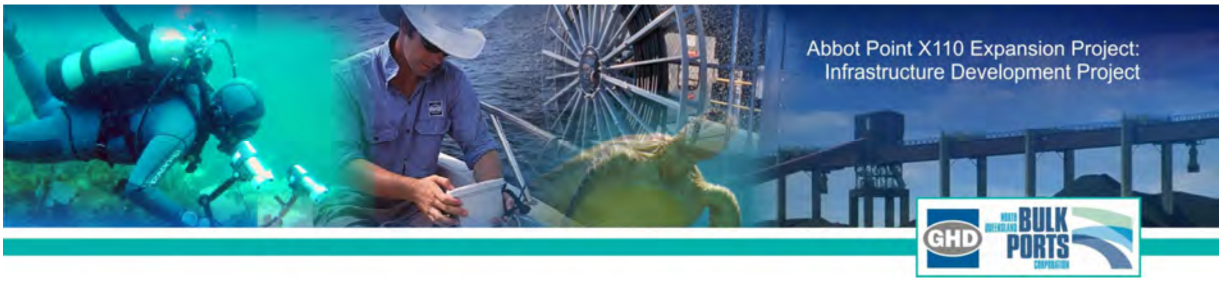


4.6 Surface Waterways

4.6.1 Description of Environmental Values

4.6.1.1 Caley Valley Wetland

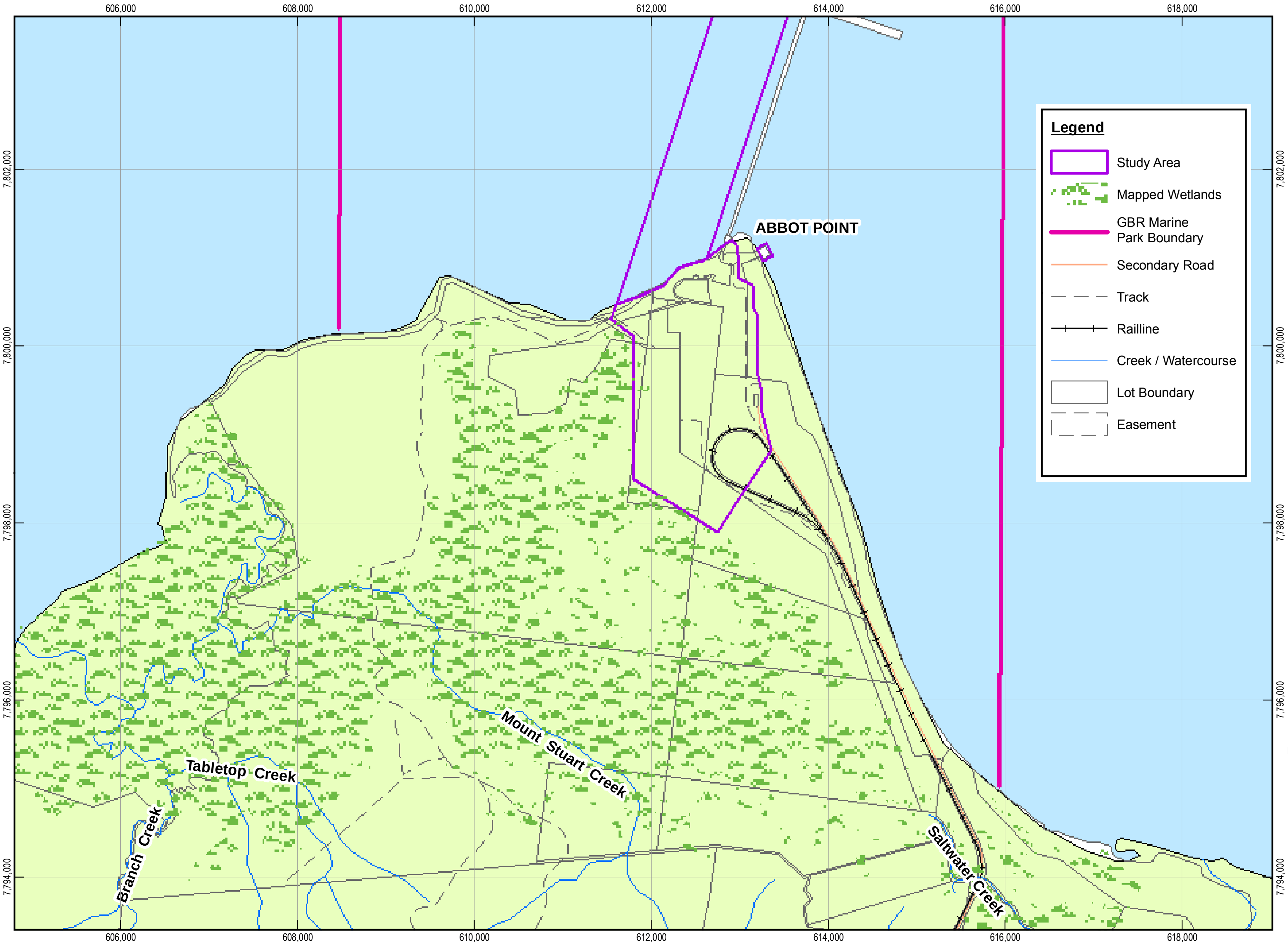
Figure 4-17 shows the extent of the Caley Valley Wetland and surrounding waterways. The Abbot Point – Caley Valley Aggregation is a 5,154 ha site that extends approximately 18 km long and 6 km wide, bounded by Mt Curlewis in the west, Euri Creek in the east, Bald Hill in the north and Caley Valley homestead in the south.

The system comprises a continuous wetland aggregation of subtidal and intertidal marine and estuarine wetlands. The marine wetland is mainly intertidal and limited to the western side of the system (inshore Curlewis Bay) (DEWHA 2008). The majority of the estuarine part of the wetland system was artificially isolated from tidal influences in 1956 when the Bowen Gun Club constructed a bund across the Mt Stuart Creek near the downstream limit of the wetland (Peter Hollingsworth and Associates 1979 and 1981). An inner bund incorporating the water delivery pipeline to the Abbot Point Coal Terminal and vehicle access was subsequently constructed across the wetland. Drainage culverts allow the passage of catchment flows through the bund (WBM 2006).

A portion of the Salisbury Plain and the slopes of Mount Roundback and Mount Little form the catchment for the wetland. Inflows to the impounded area are from Six Mile, Goodbye and Saltwater creeks. The wetland drains northeast to Curlewis Bay via Spring, Table Top, Main and Mount Stuart creeks. Surface water from the APCT's settlement ponds enters the wetland from the north. Runoff from the elevated dunes and ridges within the APCT enter the wetland from the east. Saltwater Creek enters the wetland from the south east and catchment runoff from south of the Bruce Highway enters the wetland from the south. Surface water flows within the wetland are generally in an east-west direction during the wet season.

Saltwater Creek (south east of the main body of the wetland), provides the connection between the wetland and Euri Creek. During the wet season, water flows northwest through Saltwater Creek from Euri Creek and the Don River into the wetland and ultimately into Curlewis Bay. During the dry season, tidal movements dominate the system and saline water enters the wetland from Curlewis Bay.

Tidal movements have been restricted by the causeway construction between the Caley Valley Homestead and Mt Luce. Mt Stuart Creek still flows through culverts under the northern end of the causeway, however, the salt water remains longer on the higher flats around the lake. The result is a reduction in salinity on the eastern side of the wetland (DEWHA 2008).



ABBOT POINT X110 EXPANSION

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Job Number	41-20175
Revision	B
Date	06 OCT 2009

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0 500 1,000 1,500 2,000

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

SURFACE WATERWAYS, CREEKS AND WETLANDS

FIGURE 4-17

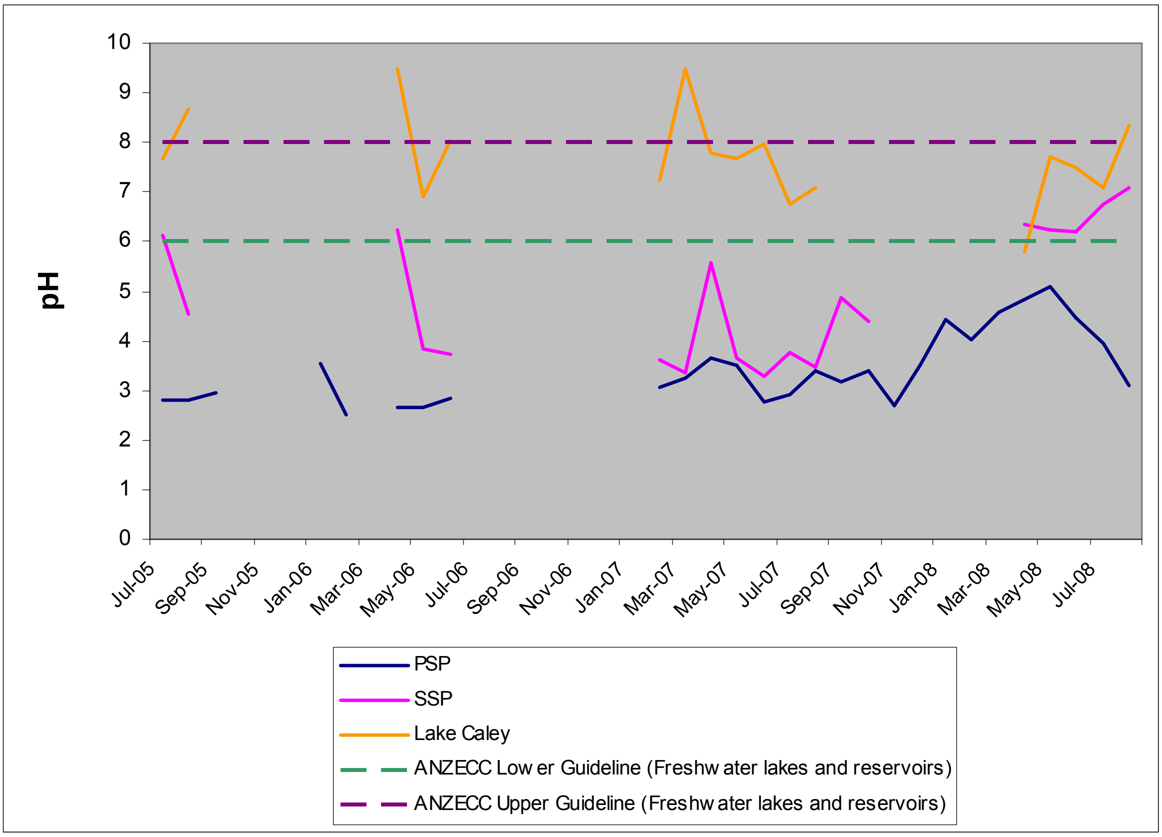
G:\41\20175\05 GIS\Projects\mxd's\41-20175-046_waterways_Fig4-17_revB.mxd

Data Source: DERM: cadastre - 2009, DERM: wetland mapping - 2000, GA: roads, watercoures - 2006. Created : jvc

Level 4, 201 Charlotte St Brisbane QLD 4000 **T** 61 7 3316 3000 **F** 61 7 3316 3333 **E** bnemail@ghd.com.au **W** www.ghd.com.au

