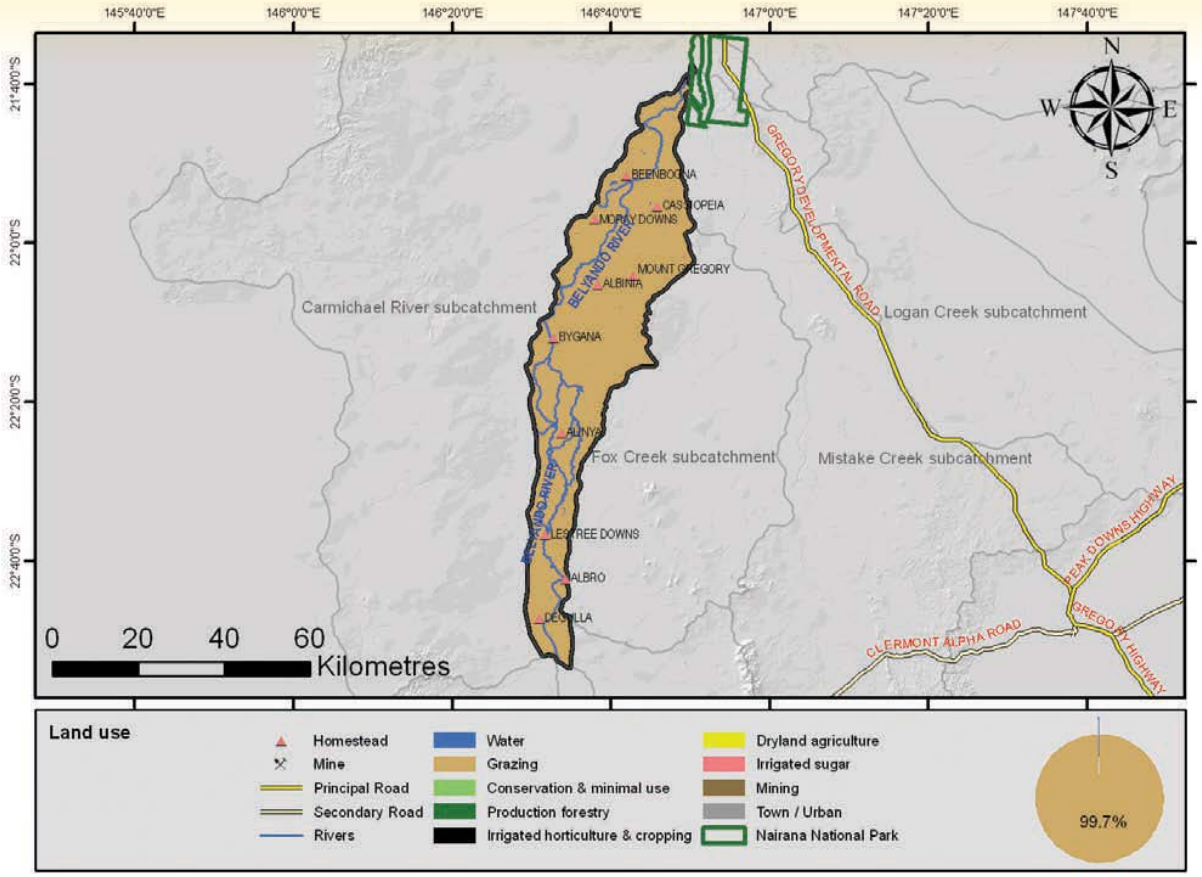
Hillslope, gully and stream bank erosion are all identified by models as major sources of sediment and particulate nutrients affecting water quality within the Belyando Floodplain subcatchment[4]. The rate of soil erosion is predicted to be low and below the basin average, while the total soil loss to subcatchment waterways is also comparatively low. Field surveys of grazing land identify a high proportion to be in fair (B) condition, while both poor (D) and good (A) condition land is also common[5,6]. This is not well reflected in the rapid ground cover assessment (2004-07). Analysis of ground cover from satellite imagery[7,8] show that the mean ground cover across the entire subcatchment declined substantially from 90% in 2000 to 56% in 2004, and had only recovered to 72% in 2006 when areas of poor ground cover were common.

Water quality in the Belyando Floodplain subcatchment is predicted by models to have only slightly elevated suspended sediment concentrations and loads during wet season event flows[4]. However, there are no water quality monitoring data with which to compare the modelled concentrations and loads. The sediment load at end-of-catchment is derived not only from this subcatchment, but also from others entering upstream.