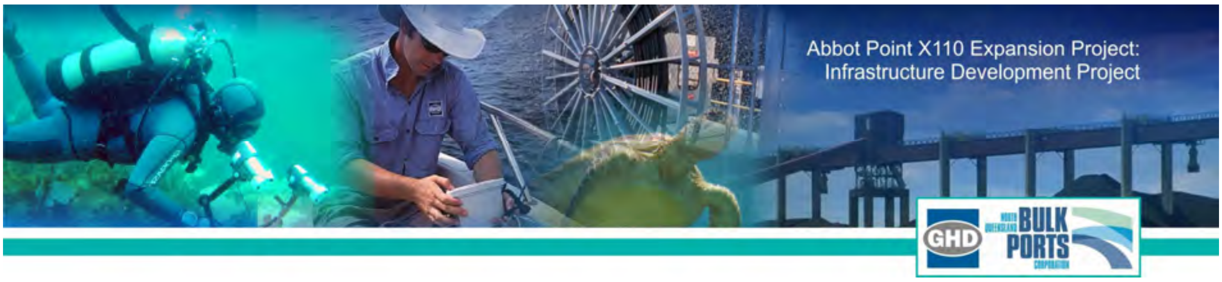
4.6.1.2 Existing Water Quality

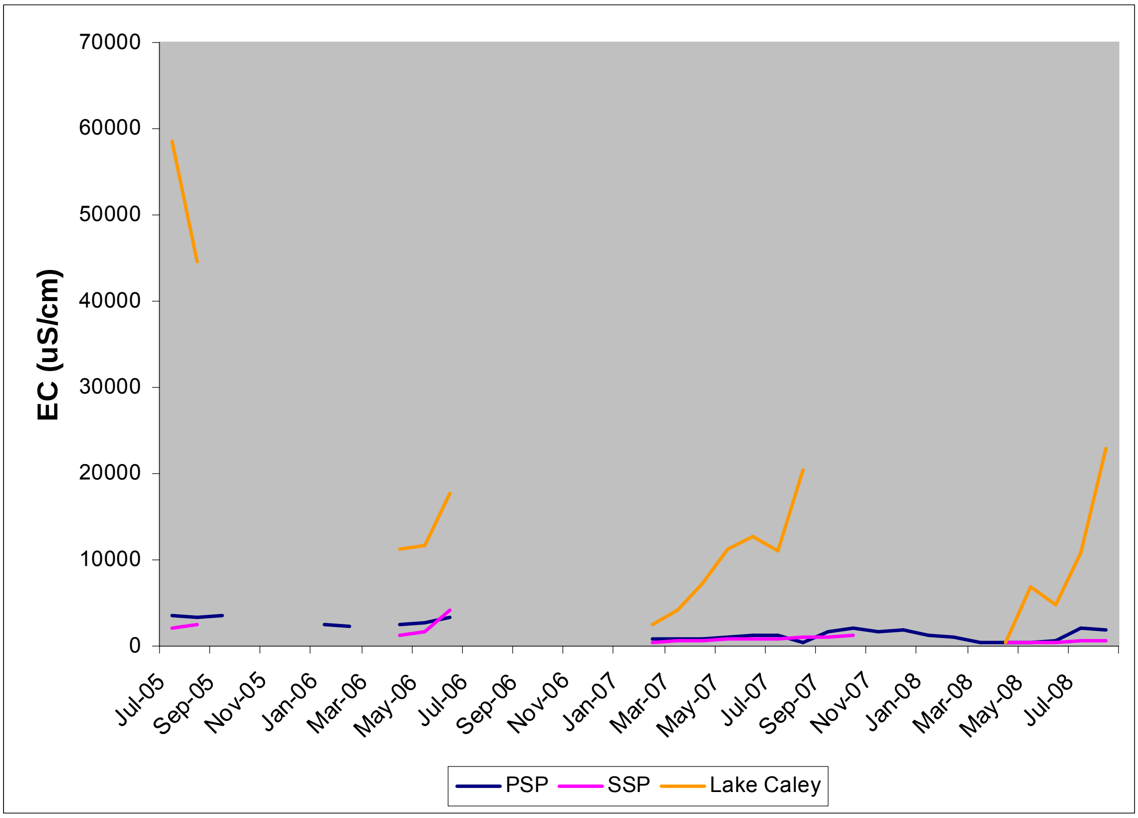
Monitoring of water quality within the primary and secondary settlement ponds and Lake Caley has been undertaken since the licensing requirements became effective in 1994. This monitoring is generally undertaken on a monthly basis, with the measured parameters varying from time to time. Figure 4-18 and Figure 4-19 provide a summary of pH and electrical conductivity for the three monitoring sites of the Primary Settlement Pond (PSP), Secondary Settlement Pond (SSP) and north eastern corner of the Caley Valley Wetland from July 2005 until July 2008. These results are discussed in more detail in the following sections.



Note: Breaks in data are due to dry season absence of water

Figure 4-18 Summary of pH data for period July 2005 to July 2008





Note: Breaks in data are due to dry season absence of water

Figure 4-19 Summary of electrical conductivity for period July 2005 to July 2008

Table 4-11 to Table 4-14 provide pH, electrical conductivity, Total P and Total N for the same three monitoring sites for the period January 2008 to July 2008. These results are discussed in more detail in the following sections.

Table 4-11 Summary of pH for period January to July 2008

Month	PSP	SSP	Lake Caley	ANZECC Lower	ANZECC Upper
Jan-08	4.52	n/d	n/d	6	8
Feb-08	3.81	4.10	7.20	6	8
Mar-08	n/d	n/d	n/d	6	8
Apr-08	5.56	6.39	7.69	6	8
May-08	n/d	n/d	n/d	6	8
Jun-08	n/d	n/d	n/d	6	8
Jul-08	3.79	6.05	7.66	6	8

Notes: n/d – No data available as no water at monitoring point; Guideline (Freshwater lakes and reservoirs); Guideline (Freshwater lakes and reservoirs)

Table 4-12 Summary of electrical conductivity for period January to January 2009

Month	PSP	SSP	Lake Caley	Fresh Water	Marine Water
Jan-08	1,270	n/d	n/d		
Feb-08	851	664	4,110		
Apr-08	423	369	3,230		
May-08	n/d	n/d	n/d		
Jul-08	2,490	672	12,200		
Jan-09	672	1,010	6,410		

Notes: n/d – No data available as no water at monitoring point

Table 4-13 Summary of total P for period January to July 2008

Month	PSP	SSP	Lake Caley	ANZECC Guideline
Jan-08	0	n/d	n/d	0.01
Feb-08	0	0	0	0.01
March-08	n/d	n/d	n/d	0.01
Apr-08	0.06	0.01	0.19	0.01
May-08	n/d	n/d	n/d	0.01
June-08	n/d	n/d	n/d	0.01
Jul-08	2.56	0.01	0.52	0.01

Notes: n/d – No data available as no water at monitoring point; Guideline (Freshwater lakes and reservoirs)

Table 4-14 Summary of total N for period January 2008 to July 2008

Month	PSP	SSP	Lake Caley	ANZECC Guideline
Jan-08	0.3	n/d	n/d	0.35
Feb-08	0.1	0.2	0.6	0.35
Apr-08	0.4	0.5	0.3	0.35
May-08	n/d	n/d	n/d	0.35
Jul-08	3.3	0.6	1.4	0.35

Notes: n/d – No data available as no water at monitoring point; Guideline (Freshwater lakes and reservoirs)

Caley Valley Wetland

Water quality within the Caley-Valley wetland is fresh to saline and seasonally variable, with a maximum water depth of 10 m in Lake Caley proper (Blackman *et al*. 1999). The construction of earth retaining walls built in 1956 and upgraded in 1981/82 essentially isolated the lake from most tidal influence. With the lack of tidal flushing, the lake has become progressively more saline, with a reduction in the extent of sedgelands and saltmarsh and replacement by mud flats with salt fields (Ecoserve 2005).

Water quality measurements from the Caley Valley Wetland conducted by Ecowise Environmental were limited to electrical conductivity, pH and occasional dissolved oxygen concentrations. The measurement location was the north eastern extremity of the wetland closest to the APCT and just downstream of the Secondary Settlement Pond.

The results show that over the 7-year period of measurement to March 2004, waters within the wetland also experienced large variations in electrical conductivity of between 900 and 15,000 µS/cm. The equivalent range of salinity was less than 1,000 mg/L (freshwater) to approximately 10,000 mg/L (approximately 28% seawater). There did not appear to be any particular trend of increasing or decreasing conductivity or salinity over the period. The electrical conductivity (salinity) of the wetland waters was usually higher than that occurring in the settlement ponds at any given time.

Over the measurement period, the pH of wetland waters was much less variable than either of the two settlement ponds, with either mildly acidic or mildly alkaline conditions occurring. Dissolved oxygen concentrations also showed wide variation but data was too limited for any inference on water quality.

4.6.1.3 Stormwater Management

Abbot Point Coal Terminal Drainage

The principle objective of the stormwater management plan currently in place at APCT is to minimise as far as possible, any release of dirty water, ie rainfall that comes in contact with coal and other disturbed areas into the surrounding environment.

All stormwater and runoff within the existing operations of the APCT is captured and directed to a number of sedimentation ponds and traps. Most stormwater runoff from the Abbot Point Coal Terminal operations area is directed to the Primary Settlement Pond (PSP) to the west of the existing stockpiles. Most of the sediment is settled out in this pond. When full, the overflow from the PSP is directed into a Secondary Settlement Pond (SSP) via a skimming weir. The combined PSP and SSP system is currently designed to contain the stormwater runoff for a 1 in 10 year ARI, 24 hr duration rainfall event. During periods of high flow, a Rising Stage Sampler (RSS) at the outlet of the SSP measures pH and EC of the discharge water.

Water collected in the primary pond is recycled and used for wash-down water. There are coal fines separation/collection devices and a number of sediment sumps in the drainage network to remove solids from the water. These systems will be incorporated into the expanded X110 terminal with similar systems being installed for the new coal stockpile areas (see Figure 4-20).

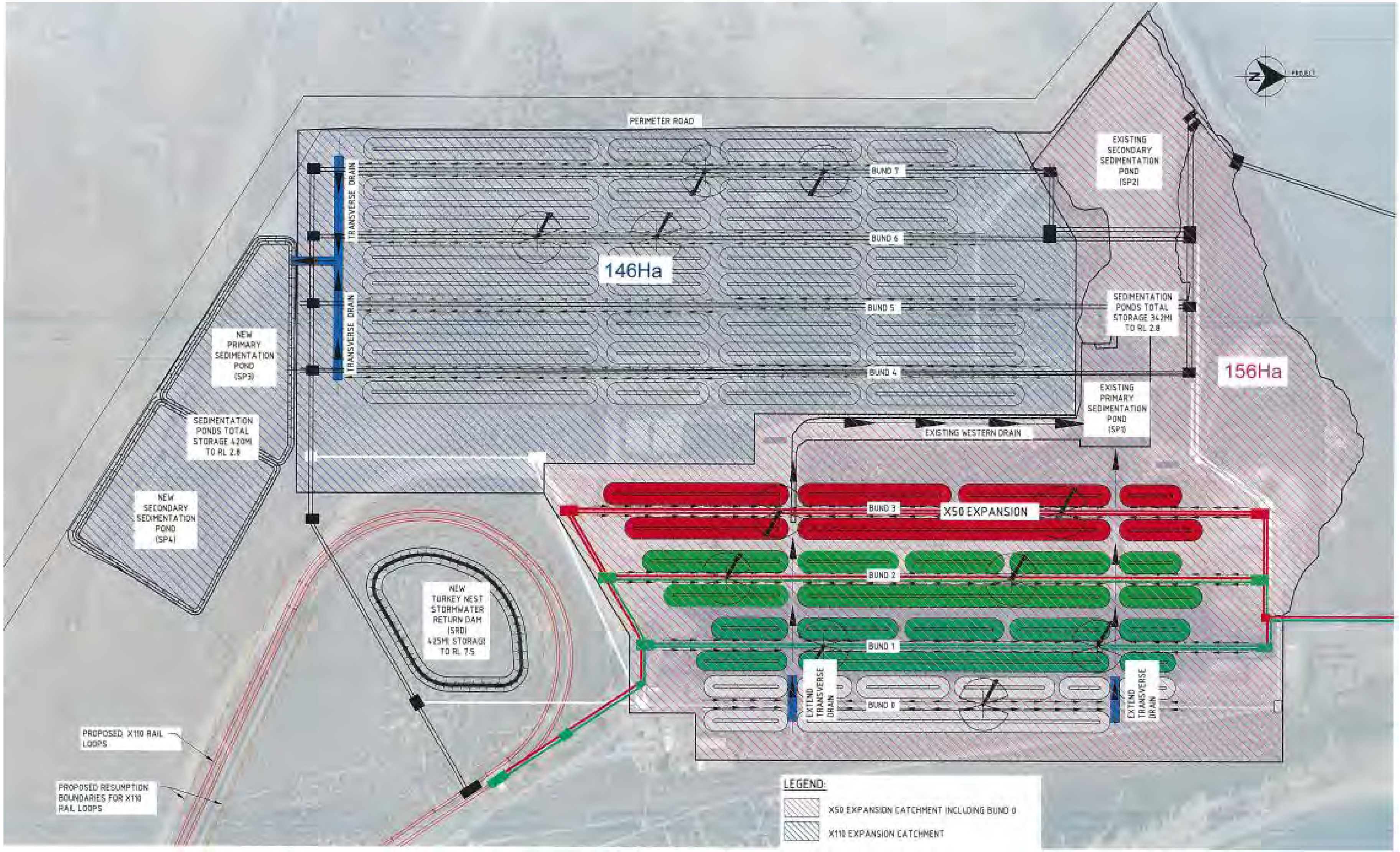


Figure 4-20 Stormwater management plan for X110 Expansion

All potentially impacted water from the X110 expansion will be diverted to one of the two primary settlement ponds at the southern and northern ends of the site (refer Figure 4-20). Similarly, wash-down water from the offshore structures will be conveyed back to shore via a slurry return system on Conveyor C344 and Berth 3 (similar to what has been installed on Berth 2 and Conveyor C334). This slurry return also finds its way into the settlement pond. Due to the terrain at the northern end of the site, some clean water runoff from Bald Hill also ends up in the northern settlement pond.

During February 2009, following a period of heavy rainfall, severe flooding occurred throughout the APCT site. Due to the rainfall, water from the exisiting Secondary Settlement Pond was discharged into the Caley Valley Wetland. The discrahged water was below the minimum licence threshold for disrchagre of pH 6. Ther incident occurred principally due to the severe rainfall and secondarily as a result of a reduction in the capacity of the settlement pond due to erosion which had occurred at the overflow. This issue was addressed by Xstrata in consultation with DERM.

Current licensing of the facility allows for four potential stormwater discharge locations at the Abbot Point Coal Terminal:

1. Secondary Settlement Pond (W1). Discharges into the Caley Valley Wetland.
2. Sample station sediment sump (W2). Recovers water and returns to Primary Settlement Pond via fine coal collection pond. When pump capacity is exceeded, storm water discharges into the ocean at Dingo Beach.
3. Surge Bin sediment sump (W3). Recovers water and returns to Primary Settlement Pond via fine coal collection pond. When pump capacity is exceeded, stormwater is discharged into bushland.
4. Main sub-station sediment sump (W4). Recovers water and returns to the Primary Settlement Pond via fine coal collection pond. When pump capacity is exceeded, stormwater discharges into bushland.

The same four discharge locations are intended for operation following the X50 expansion. The Development Approval for the X21 Expansion (DA 05/076) retains the above four discharge points and imposes specific discharge limits on the release and testing requirements. The limits for each sampling point ie. W1, W2, W3 and W4, are for pH levels between 6.0 and 8.0 and suspended solid levels not to exceed 30 mg/L.

As part of the X110 Expansion the following additional discharge points will be required:

1. Secondary Settlement Pond (SP4). Recovers water from the Primary Settlement Ponds and returns to the Stormwater Return Dam. Discharge into Caley Valley Wetland when design level of 1 in 10 year ARI occurs.
2. Stormwater Return Dam (SR1). Discharge into open paddock when design level of 1in 10 year ARI occurs.

NQBP will seek development approval for discharge points SP4 and SR1 and will be liaising with DERM regarding this.

The final discharge point for the new secondary pond will be determined during detailed design and in consultation with regulatory authorities. The discharge for the existing secondary sedimentation pond will remain unchanged (o.e into the wetland). It is anticipated that the discharge from the secondary ponds to the wetland will be less than the current arrangement as water will be continually pumped into the stormwater return dam within the rain loop for reuse in the terminal. Discharge from this dam will be only during severe rain events.

4.6.2 Potential Impacts and Mitigation Measures

4.6.2.1 Loss of Habitat

Potential Impacts

The loss of 12.21 ha of seasonal fringing wetland will occur due to development works to establish Bund 7. The area of wetland to be developed has been minimised as far as possible during the engineering design. In the context of the overall wetland, it is considered to be a small portion at the fringe of the wet season extent of the wetland and is expected to have minimal impact on the overall integrity of the habitat.

Mitigation Measures

During clearing, the contractor will comply with management measures detailed in the Construction Environmental Management Plan. To ensure the area of habitat loss is minimised as far as possible, all boundaries for clearing shall be clearing marked.

4.6.2.2 Surface Water Quality

Potential Impacts – Construction Phase

During construction, water quality may be impacted by the following activities:

- Clearing of vegetation and the exposure of soils to erosive forces, such as wind and rain; and
- Erosion and sedimentation from construction activities.

Clearing of vegetation along the western part of the development site will be undertaken during the dry season. Clearing will result in the exposure of soils to erosive forces and the potential for dust and sediment to migrate into the adjoining wetland which could then lead to future water quality degradation. Similarly, erosion and sediment from construction activities may migrate into adjoining wetland areas and degrade water quality.

Potential Impacts – Operational Phase

Changes in the water quality of the primary and secondary sedimentation ponds may occur due to the increase in coal being managed onsite. Managing the acidity of water within the settlement ponds is essential to reduce the potential impact on water quality within the wetland, when discharge occurs. Water within the wetland exhibits a pH generally in the neutral range. Acidity of water within the settlement ponds is regularly monitored and where high levels of acidity are detected, management measures are implemented to neutralise the water.

Mitigation Measures

During construction, the contractor will implement an environmental management plan to control erosion or construction runoff. Draft erosion and sediment control measures for the construction period are included in Section 5 of this report.

Operational phase management of water quality within the settlement ponds is critical to enable the ongoing use of the water on site and to ensure environmental damage does not result from a discharge of contaminated water.

NQBP has an established method for managing stormwater within the existing ABPT site which is demonstrated to achieve water quality guidelines relevant to the receiving waters. All operations are undertaken in accordance with NQBP environmental licences. Most recently, a non-compliance event occurred due to heavy seasonal rains and a partial reduction in cpacity of the existing secondary settlement pond. This non-compliance has been investigated and measures are being implemented to prevent a future occurance. DERM have been involved in this matter. Of particular importance the lessons learned from this non-compliance will be implemented in the X110 expansion.

The proposed stormwater management measures outlined in Section 4.6.1.3 expand the existing management system and are expected to reduce the frequency of discharge of water from the secondary settlement ponds. The proposed stormwater management plan for the X110 expansion more than doubles the capacity of the existing system and sees the addition of a stormwater return dam for management of water from the secondary settlement ponds, which will further reduce the frequency of discharge. Furthermore, the harvesting of water will minimise the requirement for an external water source. The increased capacity of the primary and secondary settlement ponds will result in increased residency of water within the system, prior to pump-out to the stormwater return dam or discharge to the wetland.

Current measures to manage acidity of discharge water include water quality monitoring and dosing of waters with soda ash when the pH levels are below the licence thresholds of between 6 and 8. As a result of the non-compliance which occurred in early 2009, NQBP and the terminal operator Xstrata have been working together to develop an action to prevent a recurrence of the non-compliance. Management measures focus on the installation of a permanent dosing facility, to correct the pH of water prior to discharge at the existing Secondary Settlement Pond. This or a similar system will also be installed in the proposed new Secondary Settlement Pond at the southern end of the site.

4.7 Groundwater Resources

4.7.1 Description of Environmental Values

4.7.1.1 Baseline Hydrogeological Conditions

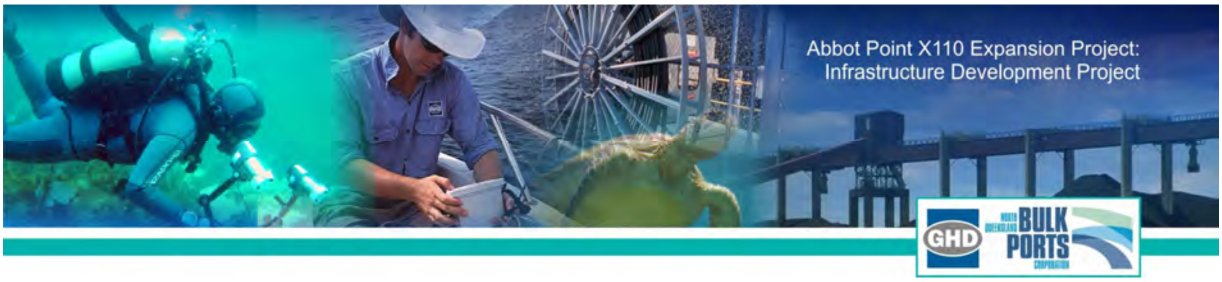
The following information sources have been used in the assessment of existing groundwater conditions:

- Mapped geology for the site and surrounding area (1:250,000 scale for Ayr, Sheet SE 55-15);
- Queensland Bore Database, accessed November 2007 (NRW);
- ‘Abbot Point Coal Terminal Stage 3 Expansion, Environmental Impact Statement’, WBM Australia, March 2006;
- ‘Abbot Point Coal Terminal Stage 3 Expansion, Supplement to the Environmental Impact Statement’, prepared by WBM Pty Ltd for Ports Corporation of Queensland, October 2006;
- ‘Abbot Point Expansion – Preliminary Hydrological Review of Splitters Creek Borefield Performance Report’, prepared by Environmental Hydrology Associates (EHA Pty Ltd) for WBM Pty Ltd, December 2005; and
- ‘Abbot Point Expansion – Baseline Groundwater Monitoring Investigation Report’, prepared by Environmental Hydrology Associates (EHA Pty Ltd) for WBM Pty Ltd, November 2005.

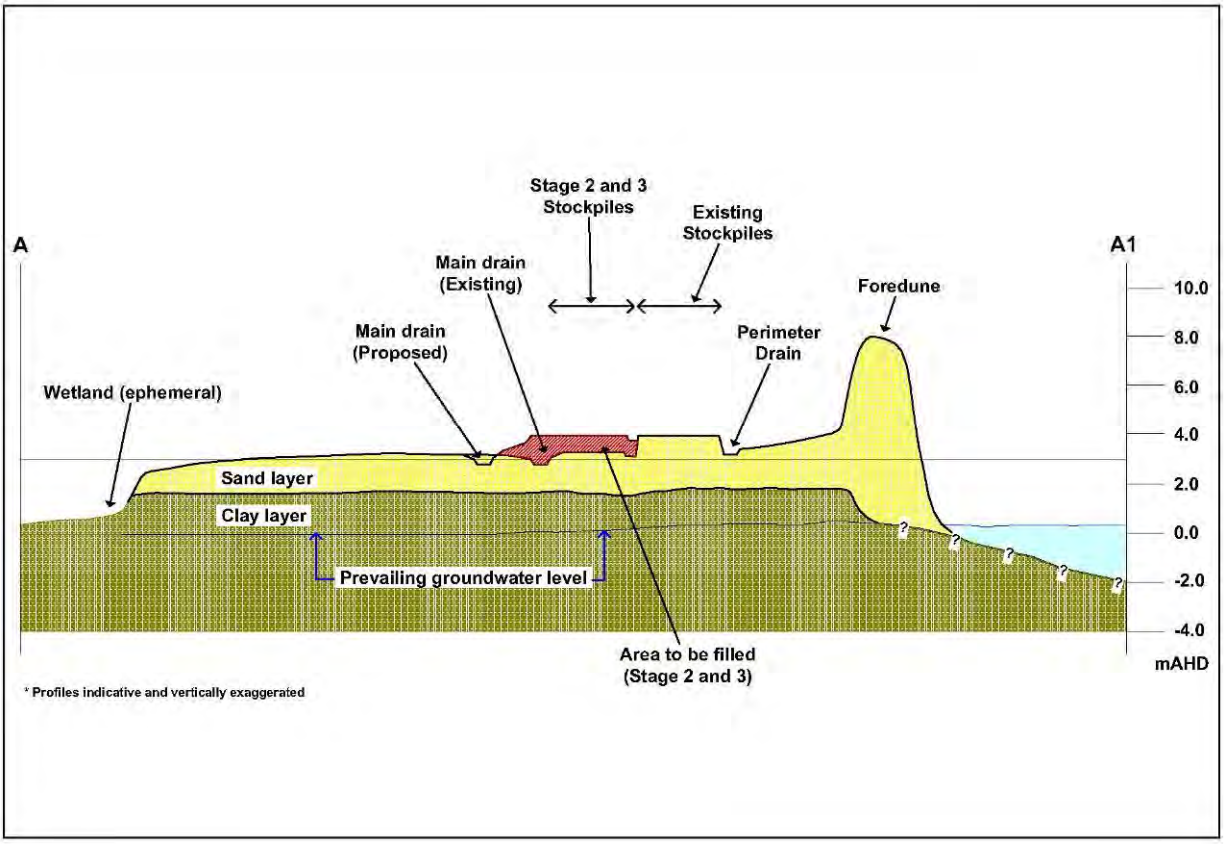
A review of the above list of reports and the Queensland bore database indicated six (6) registered groundwater bores occur within the site area (Figure 4-22). Two other pre-existing geotechnical investigation bores on the site labelled as ‘Unknown geotech hole’ and ‘Geotech hole B109’, were identified in EHA (November 2005). Sub-surface conditions, water levels and water quality results are presented by EHA (November 2005) and WBM (October 2006).

Geological mapping suggests that all 6 bores are located within Quaternary-aged Coastal Sand Dune deposits which underlie the majority of the site area. The western edge of the site however is mapped as Quaternary-aged coastal Mudflats which also underlie the Caley Valley Wetlands. The back dune sediments which characterise the X110 Expansion area appear to comprise mostly sands overlying clayey sands and sandy clays. The borehole logs presented by EHA (November 2005) indicate that the six monitoring bores encountered sandy clays to a maximum depth of 8 mBGL. Figure 4-21 provides a geological section through the site (WBM Oceanics Australia, 2006). No geological logs have been identified for the pre-existing boreholes ‘Unknown geotech hole’ and ‘Geotech hole B109’ as these were pre-existing.