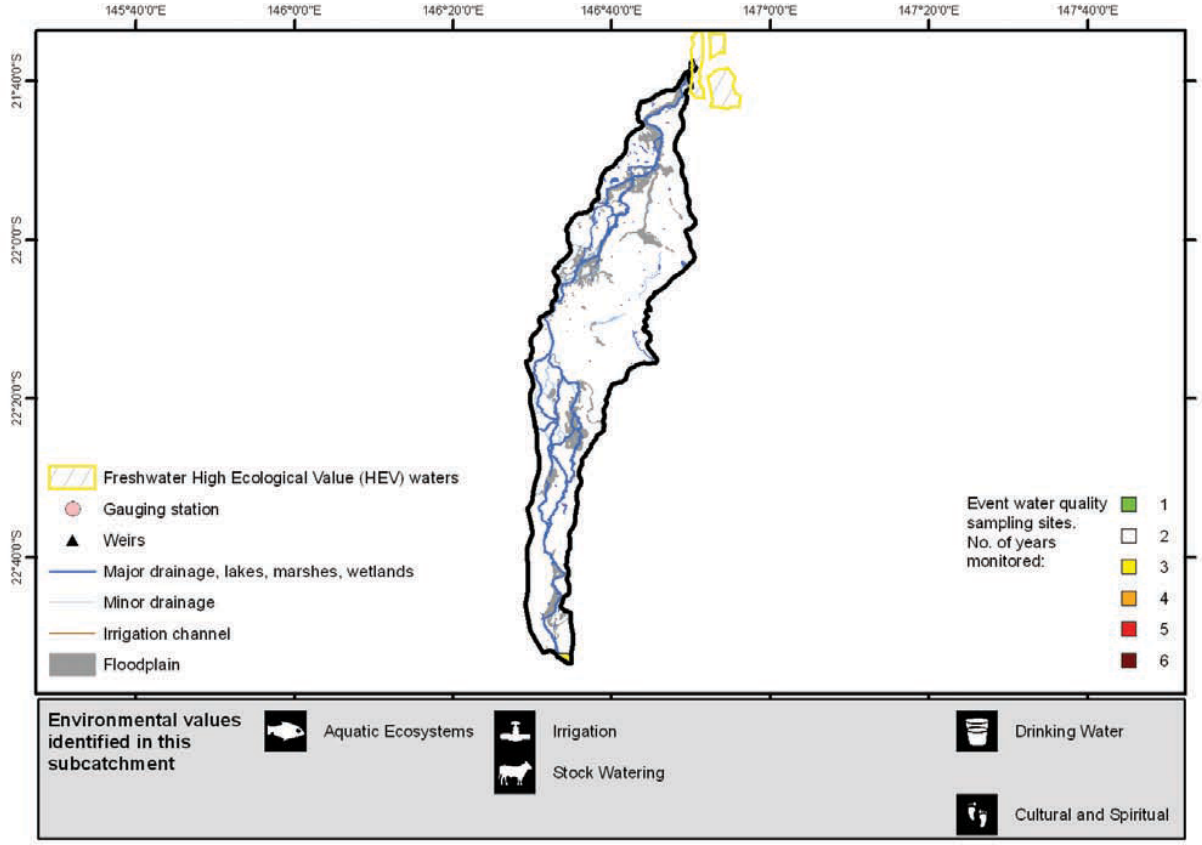
### Draft Environmental Values

The aquatic ecosystem values of the Belyando Floodplain subcatchment are poorly known and, while considered to be Slightly to Moderately Disturbed (SMD) as a consequence of the surrounding land use for cattle grazing, the biological communities are thought to remain in a healthy condition and ecosystem integrity is likely to be largely retained. No High Ecological Value (HEV) waters have been identified in the subcatchment. Little is known about the human use Environmental Values of the Belyando Floodplain subcatchment, which are thought to be limited to use for irrigation, stock watering, drinking water, and the cultural and spiritual values of the Jangga traditional owners.

## LAND USE




## DRAFT ENVIRONMENTAL VALUES OF WATER



# APPENDIX B

## Queensland Wetlands Mapping

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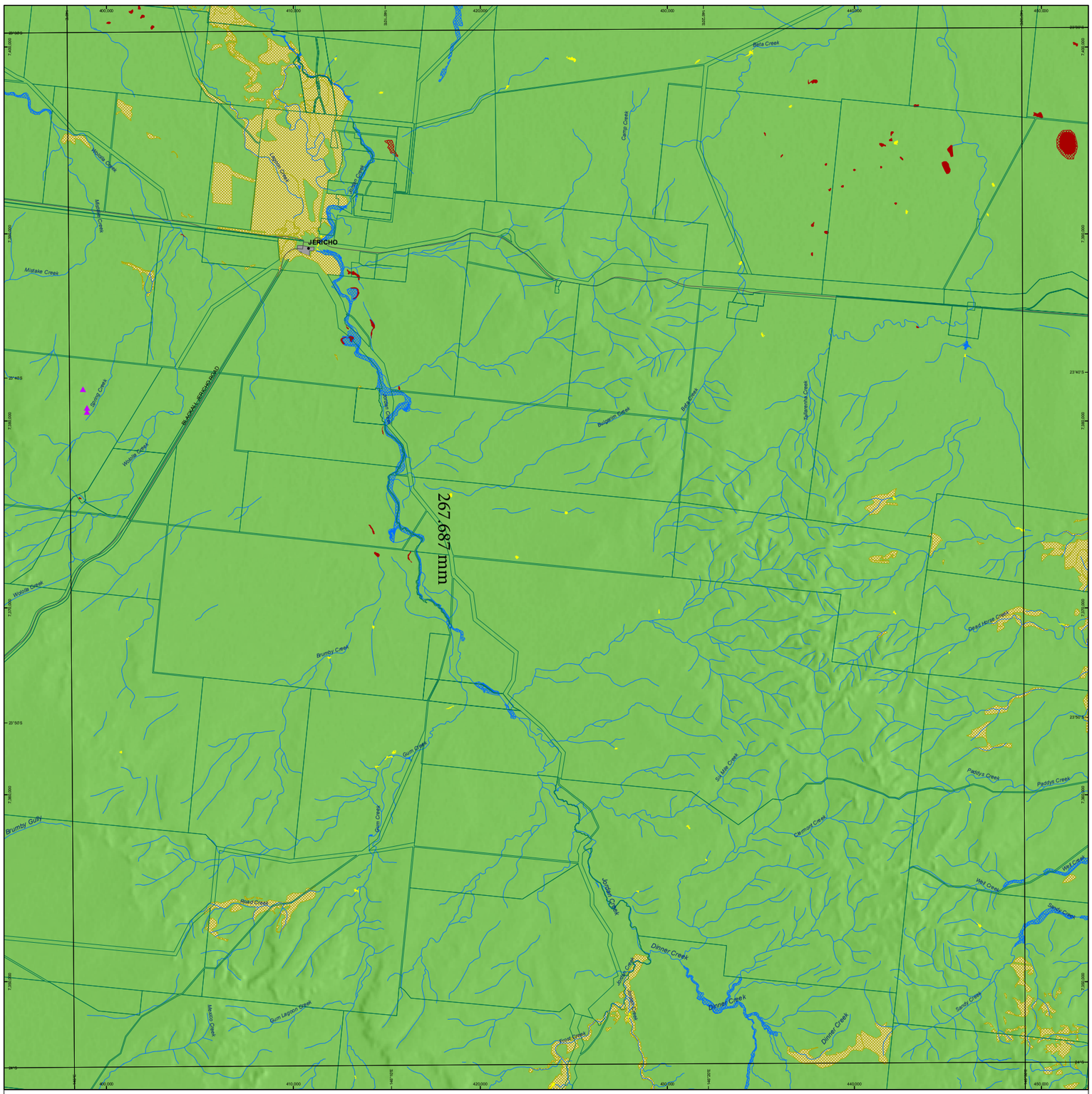


## Water bodies and Wetland Regional Ecosystems

**Water bodies**

**Wetland Regional Ecosystem**

**Marine system** (e.g. open ocean) Open ocean extending to the Queensland 3 nautical mile coastal limit. Includes shallow coastal indentations or bays without appreciable freshwater inflows, and coasts that are exposed to oceanic waves and currents. Water regimes are determined primarily by oceanic tides.