The initial impact assessment study for the terminal conducted by Peter Hollingsworth and Associates (1979) (WBM, 2006, p 5-24) indicated the presence of fresh groundwater within the main coastal dune ridges which run parallel on the eastern side of the existing coal stockpiles. Historical levelling and clearing on site has eliminated the subtle crest/swale formation of the back dunes which characterise the X110 expansion area. Therefore, the hydraulic properties of this deposit are likely to vary greatly on the east west axis, as alternation between high permeability sands (dune deposits) and lower permeability silts and clay (swale deposits) occurs. Review of the Queensland Groundwater database showed two shallow bores, RN54547 and RN54548 which are located 1.3 and 1.2 km south east of the site respectively. The locations and the shallow recorded depths of these bores suggest that they penetrate

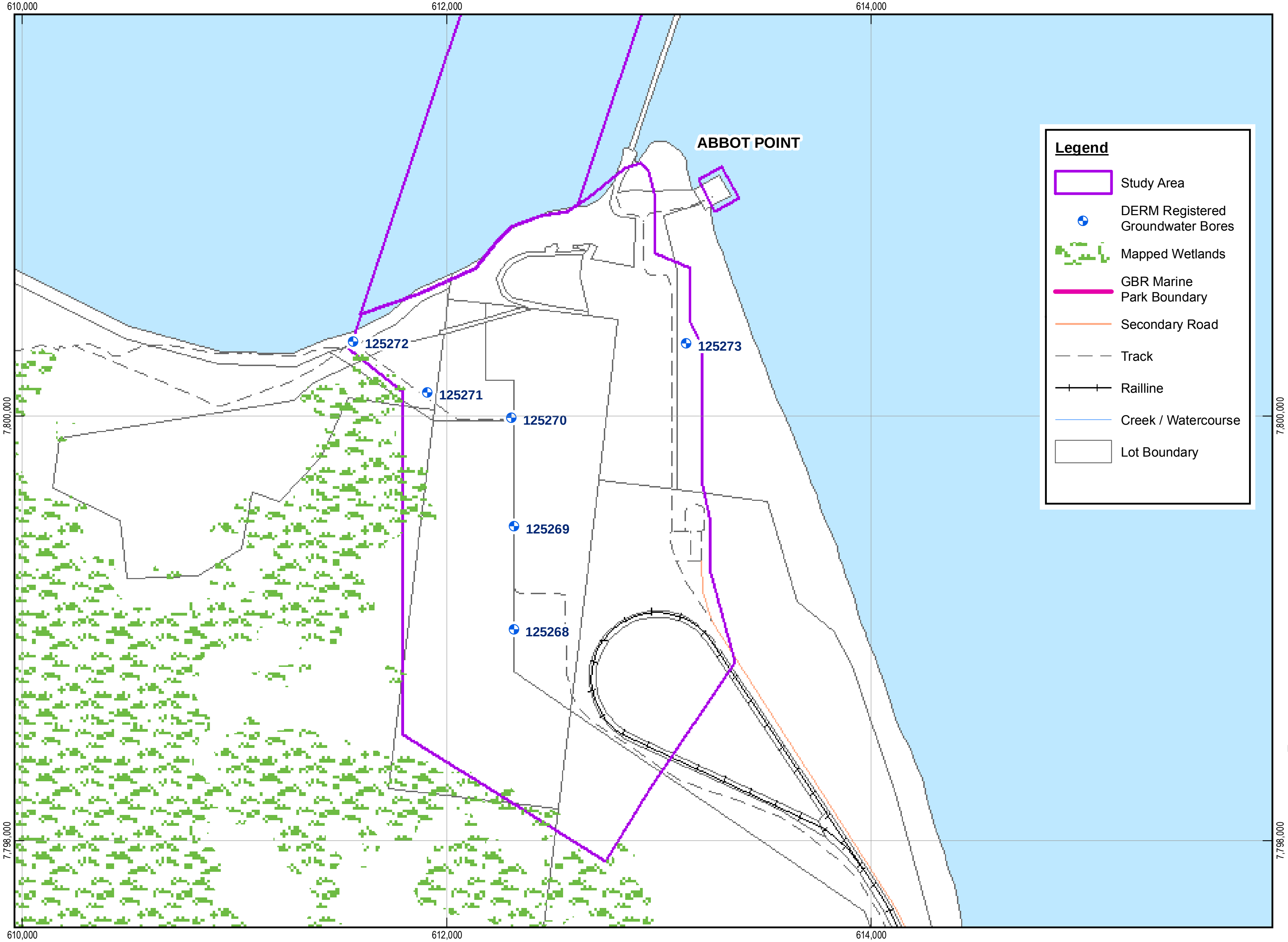


into the coastal sand dunes. No other hydrogeological information is available for these bores. The six onsite monitoring bores were installed on 13 July 2005. These sites comprise the monitoring sites for the X50 groundwater monitoring program that has been approved by DERM.



Source: WBM 2006

Figure 4-21 Geological section through the site including X110



ABBOT POINT X110 EXPANSION

Job Number 41-20175
Revision B
Date 06 OCT 2009

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

GEOLOGICAL BORE LOCATIONS

FIGURE 4-22

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Level 4, 201 Charlotte St Brisbane QLD 4000 **T** 61 7 3316 3000 **F** 61 7 3316 3333 **E** bnemail@ghd.com.au **W** www.ghd.com.au

Data Source: DERM: cadastre - 2009, DERM: bores - 2008, GA: roads, waterways - 2006. Created : jvc

4.7.1.2 Groundwater Quality

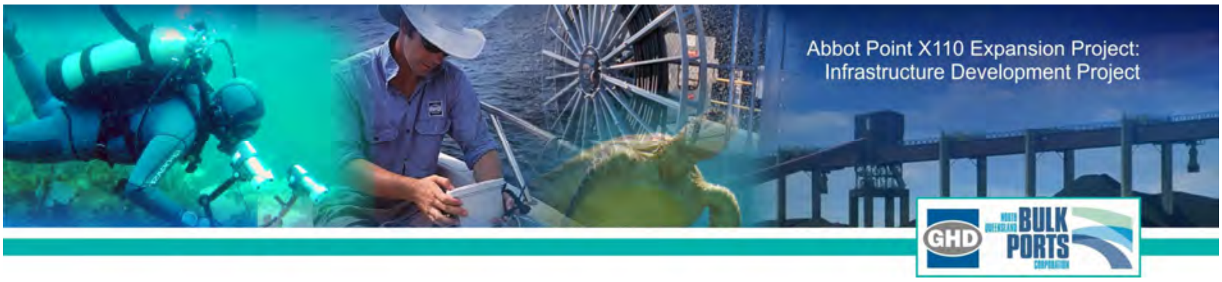
Groundwater quality data reported for two sampling rounds conducted on the 14 July 2005 and 8 June 2006 (WBM October 2006) generally characterise the groundwater as neutral to slightly acidic (pH 6.03-7.31) and brackish to saline (Electrical conductivity 1,190 µS/cm – 39,300 µS/cm). Electrical conductivity (EC) data provided by NQBP for selected bores monitored in March 2009 indicates brackish groundwater (1,100 to 2,100 µS/cm).

The laboratory analysis results reported in WBM (October 2006) were compared with the ANZECC 2000 Marine Aquatic ecosystems at a 95% protection level (MAE95%) and Freshwater Aquatic ecosystem at a 95% protection level (FAE95%). The exceedences are summarised below:

- Total arsenic concentrations in 125268 (July 2005 and June 2006), 125271 (June 2006) and 125272 (June 2006) exceeded the FAE95% of 0.024 mg/L;
- Total aluminium concentrations in all monitoring bores exceeded the FAE95% of 0.055 mg/L in June 2006;
- Total cadmium concentrations in 125272 (June 2006) exceeded the FAE95% of 0.0002 mg/L;
- Total chromium concentrations in 125270 (June 2006), 125272 (June 2006), 125269 (June 2006), 125268 (June 2006) exceeded the FAE95% of 0.001 mg/L. Concentrations in 125273 (June 2006) exceeded both the FAE95% (0.001 mg/L) and the MAE95% (0.0274 mg/L) ;
- Total copper concentrations in 125272 (June 2006), 125271 (June 2006 and July 2005), 125269 (June 2006), 125268 (June 2006 and July 2005) and 125273 (June 2006 and July 2005) exceeded the FAE95%)0.0014 mg/L) and MAE95% (0.0013 mg/L);
- Total lead concentrations in all monitoring bores exceeded the FAE95% (0.0034 mg/L) and MAE95% (0.0044 mg/L) for June 2006 results except 125269, which only exceeded the FAE95% guideline in June 2006;
- Total manganese concentrations in 125272 (July 2005 and June 2006) exceeded the FAE95% of 1.9 mg/L;
- Total nickel concentrations in 125272 (June 2006) and 125273 (June 2006) exceeded the FAE95% (0.011 m/L) and MAE95% (0.07 mg/L);
- Total zinc concentrations in all monitoring bores exceeded the FAE95% (0.008 mg/L) and MAE95% (0.015 mg/L) except 125269 which did not exceed the MAE95% guideline;

There are no guidelines for concentrations of iron or sulphate, however, all monitoring bore concentrations were elevated, with 125272 displaying the highest levels for both analytes. The elevated concentrations of iron and sulphate above the guideline values for FAE95% and MAE95% may be a result of infiltration of runoff contaminated from the coal stockpiles, leakage of the settlement ponds into the groundwater, or natural occurrence of elevated concentrations associated with acid sulfate soils (ASS) or marine sediments.

Although the reported concentrations for a number of the metals analysed exceed the freshwater (FAE95%) and/or marine water (MAE95%) guideline values, the reported concentrations are for total metals, rather than dissolved metals. The concentrations of metals in solution and hence 'available' to the environment, may be significantly lower than reported.



The reported results (Table F-1, WBM October 2006) indicate that concentrations of total metals (including aluminium, arsenic, cadmium, chromium, copper, lead, manganese, nickel and zinc) at the majority of the monitoring locations were typically higher in June 2006 than in July 2005. Some of the reported increases in concentration are significant, with an increase of 2 to 3 orders of magnitude. The cause of the apparent increases in concentration cannot be confirmed at this stage, given that results for only two sampling rounds are available.

Major ion analysis was not conducted during the two sampling rounds. The total dissolved solids analysis results ranged from 840 mg/L to 25,500 mg/L. EHA (November 2005) concluded the low TDS and EC values recorded in RN125268, RN125269, and RN125271 were likely to be caused by mixing of thin lenses of fresher groundwater with more saline/brackish groundwater. Recharge of these shallow water bearing horizons on site are likely to be from direct rainfall infiltration through the shallow sands and sandy clays. This is likely to cause stratification of the groundwater with accumulation of fresher waters above denser brackish/saline waters.

4.7.1.3 Groundwater Levels and Flow Directions

Groundwater levels were taken on 3 separate occasions: 14 July 2005, 19 August 2005 and 8 June 2006, however, this limited dataset does not describe seasonal fluctuations. On these dates, the standing water level in the monitoring bores was at, or within, 1 m of 0 m AHD. Groundwater ranged between 2.96 mBGL (125278 – 14 July 2005) and 4.59 mBGL (125268 – 19 August 2005) (see Figure 4-23).

The predicted groundwater flow direction within the western side of the existing coal stockpile is likely to be in a westerly direction towards the Caley Valley Wetlands and north towards Dingo Beach. The Hollingsworth and Associates (1979) (WBM 2006, p 5-13) report suggested that the dense saline marine clays underlying the wetland were likely to restrict groundwater discharge into the wetlands except for minor seepages on the eastern wetlands perimeter. Groundwater flow velocities are likely to be low, resulting from a very low groundwater gradient of approximately 3×10^{-4} (EHA, November 2005).

The fore dunes on the eastern side of the site run north-south parallel with the coastline. Groundwater within this deposit is likely to move in an easterly direction and towards the South Pacific Ocean.

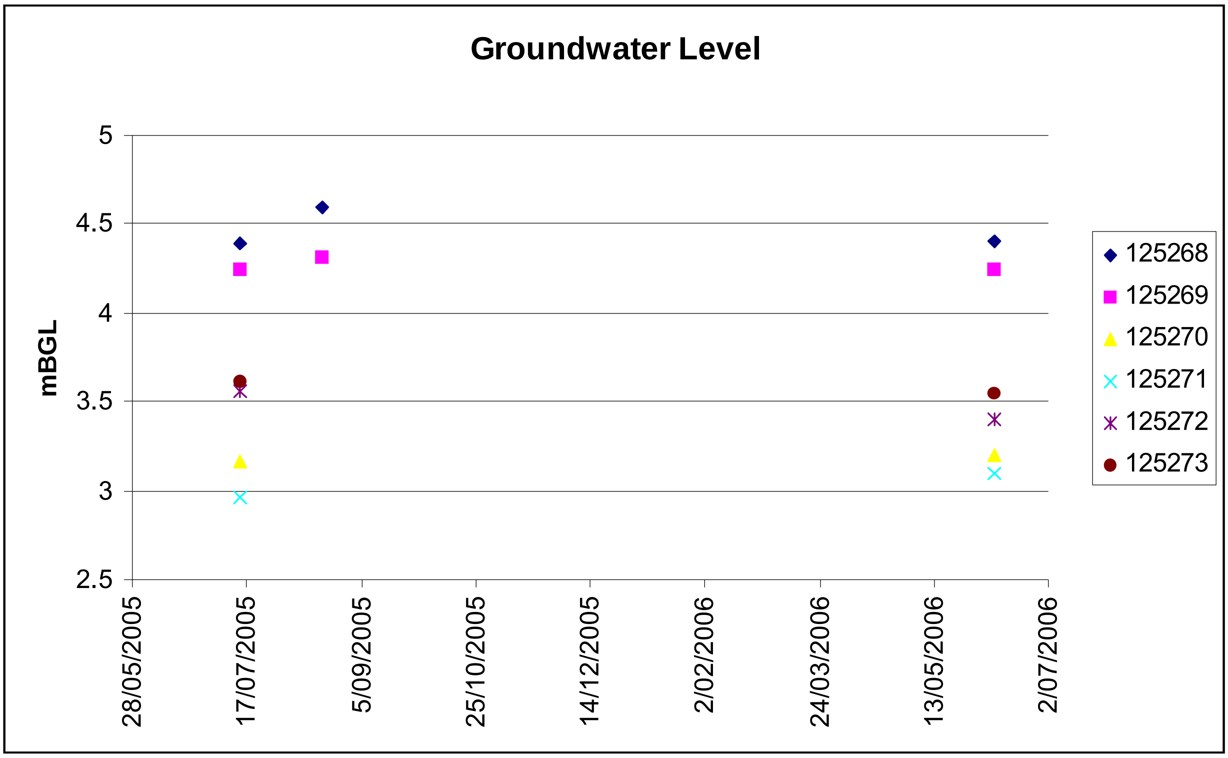


Figure 4-23 Groundwater levels July 2005 to June 2006 (Table F-1 WBM October 2006)

4.7.1.4 Groundwater Abstractions

Splitters Creek bore field is located approximately 14 km west of the site area and was previously used to provide water for the Abbot Point Coal Terminal. Section 5.4.3 of the *Abbot Point Coal Terminal Stage 3 Expansion Environmental Impact Statement* (WBM Oceanics Australia, 2006) discusses the environmental values of the Splitters Creek borefield. The current bore is licensed for an allocation of 250L/pa. There is no intent to increase this allocation into the future.