**Estuarine system** (e.g. mangroves, salt flats and estuaries) Includes wetlands with oceanic water that are significantly diluted with freshwater derived from land drainage.

**Riverine system** (e.g. river and creek channels) Wetlands and deepwater habitats contained within a channel. Due to scale constraints these areas may include fringing palustrine vegetation.

**Lacustrine system** (e.g. lakes) Wetlands and deepwater habitats situated in a topographic depression or a dammed river channel. Includes areas where emergent perennial vegetation has less than 30% areal coverage and total waterbody area exceeds 8 ha.

**Palustrine system** (e.g. vegetated swamps) Wetlands dominated by persistent emergent vegetation or where water in deepest part of the basin is less than 2 m, active wave formed shores or bedrock features are lacking.

**Wetland point features** (e.g. springs, rockholes)

**Riverine system (drainage lines)**

**Areas that may include wetlands**

**Remnant regional ecosystem 51 -80% wetland (mosaic units)**

**Remnant regional ecosystem 1 -50% wetland (mosaic units)**

*The above descriptions are an abbreviated version of the full descriptions in the Wetland Mapping and Classification Methodology <www.wetlandinfo.derm.qld.gov.au>*

**Wetlands**

For the purposes of mapping and classification, wetlands are:
"areas of permanent or periodic/intermittent inundation, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed 6 m. To be a wetland the area must have one or more of the following attributes:

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ii. *the substratum is predominantly undrained soils that are saturated, flooded or ponded long enough to develop anaerobic conditions in the upper layers, or*
iii. *the substratum is not soil and is saturated with water, or covered by water at some time."*

### Other features

- Towns
- Roads
- Cadastral boundaries (>0.5 sq km area)
- Built-up areas of Queensland
- Ocean outside 3 nautical mile limit
- Land at least 1 km outside of Queensland

# Queensland Wetlands 2009

## MAP SERIES VERSION 3.0

**JERICHO**
8150

N

Horizontal Datum: GDA 1994

Projection: Map Grid of Australia 1994 (MGA94 Zone 55)

0 2 4 6 8 10
Kilometres

Scale 1:100 000 at A1 size





Further information on wetland mapping (including methodology and digital data) is available from <www.wetlandinfo.derm.qld.gov.au>

**Accuracy information:** The positional accuracy of wetland data mapped at a scale of 1:100 000 is +/-100 m with a minimum polygon size of 5 ha or 75 m wide for linear features, except for areas along the east coast which are mapped at the 1:50 000 scale with a positional accuracy of +/-50 m, with a minimum polygon size of 1 ha or 35 m wide for linear features. Wetlands smaller than 1 ha are not delineated on the wetland data. Consideration of the effects of mapped scale is necessary when interpreting data at a larger scale, e.g. 1:25 000. For property assessment, digital linework should be used as a guide only. The extent of wetlands depicted on this map is based on rectified 2009 Landsat ETM+ imagery supplied by Statewide Landcover and Trees Study (SLATS), Department of Environment and Resource Management (DERM). The extent of water bodies is based on the maximum extent of inundation derived from available Landsat imagery up to and including the 2009 imagery.

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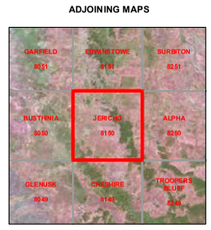
**Date of map production: November 2011** © The State of Queensland (Department of Environment and Resource Management) 2011

### ADJOINING MAPS

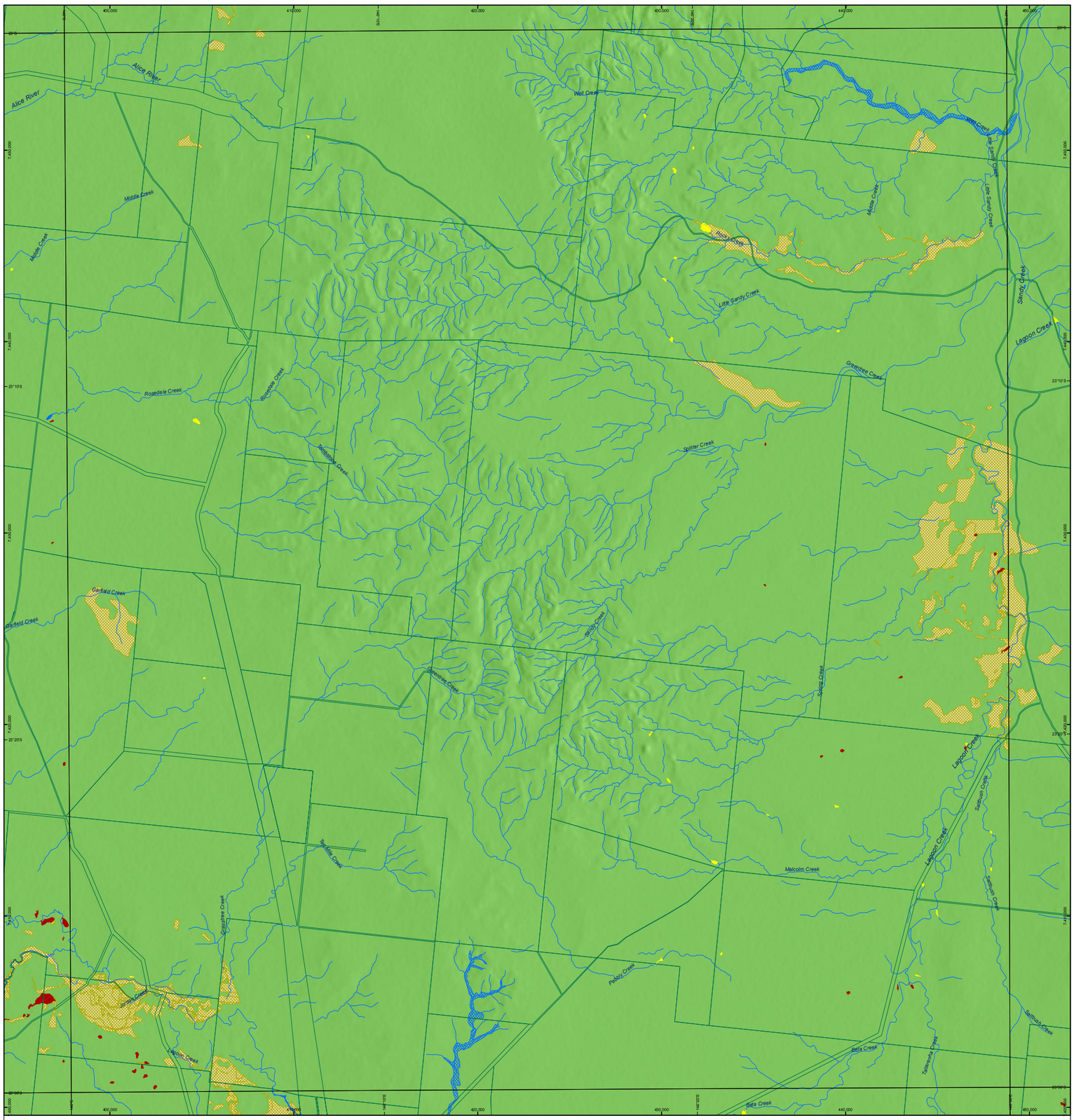



### MAP LOCATION IN QUEENSLAND


Australian Government

Queensland Government

Queensland Wetlands Program

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**Water bodies**

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**Riverine system (drainage lines)**

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### Other features

- Towns
- Roads
- Cadastral boundaries (>0.5 sq km area)
- Built-up areas of Queensland
- Ocean outside 3 nautical mile limit
- Land at least 1 km outside of Queensland

# Queensland Wetlands 2009

## MAP SERIES VERSION 3.0

## EDWINSTOWE
## 8151

N

Horizontal Datum: GDA 1994

Projection: Map Grid of Australia 1994 (MGA94 Zone 55)

0 2 4 6 8 10

Kilometres

Scale 1:100 000 at A1 size





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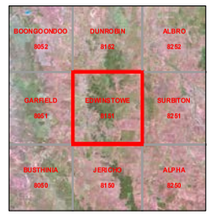
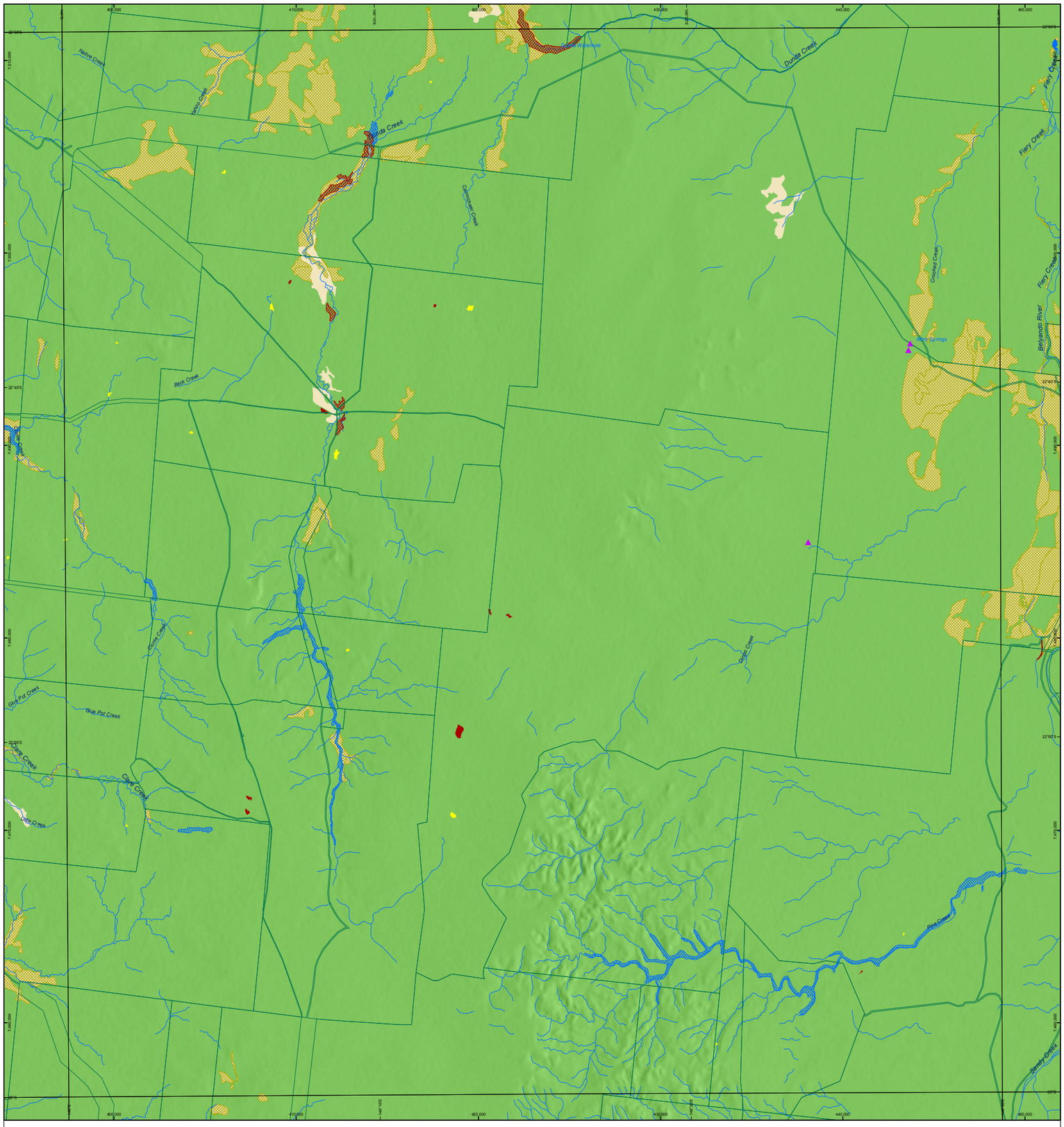



### MAP LOCATION IN QUEENSLAND


Australian Government

Queensland Government

Queensland Wetlands Program




## Water bodies and Wetland Regional Ecosystems

| Water bodies | Wetland Regional Ecosystem | |
|---|---|---|
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| | | **Wetland point features** (e.g. springs, rocklndes) |
| | | **Riverine system (drainage lines)** |

**Areas that may include wetlands**

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- Roads
- Cadastral boundaries (>0.5 sq km area)
- Built-up areas of Queensland
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- Land at least 1 km outside of Queensland

# Queensland Wetlands 2009

## MAP SERIES VERSION 3.0

## DUNROBIN
## 8152

N

Horizontal Datum: GDA 1994

Projection: Map Grid of Australia 1994 (MGA94 Zone 55)