Water will be harvested on site for reuse and if required, additional water will be trucked to the site. External water will be sourced from either the Water for Bowen Porject or a desalination plant. Should a desalination plant be the preferred option, then this would be assessed separately to the current project. Hence the construction and operation of the proposed expansion will have no impact on the Splitters Creek bore field.

A number of water supply bores listed in the Queensland groundwater database to the south of the X110 Expansion area indicated to be sunk within the Quaternary-age ‘alluvial and deltaic deposits’. These bores are greater than 4.5 km south of the site area and are unlikely to be affected by the X110 expansion.

NQBP understand the cultural sensitivities of the Saltwater Creek system through previous consultation with Traditional Owners. There is not intent to take water from this system.

4.7.2 Potential Impacts and Mitigation Measures

4.7.2.1 Groundwater Quality

Potential Impacts – Construction Phase

Based on the hydrogeological understanding presented, the following potential impacts have been identified for the proposed construction of the X110 expansion:

» Potential for the degradation of groundwater quality as a result of any leaks and spills originating from construction activities; and

» Potential for the acidification and degradation in quality of groundwater if any potential acid sulfate soil (PASS) issues are not managed appropriately. Exposure of PASS could generate acidic leachate and mobilise metals into groundwater,which could potentially discharge to the adjacent wetland or other nearby waterbodies (ie marine environment). PASS have been identified onsite (see Section 4.2.1.3), but will be managed in accordance with established practices established within an approved ASS Managmenet Plan for the project.

Potential Impacts – Operational Phase

Based on the hydrogeological understanding presented, the following potential impacts have been identified for the operation of the proposed development:

» Potential for the degradation of groundwater quality as a result of infiltration of surface water runoff from coal stockpiles and hardstanding areas if runoff water is not appropriately managed;

» Potential for the degradation of groundwater quality as a result of any leaks and spills originating from new infrastructure, such as chemical and vehicle storage, sewage treatment and workshops if appropriate control measures are not put in place and maintained; and

» Potential for the acidification and degradation in quality of groundwater if any potential acid sulfate soil (PASS) issues are not managed appropriately. Exposure of PASS could generate acidic leachate and mobilise metals into groundwater,which could potentially discharge to the Caley Valley wetland or other nearby waterbodies (ie marine environment)..

Mitigation Measures

The following measures are proposed to mitigate the identified potential impacts:

» All storage areas, stockyards and work shops should have appropriate contamination collection points for spills and lined settlement ponds large enough for large storm events. This will allow monitoring of collected water prior to release and reduce the potential of contamination infiltrating into the groundwater.

» Collection points should be lined (with clay or PVC) to reduce infiltrations until testing and treatment of runoff can be conducted.

» Spills clean up procedures and kits on hand in park up areas, workshops and other areas where spills may occur. These procedures should comply with relevant standards and be backed by an appropriate environmental management system.

» Stormwater management systems should be in place to ensure uncontaminated runoff cannot seep into the shallow water-bearing strata.

- Storage of all chemicals and potential contaminants in designated areas designed to appropriate standards.
- Implement ASS Management Measures as outlined in Section 5.
- Install a groundwater monitoring network around the sewage treatment plant, workshops, settlement ponds and waste disposal areas to allow any changes in groundwater quality to be detected. Details of the network will be detailed in a groundwater monitoring program is to be finalised with DERM prior to operation of X110 commencing.
- Implement a groundwater monitoring program, to include an action plan in the event of trigger levels being exceeded. Details of the monitoring program will be finalised with DERM prior to operation commencing.
- Regular monitoring and assessment of groundwater quality.

4.7.2.2 Changes in Groundwater Levels

Potential Impacts - Construction Phase

There is potential for minor localised increases or decreases to groundwater levels as a result of the clearance of any vegetation for the proposed additional stockpile yard (approximately 58 ha). Clearance of vegetation could result in an increase in recharge to the cleared area and hence potentialy result in a localised increase in groundwater levels as a result of reduced evapo-transpiration losses. Clearance could also result in a reduction in groundwater levels as a result of increased runoff from bare soil surfaces. If groundwater levels increase as a result of clearance where levels are currently close to ground surface, then there may be increased potential for water logging, however no water level data are currently available for the proposed site. Any impacts as a result of land clearance are likely to be minor, which can be confirmed by pre and post construction and operational monitoring.

Potential Impacts - Operational Phase

There is potential for a decrease in groundwater levels beneath the additional proposed stockpile site, assuming that the site will partially be covered with low permeability structures for stockpile storage and management. Any lowering of groundwater levels is likley to be minor and can be confirmed by pre and post construction and operational monitoring.

It is understood that the proposed additonal settlement ponds will be lined wtih an engineered clay liner or other material of low permeability (at least of the order of 1x10-8 m/s), hence the rate of any leakage of water through the liner to the water table is unlikely to result in the formation of a groundwater mound and hence no significant changes to groundwater levels or flow directions are considered likely as a result. This can be confimed by pre and post construction and operational monitoring.

Mitigation Measures

- Clearing should be conducted on a staged approach and kept to a minimum;
- Design of the settlement ponds to minimise the interaction between groundwater and surface water through use of a low permeability liner with a maximum permeability of 1x10-8 m/s;
- Develop and implement a groundwater level monitoring program (in conjunction with groundwater quality monitoring, see Section 4.7.2.1) which includes the installation of a groundwater monitoring

network around the settlement ponds and stockpile site. This will be done in conjunction with groundwater quality monitoring on a regular basis, pre and post construction and site operation to allow any significant changes in groundwater levels to be detected;

- Regular review of groundwater levels against baseline conditions.

4.8 Marine Water Quality

4.8.1 Description of Environmental Values

4.8.1.1 Overview

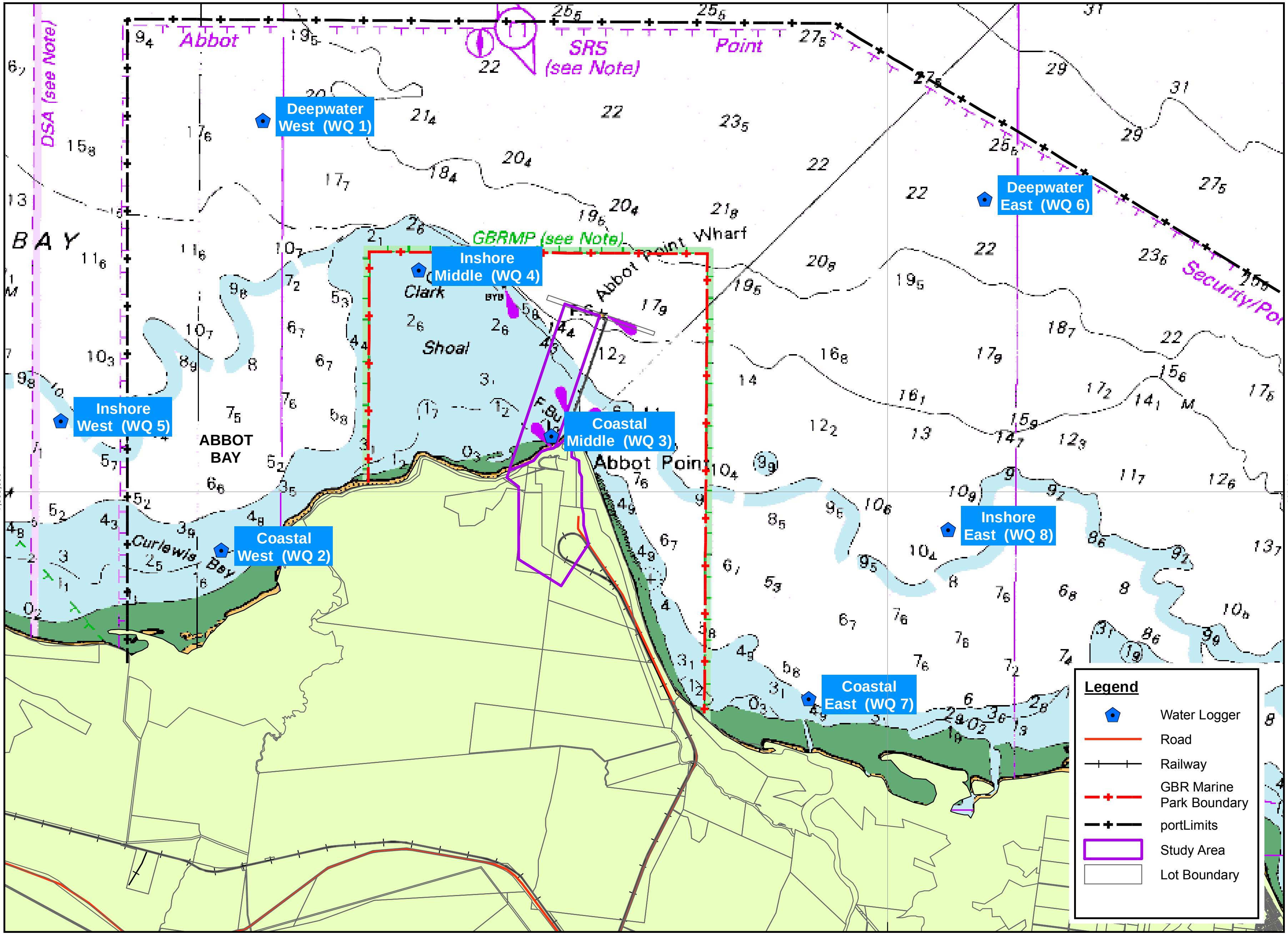
The presence and health of marine communities may be affected by changes in ambient water quality. Construction and operation of port facilities can impact upon existing water quality and have follow on effects to marine communities. To provide an understanding of existing water quality conditions at Abbot Point, sedentary water quality loggers were deployed at eight sites within the port (refer Table 4-15 and Figure 4-24). The locations for the water quality loggers were identified in consultation with GBRMPA and QPIF. Six loggers were deployed in areas of known seagrass habitat, three at coastal locations and three at inshore locations. For both coastal and inshore locations, one logger was deployed in proximity to the existing facilities, one deployed to the west of the existing facilities and one deployed to the east of the existing facilities. The two remaining loggers were deployed in deepwater areas to the east and west of the existing facilities. These instruments continually record water quality parameters including turbidity, photosynthetic active radiation (PAR), sediment deposition and water pressure.

Table 4-15 Water Quality Monitoring Locations

Site	Location	Latitude	Longitude
1	Deepwater West	-19.818709	148.013277
2	Coastal West	-19.905033	148.005012
3	Coastal Middle	-19.881635	148.074895
4	Inshore Middle	-19.848547	148.046584
5	Inshore West	-19.879221	147.970785
6	Deepwater East	-19.833550	148.166550
7	Coastal East	-19.934103	148.129964
8	Inshore East	-19.899935	148.159317

Notes: Locations are defined as: Deepwater: > 6 km from the coast; Inshore: 2 – 6 km from the coast; Coastal: Within 2 km of the coast

Boat-based sampling was also undertaken monthly at each of the logger sites and included the collection of water samples for laboratory analysis and in situ collection of water quality parameters using a hand-held electronic multi-parameter water quality meter (either the Yeokal 611 Multi-parameter Water Quality Analyser (Yeokal 611), or the TPS 90FLT Multi-Parameter Water Quality meter (TPS 90FLT)). The retained water samples were analysed for Total Suspended Solids (TSS), chlorophyll *a,* total nitrogen and total phosphorus. The parameters measured in situ with the Yeokal 611/TPS 90FLT include turbidity, dissolved oxygen, pH, conductivity and temperature. Additionally, the prevailing weather conditions, in the form of wind, cloud and tidal data were collated for each monitoring period.



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NORTH QUEENSLAND BULK PORTS CORPORATION

ABBOT POINT X110 EXPANSION

Job Number 41-20175
Revision B
Date 06 OCT 2009

1:120,000 (at A4)

0 1 2 3 4 5
Kilometers

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

WATER QUALITY SURVEY SITES

FIGURE 4-24

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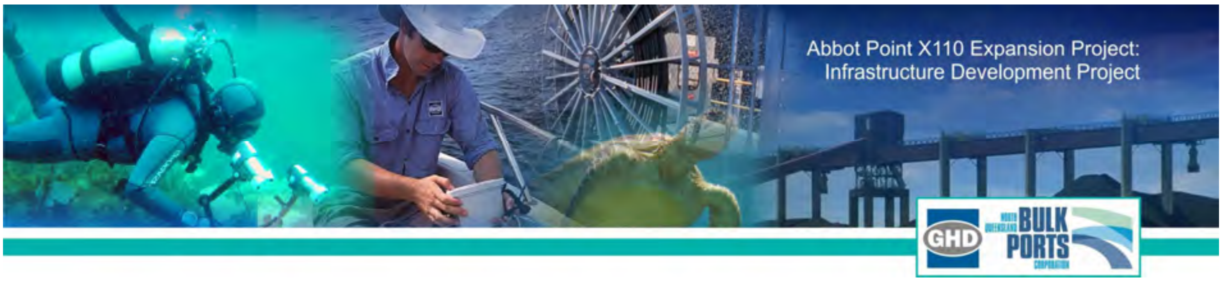
Data Source: GA: road, rail, coastline - 2006, Seafarer: Hygrographis Charts AUS 826 - 2007. Created : jvc

Level 4, 201 Charlotte St Brisbane QLD 4000 T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com.au W www.ghd.com.au



4.8.1.2 Key Findings

Weather Conditions

Over the 12 month monitoring program, wind data was variable, while cloud and rainfall data showed distinct seasonality. Cloud cover was generally greater during the warmer, wetter summer months of the northern Australian wet season (i.e. December to March), with the highest rainfall recorded in January. Accordingly, rainfall was extremely low during the drier months of winter and spring. Temperature also exhibited a strong seasonal trend, with warmer temperatures recorded during the summer and cooler temperatures during the winter. Little spatial variation was noted in this parameter. For the entire monitoring program, there was less than 1°C difference in the mean temperature values across all eight sites.