0 2 4 6 8 10

Kilometres

Scale 1:100 000 at A1 size





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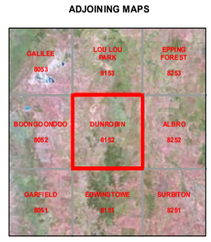
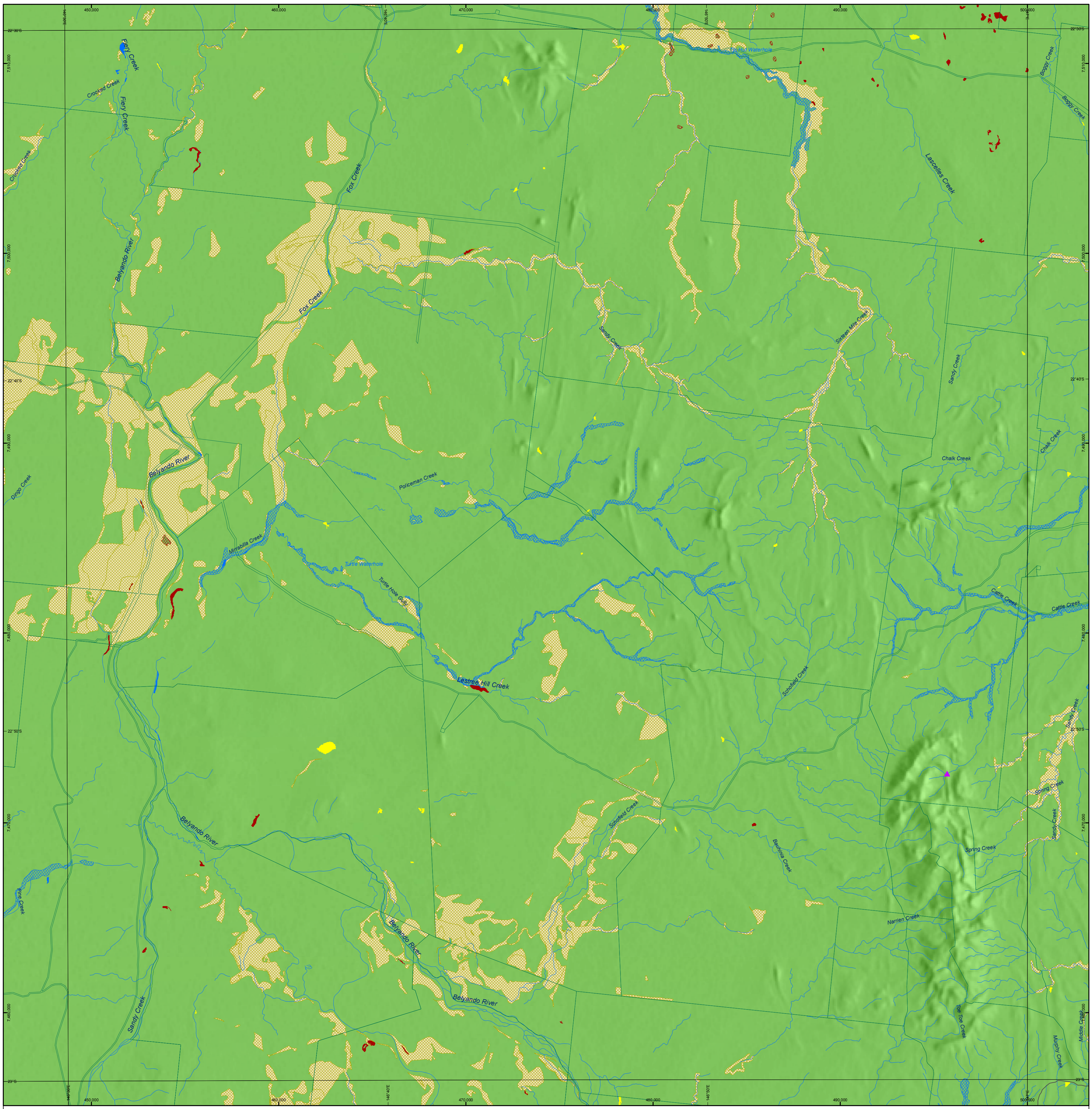



**MAP LOCATION IN QUEENSLAND**


Australian Government

Queensland Government

Queensland Wetlands Program



# Queensland Wetlands 2009

MAP SERIES VERSION 3.0

ALBRO
8252

Horizontal Datum: GDA 1994
Projection: Map Grid of Australia 1994 (MGA94 Zone 55)

0 2 4 6 8 10
Kilometres
Scale 1:100 000 at A1 size

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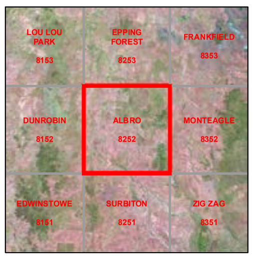
ADJOINING MAPS



MAP LOCATION IN QUEENSLAND

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**Areas that may include wetlands**

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|---|---|---|---|
| ● | Towns | ▨ | Built-up areas of Queensland |
| — | Roads | 🟦 | Ocean outside 3 nautical mile limit |
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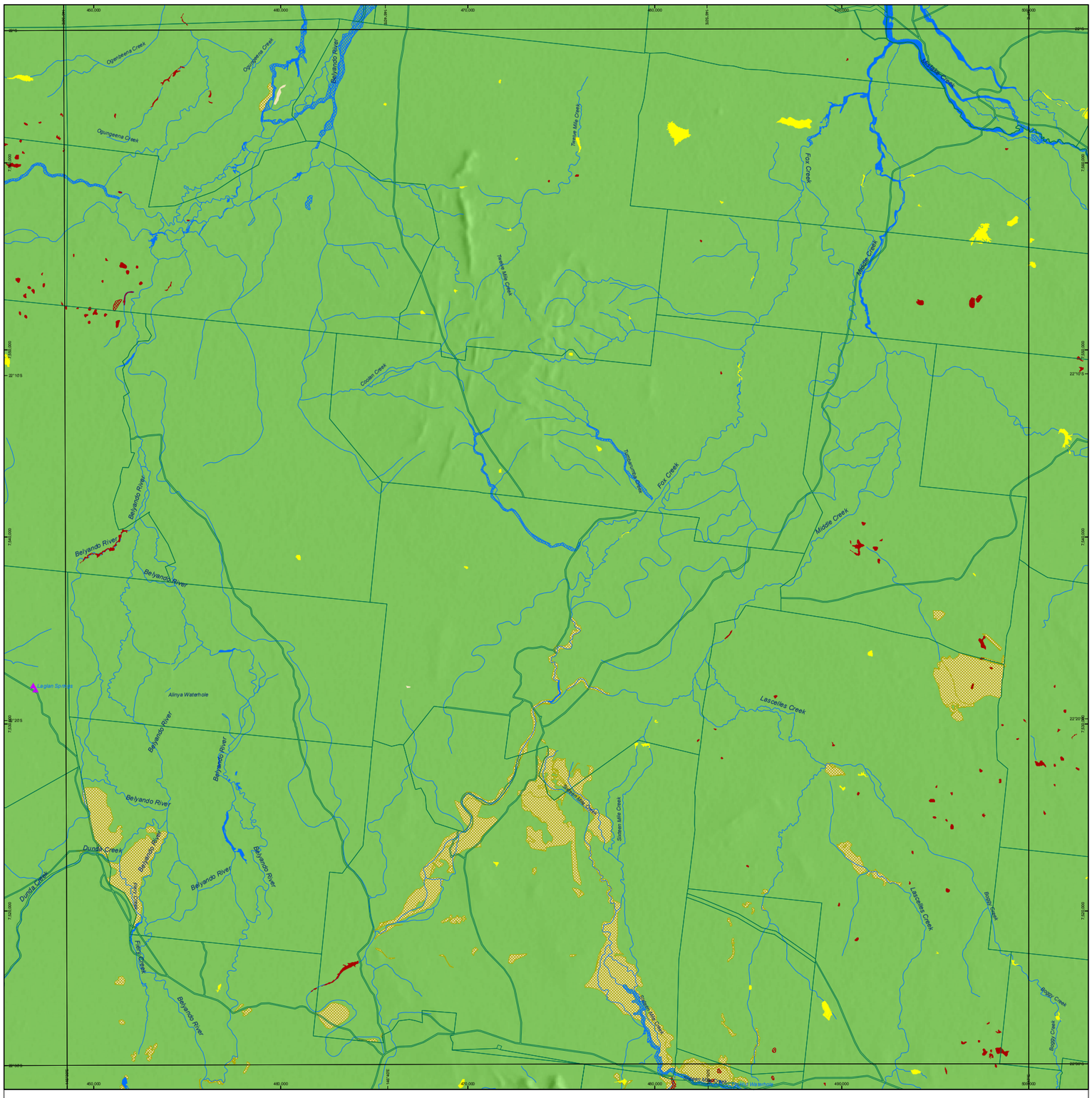
Australian Government
Queensland Government

Queensland
Wetlands Program

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**Wetland Regional Ecosystem**

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- **Estuarine system** (e.g. mangroves, salt flats and estuaries) Includes wetlands with oceanic water that are significantly diluted with freshwater derived from land drainage.
- **Riverine system** (e.g. river and creek channels) Wetlands and deepwater habitats contained within a channel. Due to scale constraints these areas may include fringing palustrine vegetation.
- **Lacustrine system** (e.g. lakes) Wetlands and deepwater habitats situated in a topographic depression or a dammed river channel. Includes areas where emergent perennial vegetation has less than 30% areal coverage and total waterbody area exceeds 8 ha.
- **Palustrine system** (e.g. vegetated swamps) Wetlands dominated by persistent emergent vegetation or where water in deepest part of the basin is less than 2 m, active wave formed shores or bedrock features are lacking.
- **Wetland point features** (e.g. springs, rockholes)
- **Riverine system (drainage lines)**

**Areas that may include wetlands**

- **Remnant regional ecosystem 51 -80% wetland (mosaic units)**
- **Remnant regional ecosystem 1 -50% wetland (mosaic units)**

*The above descriptions are an abbreviated version of the full descriptions in the Wetland Mapping and Classification Methodology <www.wetlandinfo.derm.qld.gov.au>*

**Wetlands**

For the purposes of mapping and classification, wetlands are:

"areas of permanent or periodic/intermittent inundation, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed 6 m. To be a wetland the area must have one or more of the following attributes:

i. *at least periodically the land supports plants or animals that are adapted to and dependent on living in wet conditions for at least part of their life cycle, or*
ii. *the substratum is predominantly undrained soils that are saturated, flooded or ponded long enough to develop anaerobic conditions in the upper layers, or*
iii. *the substratum is not soil and is saturated with water, or covered by water at some time."*

**Other features**

- Towns
- Roads
- Cadastral boundaries (>0.5 sq km area)
- Built-up areas of Queensland
- Ocean outside 3 nautical mile limit
- Land at least 1 km outside of Queensland

# Queensland Wetlands 2009

## MAP SERIES VERSION 3.0

## EPPING FOREST
## 8253

N

Horizontal Datum: GDA 1994

Projection: Map Grid of Australia 1994 (MGA94 Zone 55)

0 2 4 6 8 10

Kilometres

Scale 1:100 000 at A1 size


Further information on wetland mapping (including methodology and digital data) is available from <www.wetlandinfo.derm.qld.gov.au>

**Accuracy infomation:** The positional accuracy of wetland data mapped at a scale of 1:100 000 is +/-100 m with a minimum polygon size of 5 ha or 75 m wide for linear features, except for areas along the east coast which are mapped at the 1:50 000 scale with a positional accuracy of +/-50 m, with a minimum polygon size of 1 ha or 35 m wide for linear features. Wetlands smaller than 1 ha are not delineated on the wetland data. Consideration of the effects of mapped scale is necessary when interpreting data at a larger scale, e.g. 1:25 000. For property assessment, digital linework should be used as a guide only. The extent of wetlands depicted on this map is based on rectified 2009 Landsat ETM+ imagery supplied by Statewide Landcover and Trees Study (SLATS), Department of Environment and Resource Management (DERM). The extent of water bodies is based on the maximum extent of inundation derived from available Landsat imagery up to and including the 2009 imagery.

**Data sources:** Water body mapping derived from satellite imagery, DERM; Regional Ecosystem mapping, DERM; drainage mapping, Geoscience Australia (GA), Department of Defence and DERM; roads, MapInfo Australia Pty Ltd, 2006; towns and built-up areas, GA, 2003; coastline, GA, 2004; Queensland 3NM Limit, Australian Maritime Boundaries Information System (AMBIS), GA, 2001; Digital Cadastral Database (DCDB), DERM, July 2011; springs database, Queensland Herbarium, 2011; SRTM 90 m DEM, USGS/NASA, 2006. Landsat ETM+ imagery supplied by the Australian Centre for Remote Sensing (ACRES), Australian Surveying and Land Information Group (AUSLIG), Canberra. The satellite imagery used in this product has been pre-processed by SLATS, DERM.