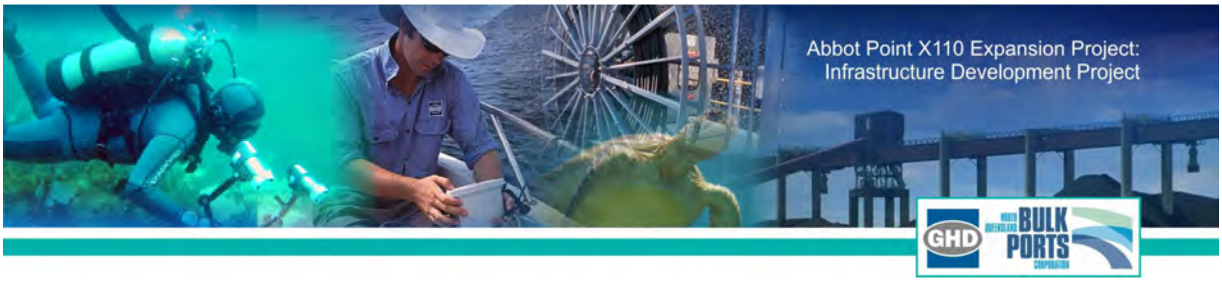
Turbidity

Measurements of turbidity and Suspended Sediment Concentration (SSC) are important parameters for defining the environmental and sedimentary conditions of coastal systems (Larcombe *et al*., 1995). Benthic communities in near-shore environments are subject to large natural variations in turbidity and in turn, extreme turbidity levels can be considered a stress factor for many benthic organisms (Rogers, 1990; Brown, 1997), particularly for sensitive habitats such as seagrass meadows and inshore and fringing reefs. High turbidity reduces availability of light for photosynthesis for zooxanthellae in corals (Anthony and Fabricius, 2000) and seagrasses (Moore *et al.,* 1996). Settlement of suspended particles may smother the surface of organisms (Rogers, 1990; Stafford-Smith, 1992; Fabricius and Wolanski, 2000), reducing their capacity to feed or photosynthesise.

Wave-induced bed stress is the most significant mechanism of sediment re-suspension in the Great Barrier Reef (Orpin *et al*., 1999). The combined effects of short-period wind induced waves, longer period swell waves and tidal and wind-driven currents, can often exceed the critical bed stress for re-suspension (Orpin *et al*., 1999). Within the Great Barrier Reef, SSCs at 20 m water depth indicates that re-suspension seldom occurs under normal wave conditions. Non-cyclonic turbidity events are generally confined to the inner shelf regions (Orpin *et al*., 1999).

Mean weekly turbidity levels from logger recordings showed high spatial and temporal variability. The shallow coastal sites (Sites 2, 3 and 7) exhibited the highest mean weekly turbidity values, whilst deepwater Sites 1 and 6 consistently had the lowest turbidity. All sites from which data was available returned instances of elevated turbidity values during the wet season (December – March).

Turbidity levels recorded in-situ were spatially and temporally variable (Figure 4-25). Whilst spike levels above the Australia and New Zealand Environment Conservation Council (ANZECC,1.5 NTU) and the Queensland Water Quality Guidelines (QWQG, 1 NTU) were intermittently recorded from all sites, turbidity recorded in-situ was generally just above or below these guideline values. No consistent spatial trends were observed from hand-held recordings.



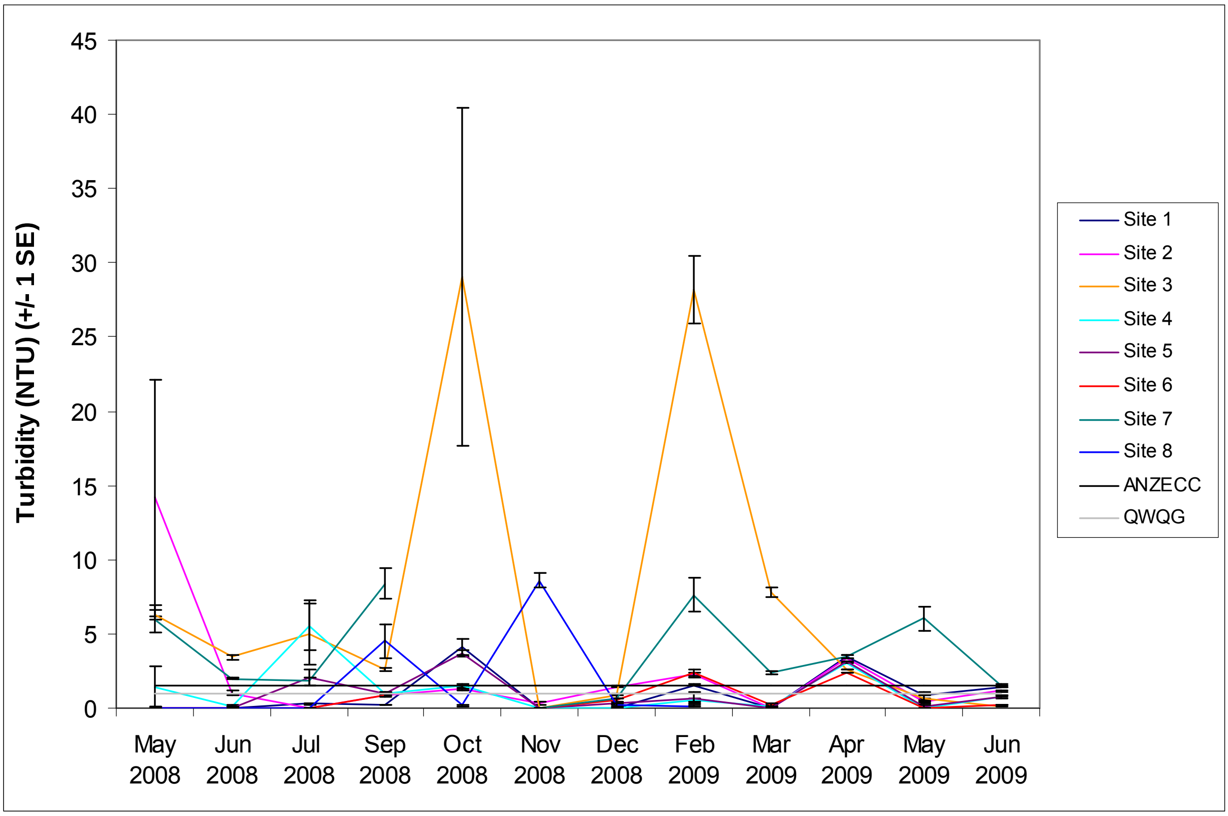


Figure 4-25 Mean monthly turbidity (± 1SE) recorded in-situ using hand-held water quality meter, in relation to ANZECC and QWQG Guidelines

Total Suspended Solids

Total suspended solids (TSS) values were temporally variable throughout the monitoring program, although a spatial trend was observed during some, but not all, sampling events (Figure 4-26). Excluding Site 7 which remained consistently low, TSS levels were generally in excess of the QWQG benchmark of 10 mg/L. TSS values increased markedly at all sites in a consistent manner in both May and February, indicating a change in conditions at Abbot Point during these periods that masked any small scale spatial differences between sites.

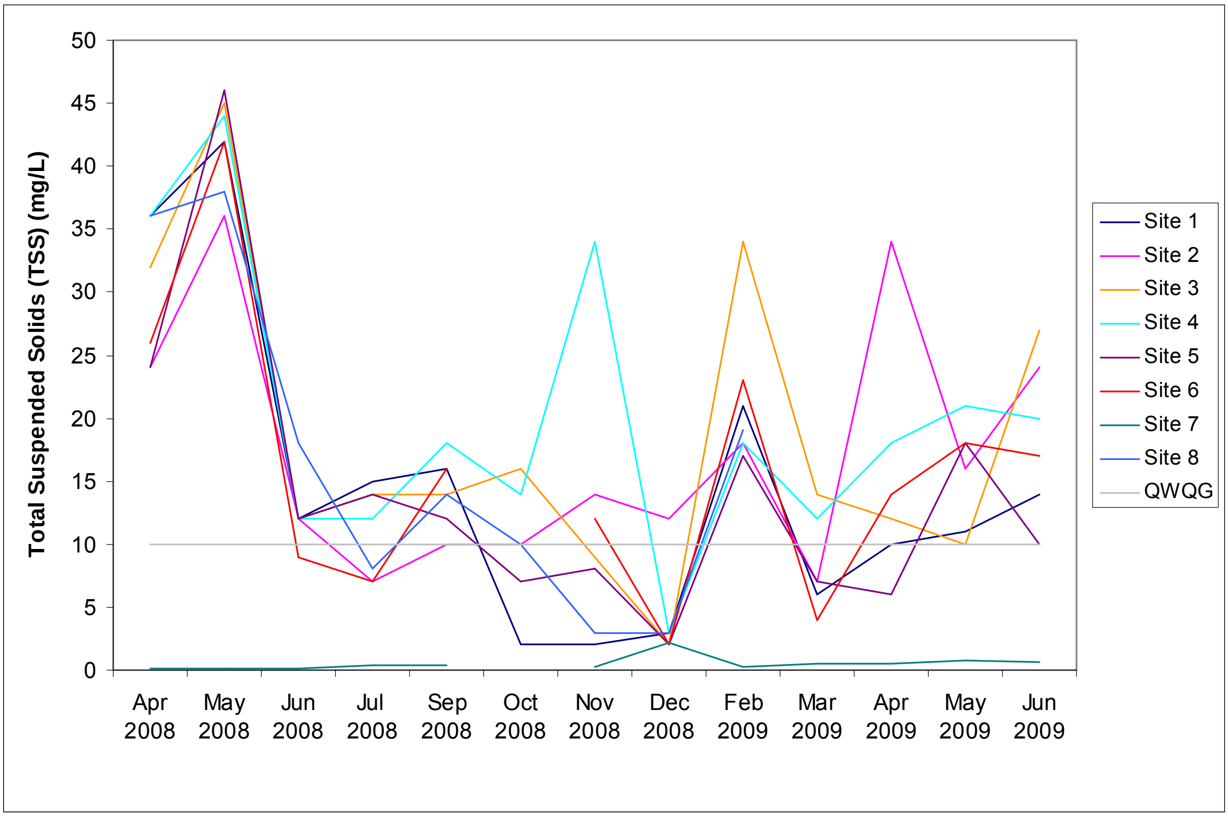


Figure 4-26 Monthly TSS recorded at the surface in relation to QWQG Guidelines

Light/PAR

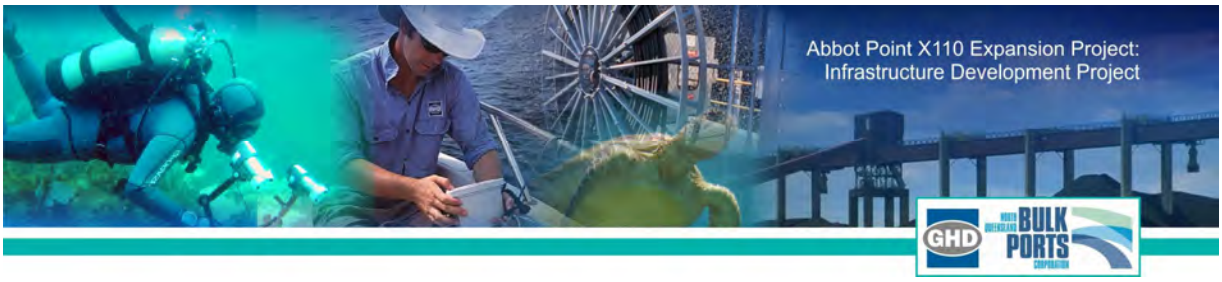
The light availability (PAR) recorded exhibited a large degree of spatial variability, indicating site specific influences on this parameter. For most sites, mean weekly light availability declined during the wet season (December to March). Light availability at deepwater Sites 1 and 6 was consistently low, whilst the coastal and inshore sites exhibited greater temporal variability in PAR. The fact that light availability is affected by factors including water depth, cloud cover and the amount of suspended solids in the water column, potentially explains the site-specific nature of the results obtained for this parameter during the monitoring program.

Deposition

Mean weekly deposition results were inconsistent between sites, with the results acquired for this parameter during the monitoring program suggesting that it is highly site-specific and is resultant from a variety of interacting drivers, including water movement (wind driven, tidal etc.), depth and suspended solid concentration. Although spatially variable, mean weekly deposition levels were generally low across all sites and rarely exceeded 5 mg/cm^2, although individual recordings of up to 85.404 mg/cm^2 at Site 1 were recorded by the sedentary loggers during the course of the monitoring period.

pH

Considerable variability in pH values within and between sites was observed throughout the monitoring period (Figure 4-27). During the monitoring program, pH varied from just above the recommended



ANZECC guideline values (lower 8, upper 8.4) to well below them. Spatially, Sites 2, 3, 4 and 8 behaved in a similar manner and different to Sites 1, 5, 6 and 7. A significant, anomoulous, drop in pH was observed in October 2008 for the first group of sites at all depths, however, values returned rapidly in the following monitoring periods to be just less than the guideline values. For the second group of sites (no data was recorded for sites 6 and 7 in October), only a small drop in pH was observed (December 2008) and it was a few months later in the monitoring period. All sites showed a similar trend of a rapid return and for the remainder of the program, pH remained within or just below guideline values.

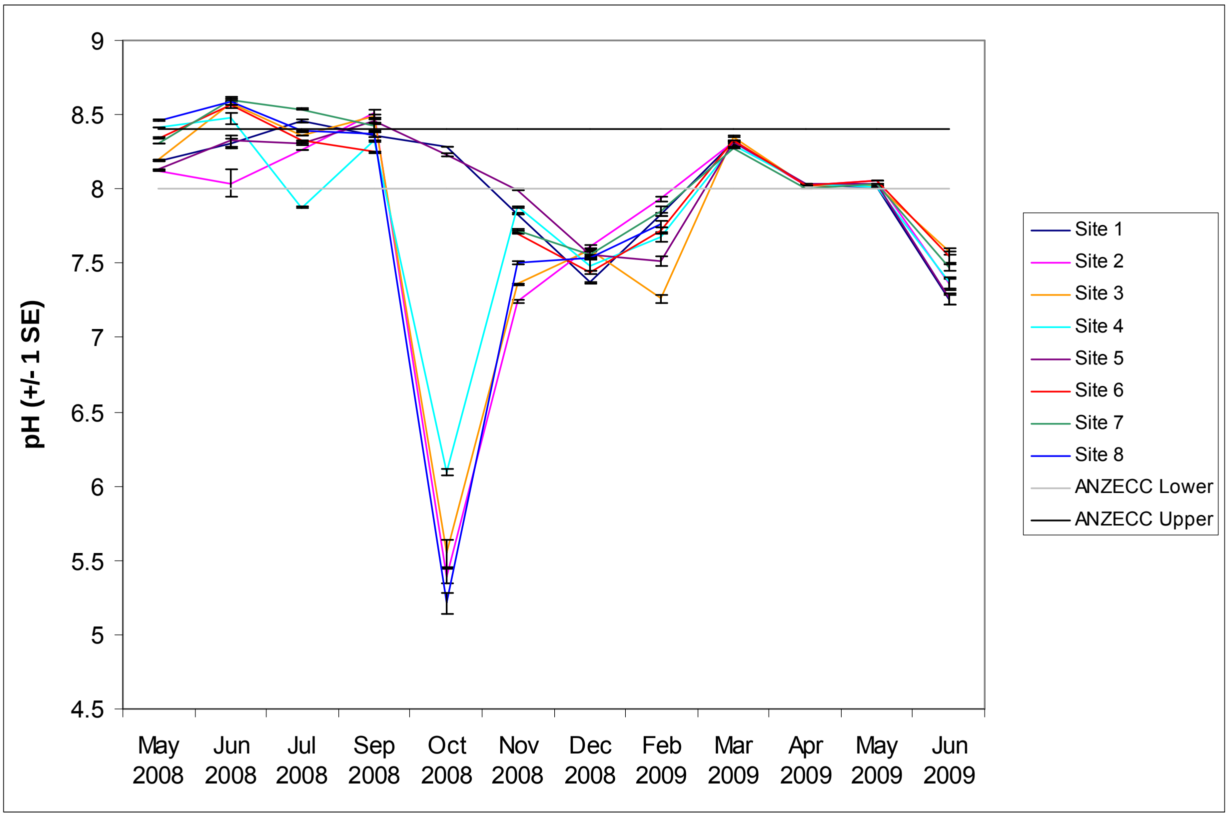


Figure 4-27 Mean monthly pH (± 1SE) recorded in-situ using hand-held water quality meter, in relation to ANZECC upper and lower guidelines

Salinity

Excluding a major decline in salinity levels in February 2009 at all sites, values for this parameter were relatively consistent both spatially and temporally. Over the entire monitoring program, variability in mean salinity levels was less than 1 part per thousand (ppt) between all 8 sites, with the range being 35.391 ppt (Site 7) to 36.147 ppt (Site 8).

Dissolved Oxygen

Dissolved Oxygen (DO) is a measure of the amount of oxygen in the water that is available to aquatic organisms. With the exception of anoxic microbes, oxygen is essential for life processes, that is, for the vast majority of marine organisms and those found in the open coastal environment. A change in DO values present in a marine environment can indicate environmental change. For example, low concentrations usually indicate the presence of excessive organic loads (QWQG, 2006). This may occur

as a result of the breakdown of a large amount of organic matter (e.g. once an algal bloom dies). High DO concentrations can indicate excessive plant production (QWQG, 2006), which occurs in the early stages of an algal bloom.

Dissolved oxygen (DO) levels fluctuated temporally during the program, but consistently across most sites (Figure 4-28). A clear temporal (i.e. seasonal) trend was not evident. DO values declined markedly during September, which is believed to be related to equipment malfunction. Values recorded suggest that DO levels and variability between sites was dampened during the wet season, with increased values and variability between sites occurring during the drier winter months. From October to March, values were below the ANZECC guideline value and at some sites, also below the QWQG value. During the drier, winter months, values were mostly above guideline values.

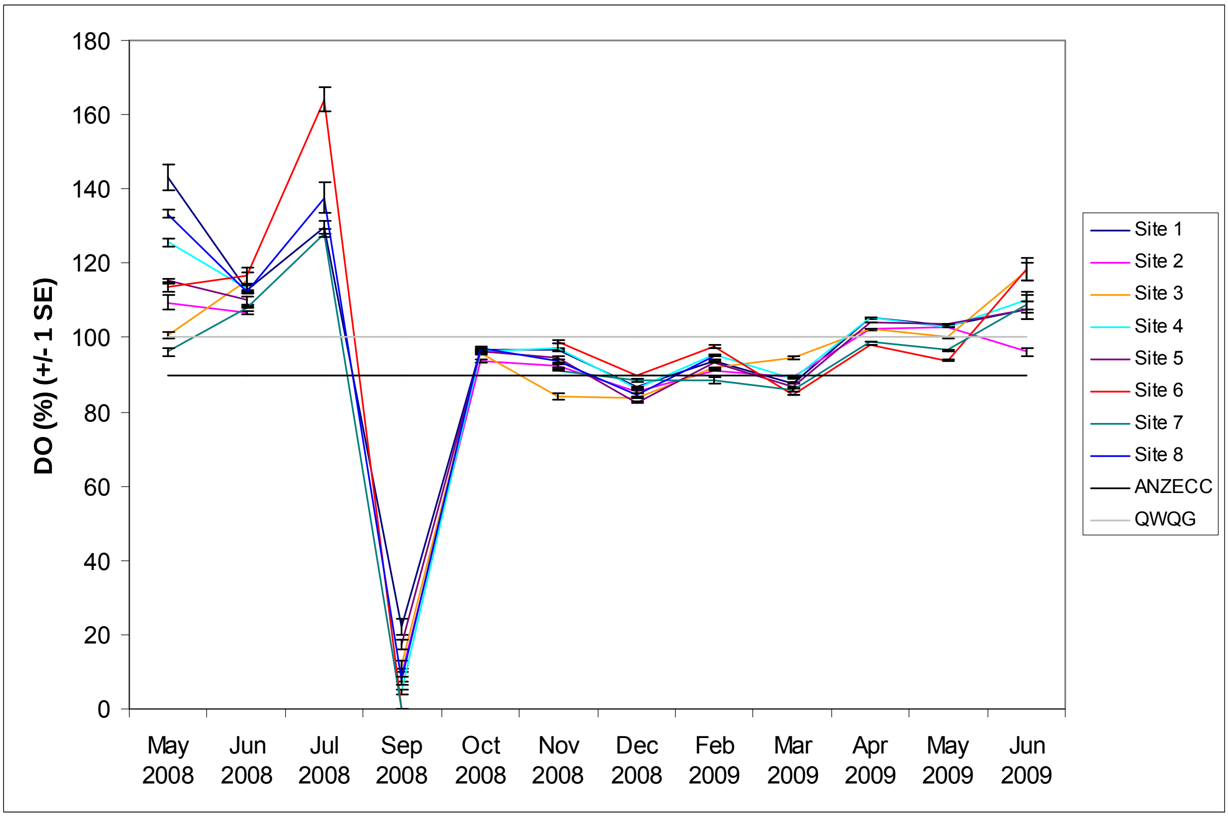


Figure 4-28 Mean monthly dissolved oxygen (± 1SE) recorded in-situ using hand-held water quality meter, in relation to ANZECC and QWQG Guidelines

Temperature

Water temperature can contribute significantly to the health of a marine ecosystem. Temperature was noted to follow seasonal patterns of change, declining towards winter months (July) and increasing towards summer months (December). Mean monthly temperature values recorded during the monitoring program followed a strong (predictable) seasonal pattern. Water temperature increased during the warmer months of the wet season and decreased during the cooler dry season. Water temperatures were warmest during December 2008 and coolest during July 2008. There was little spatial variability in temperature results, with water depth appearing to have little impact on temperature values. The range of mean temperatures recorded throughout the program was less than 1°C (23.669°C at Site 8 – 24.071 at Site 3).

Nutrients

System-level inputs of nitrogen and phosphorous into the coastal system are predominantly borne from rivers, rainfall, shelf-break up-welling, sewage outfalls, benthic mineralisation, micro-zooplankton excretion and atmospheric nitrogen fixation by coral reef cyanobacteria and phytoplankton e.g.*Trichodesmium*. These parameters are valuable indicators of ecosystem health over time.

Phosphorous

The QWQG and ANZECC guidelines for total phosphorus are 0.02 mg/L and 0.015 mg/L, respectively. Although generally in low concentration, these nutrients are clearly elevated above the guideline values during the majority of the monitoring program. This likely represents a natural state of this site. That is, dry season phosphorous levels may naturally occur at a level higher than the ANZECC guidelines for this location. Studies in other parts of the GBRMP have revealed that nutrient (phosphorous and nitrogen) levels tend to peak during the wet season as a result of the transport of large quantities of sediment and material into the marine environment from terrestrial runoff (Davies and Eyre, 2005). The elevated levels of this variable during this program highlights the importance of using site specific baseline data sets, such as that collected here, when interpreting coastal water quality conditions.

Although persisting above the QWQG (0.02 mg/L) and ANZECC (0.015 mg/L) guideline levels for the majority of the monitoring period, phosphorous results were generally consistently less than 0.5 mg/L. Four anomalous, site specific spikes occurred at sites 1 and 3 during October, site 7 during March and site 6 during May. These are likely attributable to isolated inputs of the nutrient. Temporally, there was generally only minor variability in phosphorous levels and the values recorded, although consistently above the guideline values, are likely to represent the baseline for this parameter at Abbot Point.

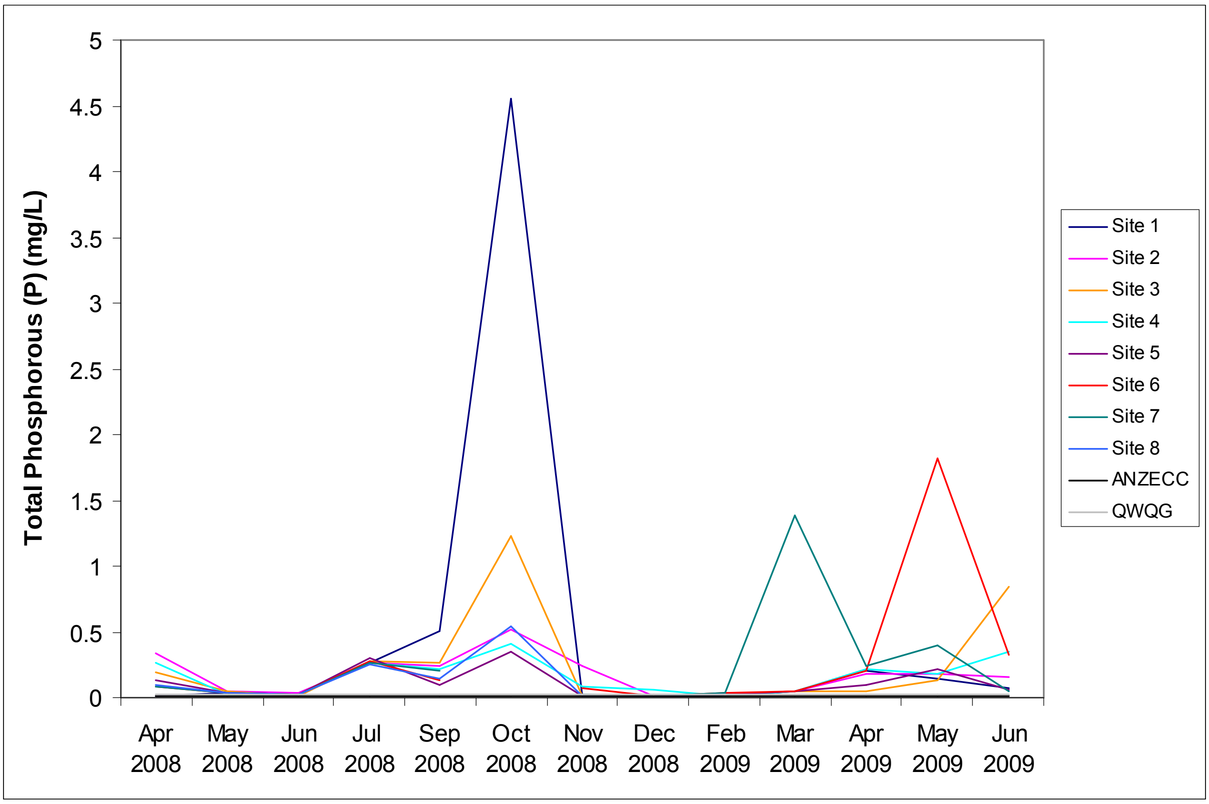


Figure 4-29 Monthly total phosphorous (P) recorded at the surface in relation to ANZECC and QWQG Guidelines