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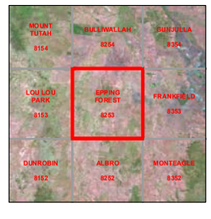
**Date of map production: November 2011** © The State of Queensland (Department of Environment and Resource Management) 2011

**ADJOINING MAPS**

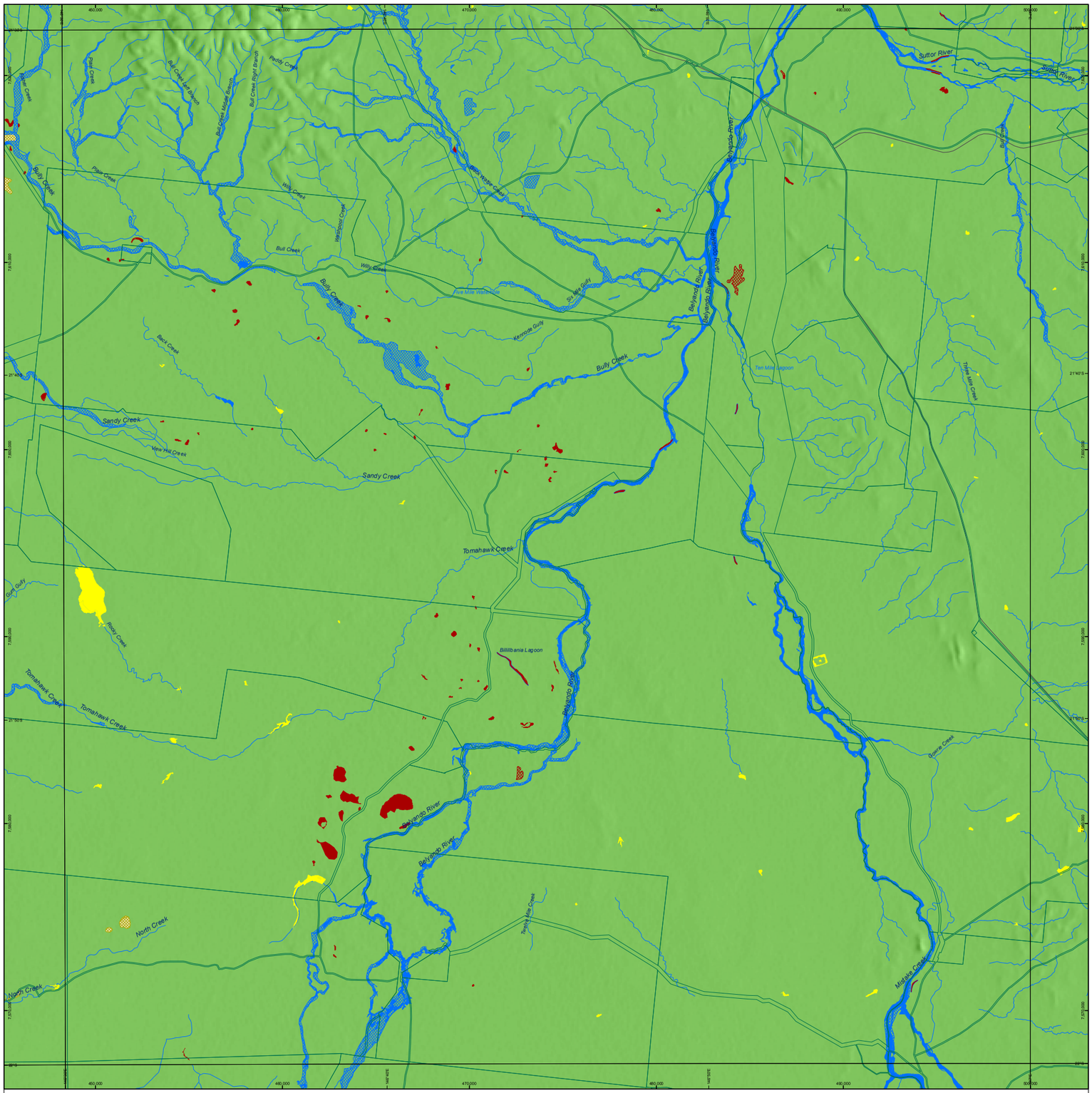



**MAP LOCATION IN QUEENSLAND**


Australian Government

Queensland Government

Queensland Wetlands Program




# Water bodies and Wetland Regional Ecosystems

**Water bodies**

**Wetland Regional Ecosystem**

**Marine system** (e.g. open ocean) Open ocean extending to the Queensland 3 nautical mile coastal limit. Includes shallow coastal indentations or bays without appreciable freshwater inflows, and coasts that are exposed to oceanic waves and currents. Water regimes are determined primarily by oceanic tides.

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**Riverine system (drainage lines)**

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- Roads
- Cadastral boundaries (>0.5 sq km area)
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- Land at least 1 km outside of Queensland

# Queensland Wetlands 2009

## MAP SERIES VERSION 3.0

## BULLIWALLAH
## 8254

N

Horizontal Datum: GDA 1994

Projection: Map Grid of Australia 1994 (MGA94 Zone 55)

0 2 4 6 8 10

Kilometres

Scale 1:100 000 at A1 size





Further information on wetland mapping (including methodology and digital data) is available from <www.wetlandinfo.derm.qld.gov.au>

**Accuracy information:** The positional accuracy of wetland data mapped at a scale of 1:100 000 is +/-100 m with a minimum polygon size of 5 ha or 75 m wide for linear features, except for areas along the east coast which are mapped at the 1:50 000 scale with a positional accuracy of +/-50 m, with a minimum polygon size of 1 ha or 35 m wide for linear features. Wetlands smaller than 1 ha are not delineated on the wetland data. Consideration of the effects of mapped scale is necessary when interpreting data at a larger scale, e.g. 1:25 000. For property assessment, digital linework should be used as a guide only. The extent of wetlands depicted on this map is based on rectified 2009 Landsat ETM+ imagery supplied by Statewide Landcover and Trees Study (SLATS), Department of Environment and Resource Management (DERM). The extent of water bodies is based on the maximum extent of inundation derived from available Landsat imagery up to and including the 2009 imagery.

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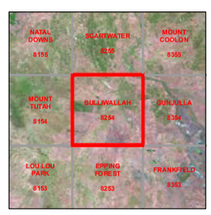
**Date of map production: November 2011** © The State of Queensland (Department of Environment and Resource Management) 2011

**ADJOINING MAPS**




**MAP LOCATION IN QUEENSLAND**


Australian Government

Queensland Government

Queensland Wetlands Program

# APPENDIX C

## Surface Water License Holders in the Belyando and Suttor River Basins

(from Alpha Coal Project Supplementary EIS, Parsons Brinkerhoff (2011))

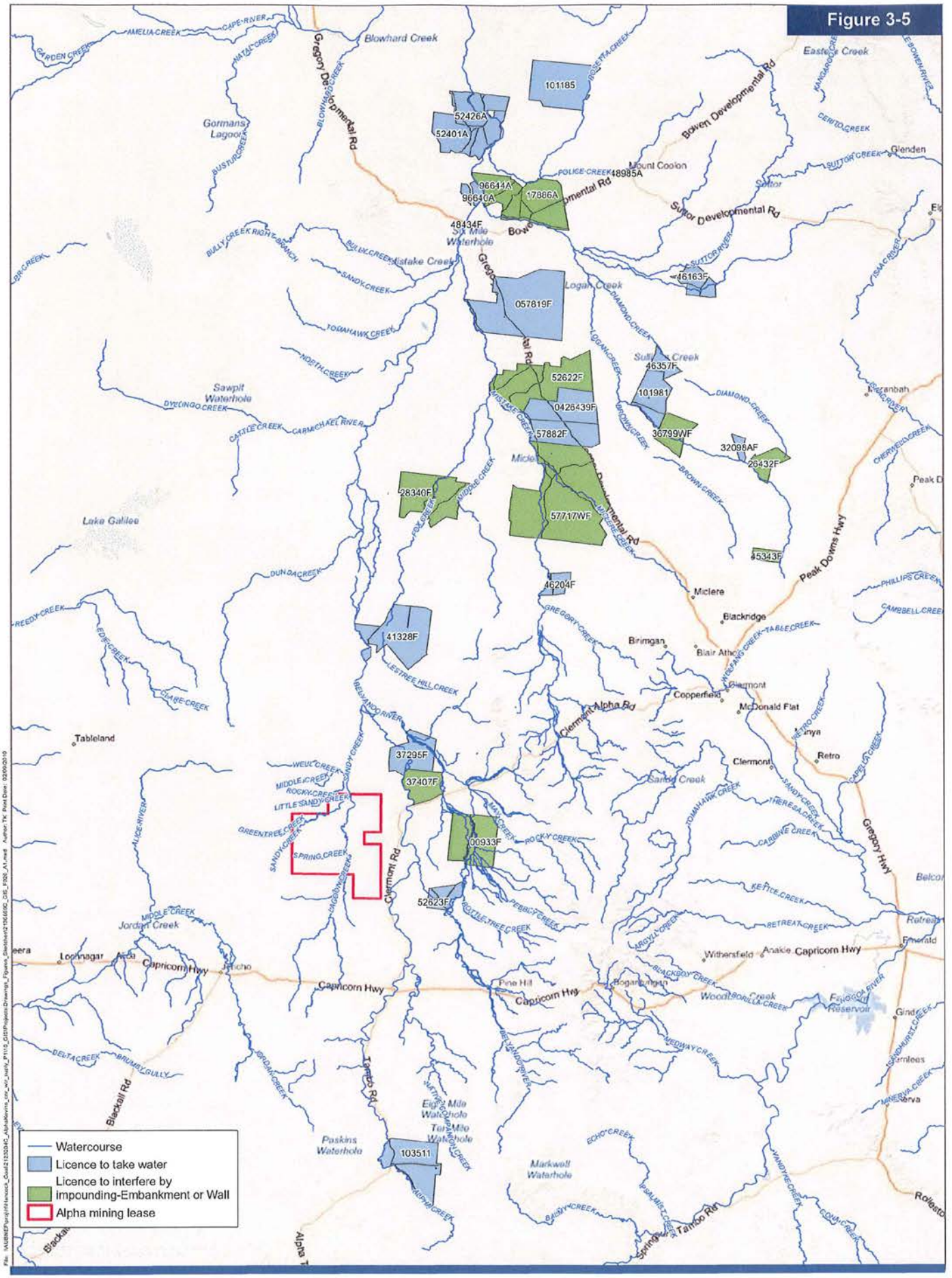


Figure 3-5
Watercourse
Licence to take water
Licence to interfere by impounding-Embankment or Wall
Alpha mining lease
101185
52426A
52401A
96644A
96640A
17886A
48985A
48434F
057819F
46163F
52622F
0426439F
57882F
46357F
101981
36799WF
32098AF
26432F
28340F
57717WF
45343F
46204F
41328F
37295F
37407F
00933F
52623F
103511
Gormans Lagoon
Blowhard Creek
Mount Coolon
Glenden
Easter Creek
Sawpit Waterhole
Lake Galilee
Tableland
Jordan Creek
Six Mile Waterhole
Eight Mile Waterhole
Ten Mile Waterhole
Paskins Waterhole
Markwell Waterhole
Miclere
Blackridge
Brimgan
Copperfield
McDonald Flat
Clermont
Retro
Alpha
Peak Downs Hwy
Gregory Hwy
Capricorn Hwy
Clermont Alpha Rd
Gregory Developmental Rd
Bowen Developmental Rd
Suttor Developmental Rd
Blackall Rd
Tambo Rd
Withersfield
Anakie
Pine Hill
Bogantungan
Emerald
Retreat
Belcon
Minerva
Rolleston
Tarlee
Logan Creek
Diamond Creek
Brown Creek
Sandy Creek
Rocky Creek
Middle Creek
Spring Creek
Greentree Creek
Little Sandy Creek
Tomahawk Creek
Theresa Creek
Carbine Creek
Retreat Creek
Peak Downs
Phillips Creek
Campbell Creek
Table Creek
Cherwell Creek
Isaac River
Suttor River
Bowen River
Fairbairn Reservoir
0 10 20 30 40 50
Kilometres
PARSONS BRINCKERHOFF
ALPHA COAL PROJECT
Licence permit holders