Nitrogen

Studies to date have shown that in the Great Barrier Reef (GBR) region, seagrass growth is limited by nitrogen (Udy *et al*., 1999; Mellors, 2003, Waycott *et al*., 2005). At Abbot Point, oxides of nitrogen (Nox) and total nitrogen levels were recorded at all sites. The baseline monitoring at Abbot Point shows that there appears to be little correlation between observed total nitrogen levels and other water quality parameters. Nitrogen in excessive quantities has the potential to adversely impact upon water quality by promoting the growth of phytoplankton and algae, which can increase turbidity and smother benthic taxa. Whilst total nitrogen levels have predominantly been low and the spike events have not occurred at elevated levels for successive monitoring periods, high nitrogen levels have been consistently recorded at regular intervals. As the wet season approaches, inputs of nitrogen into the Abbot Point system may increase in concentration or frequency. However, spike values observed during this monitoring program have not coincided with increased occurrence of algae, or been seen to be detrimental to the coastal ecology of the area. The recorded values are likely to represent natural seasonal cycling at this site, which should be considered for any future monitoring assessments.

Spatial variation in total nitrogen values recorded during the monitoring program was not pronounced. Temporally, nitrogen values varied markedly, with four notable spikes recorded consistently across most sites. These spikes occurred quarterly and corresponded with seasonal change (i.e. start of spring, start of summer etc). These spikes did not persist beyond the month in which they were recorded and although decreases in values were recorded in following months, total nitrogen levels at Abbot Point were generally consistently elevated above guideline levels (QWQG 0.14 mg/L; ANZECC 0.1 mg/L). As for phosphorous, it is likely that this represents the baseline at Abbot Point.

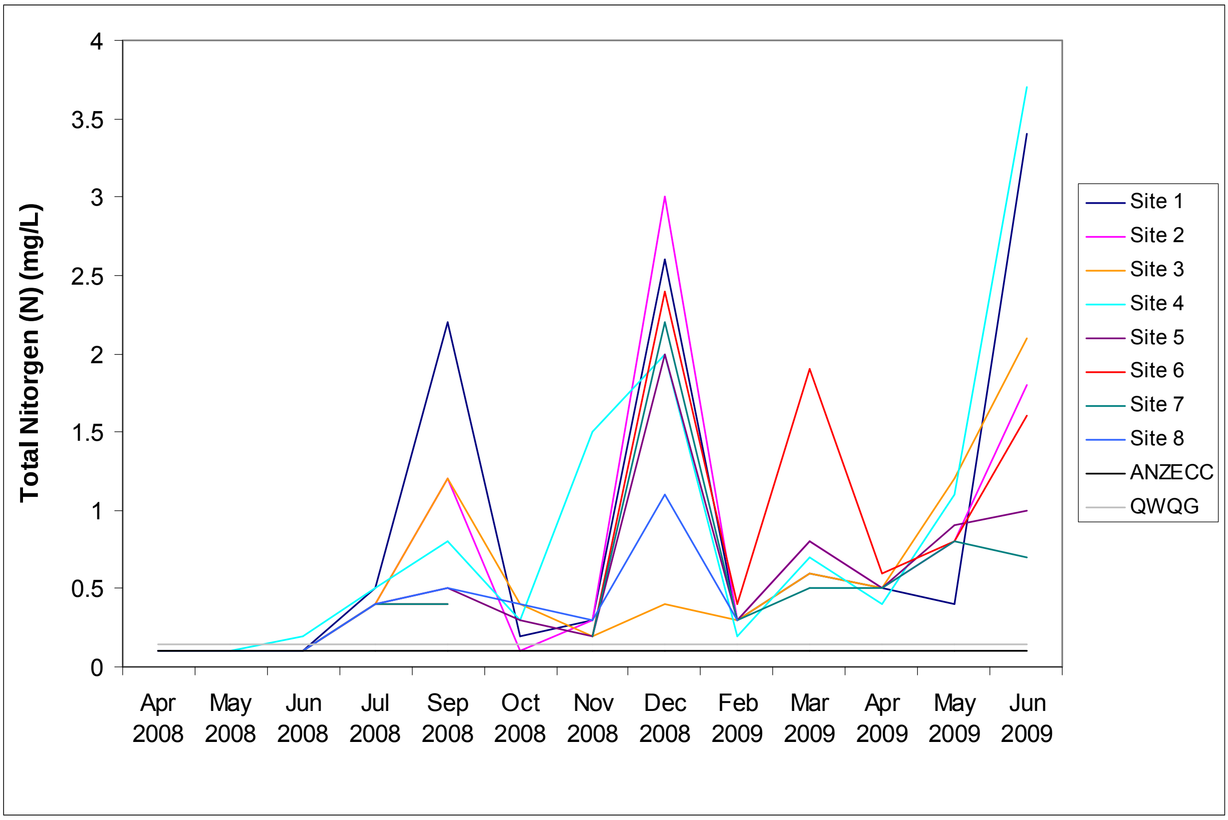
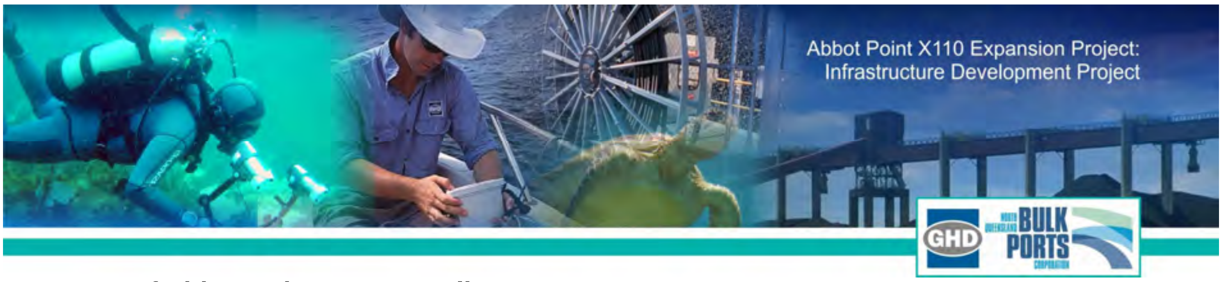


Figure 4-30 Monthly total nitrogen (N) recorded at the surface in relation to ANZECC and QWQG Guidelines

Chlorophyll *a*

Chlorophyll *a* is often used as a robust indicator for detecting spatial and temporal trends in nutrient pollution (Brodie *et al*., 2007). As outlined in the QWQG, a consistently high or variable concentration of chlorophyll *a* indicates the occurrence of algal blooms. In this monitoring program, chlorophyll *a* was sampled from the surface waters only. Very little variability in chlorophyll *a* levels was detected throughout the monitoring program. Large spikes recorded in April 2008 have been investigated and determined to be artefacts of incorrect storage and handling of samples prior to laboratory analysis during. Having removed these outlier values, recordings indicate that marginal increases (never exceeding 2 mg/m^3) were recorded in isolated instances during the second half of the program but that otherwise values were below guideline levels. Although these marginal increases resulted in values above the QWQG (1mg/m^3) and upper ANZECC (1.4 mg/m^3) guideline levels, the spatially isolated and infrequent nature of these results suggest that chlorophyll *a* levels did not vary markedly throughout the monitoring program and persisted at low levels.



Summary of Abbot Point Water Quality

Turbidity, TSS and deposition have been highly variable throughout the monitoring period at Abbot Point. The high degree of spatial and temporal variability in these inter-connected parameters is largely explained by the movement of water due to tides, currents and wind in the shallow water coastal environment that characterises Abbot Point. Rainfall (and associated runoff) has been low during the first six months of monitoring and as such, has only had a minor impact on turbidity, TSS and deposition levels. Whilst a positive relationship emerged between turbidity and TSS, deposition was not found to necessarily correspond with periods of elevated turbidity/TSS. The composition of solids in the water column and the degree of water agitation by tides, currents and winds are possible explanations for this.

Light availability (PAR) was found to be primarily affected by depth, whilst cloud cover was also important in limiting solar radiation input into the system. An inverse relationship between PAR and turbidity was identified, where increased turbidity resulted in reduced light availability.

Monitoring data for pH demonstrates that sites at Abbott Point regularly deviate (consistently) from guideline values for pH. These deviations are likely to be due to local influences including wave activity remobilising sediments, freshwater input and wind driven turbidity. The degree of variability clarifies that long term baseline data that incorporates local variability should be used for water quality monitoring program comparative purposes over guideline values. Consideration should be given to any sites selected for monitoring with a range of locations included as there may be site specific differences.

Salinity levels have shown only minor spatial and temporal variations through the monitoring period to date. This corresponds with limited freshwater input. It is predicted that with increased freshwater input into the Abbot Point marine environment during and after the wet season, greater levels of variation in salinity will be observed.

Whilst algal blooms have not been observed at Abbot Point, it is possible that small changes in the presence of micro-algae (which have not been sampled) in the water column have influenced DO levels during the monitoring period at a level against which other indicators of algae, being changes in chlorophyll *a* or turbidity, have not expressed variability. DO has generally remained above the ANZECC guideline for the entire monitoring period. Temperature increases in September and December may have facilitated corresponding DO declines, however temperature increases in October and November coincided with increasing DO levels. Further observations of DO will assist in clarifying baseline conditions for variable and potential drivers of change as they relate to seasonal variability.

Water temperature decreased during the winter months (April – July), before steadily increasing between September and December. Whilst it is likely that increasing temperatures are related to decreased DO levels, a clear relationship between these parameters has yet to be established. The observed fluctuations in temperature are within normal seasonal variability for this site.

Nutrient levels have generally been variable throughout the monitoring period. Phosphorous levels peaked in October and despite a decline in December, have been above the ANZECC and QWQG benchmarks for the majority of the six month monitoring program. The elevated phosphorous levels at Abbot Point may represent the baseline for the region and do not necessarily pose a threat to water quality and the marine environment. Surveys performed by GHD of benthic communities including sea grass and coral and marine fauna at Abbot Point revealed healthy ecosystems that were not showing signs of nutrient stress from elevated levels (such as algal smothering of sea grass and corals, or eutrophication).

Oxides of nitrogen have been relatively stable, occurring at levels above the ANZECC and QWQG guidelines. Like the elevated phosphorus levels, this may represent the baseline for the area. Total nitrogen levels have fluctuated markedly and have generally been above the ANZECC and QWQG levels. Again, this may represent a baseline that does not have negative environmental consequences for the marine environment at Abbot Point.

Whilst elevated nutrient levels have been typical, no relationship between these elevated levels and increased chlorophyll *a* concentrations (which have remained stable for all but the first month of monitoring), turbidity, dissolved oxygen, PAR and temperature have been identified. Thus it can be inferred that the persistently high (i.e. above ANZECC and QWQG) nutrient levels at Abbot Point represent baseline levels for the area that are not detrimental to the surrounding marine system.

Water quality monitored at Abbot Point to date represents a system within which turbidity is related to suspended particles that do not readily deposit, inferring a moderate energy environment that is not nutrient limiting. The water quality of the area, although variable and occasionally turbid, provides an appropriate environment for healthy benthic habitat communities, seagrasses and marine megafauna to occupy the area, as discussed below.

4.8.2 Potential Impacts and Mitigation Measures

Predicted impacts resulting from the construction of facilities at Abbot Point relate to pile driving and the mobilisation of equipment to facilitate construction, such as jack-up barges. Background turbidity levels at Abbot Point have been shown to be highly variable and often elevated. Pile driving results in a very localised, small increase in turbidity around the base of the pile that is being driven resulting from disturbance of the seabed. Similarly, placement of jack-up barges and movement of other construction equipment on-site may result in small localised increases in turbidity from disturbing the seabed. No impacts from these activities on other water quality variables are expected. Any elevations in turbidity experienced due to pile driving or construction works at Abbot Point are expected to be highly localised and short lived. They are also expected to be within the natural variability recorded for this site and accordingly, no impacts to water quality from this activity are expected as a result of in-water construction activities. Hence, no mitigation measures are deemed to be required other than the implementation of industry standard measures.

There is the potential for degradation of the coastal water quality as a result of the introduction of land based contaminants to the marine system from stormwater run-off across the construction site. This can be ameliorated by using the appropriate stormwater management strategies and waste management strategies identified for this project in the EMP (detailed under Section 5). Adopting stormwater and waste management strategies identified in the EMP will mitigate the potential for land sourced impacts to degrade the coastal water quality of this site during construction activities.