NEW HOPE GROUP

# J.5 Groundwater Monitoring and Impact Management Plan

NEW HOPE GROUP

# GROUNDWATER MONITORING AND IMPACT MANAGEMENT PLAN

*New Acland Coal Mine Stage 3 Project*

**JANUARY 2014**

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# 1. Introduction

This Groundwater Monitoring and Impact Management Plan (GMIMP) has been prepared to address the issues associated with the predicted impacts on groundwater at and surrounding the revised Project site from the proposed Stage 3 Expansion, south and west of New Acland Coal Pty Ltd's (NAC) current mining operation. It sets out the groundwater monitoring program for the revised Project site and the associated groundwater impact triggers that will invoke further assessment and groundwater impact management. The GMIMP is designed to provide consistency with the revised Project's Environmental Management Plan (EMP) and regulatory requirements.

Groundwater management plans are typically prepared following the issue of an Environmental Authority (EA) and address the relevant conditions stipulated therein. This plan has been developed as part of the Environmental Impact Statement (EIS) process and will be amended and finalised as necessary following the issue of a new draft Environmental Authority (EA) for the revised Project site.

The GMIMP will be administered as a supporting document to the revised Project's Plan of Operations.

The existing Mine currently operates under EA EMPL00335713 which covers Mining Leases (MLs) 50170 and 50216 immediately to the north of the revised Project area. The existing EA includes a number of conditions relating to groundwater monitoring and groundwater impact triggers. These conditions have been incorporated into the GMIMP for the revised Project site.

The GMIMP is structured as follows.

- Section 2: describes the principal aquifers of interest around the revised Project site, local use of groundwater, and the predicted impacts on groundwater from the revised Project's operations.
- Section 3: describes the groundwater monitoring program for the revised Project site including monitoring locations, monitoring frequency, and the parameters to be recorded/analysed.
- Section 4: sets out the groundwater impact triggers and protocols for investigating, and if required, mitigating the impacts on groundwater from the revised Project's operations.
- Section 5: describes the process of continual review and improvement of the GMIMP to ensure it continues to meet its objectives.

# 2. Predicted Impacts on Groundwater Levels

This section provides a summary of the five aquifers of interest in the vicinity of the revised Project site, the local use of groundwater and the predicted impacts from the revised Project's operations on these aquifers.

## 2.1. Principal Aquifers of Interest at the revised Project site

In the vicinity of the revised Project site, three of the principal aquifers of interest – the Walloon Coal Measures, the Marburg Sandstone, and the Helidon Sandstone – are subartesian aquifers within the Great Artesian Basin Groundwater Management Unit (GAB GMU). The *Water Resource (Great Artesian Basin) Plan 2006*, a subordinate regulation to the Water Act (2000), covers the management of all artesian and subartesian water in the vicinity of the revised Project site.

To implement the *Water Resource (Great Artesian Basin) Plan 2006*, the Queensland Government has produced the Great Artesian Basin Resource Operations Plan (GABROP). This plan came into force during early 2007 and was amended during late 2012. The GABROP applies to artesian, subartesian and spring connected water, and provides processes for dealing with unallocated water reserves (general and State). The GABROP subdivides the GAB GMU into 25 management areas. The revised Project is located within the Eastern Downs groundwater management area (Eastern Downs GMA) of the GAB GMU.

The revised Project access to unallocated general and State water reserves is very limited as a consequence of the status of the Eastern Downs GMA. Capping of abstraction volumes is employed to prevent overexploitation of groundwater and is essential for the Eastern Downs GMA, which is currently over allocated.

In addition to the three subartesian GAB aquifers at the revised Project site, the Tertiary Basalt and Quaternary Alluvium aquifers in the vicinity of the revised Project site contribute to the local hydrological environment.

The Quaternary Alluvial aquifer is not present within the revised Project site, except potentially for a very small portion of the far southeastern corner. However, to the south and north of the revised Project site, the Alluvial aquifer is associated with the Oakey and Myall Creeks and is known to support significant groundwater abstraction. Groundwater contained within the Quaternary Alluvium associated with Oakey Creek is managed under the Oakey Creek groundwater management area (Oakey Creek GMA). The water resource cap of the Oakey Creek GMA applies to abstraction for the mining, oil and gas industries.

The Tertiary Basalt aquifer is only present to a minor extent within the northwest of the revised Project site, however the aquifer becomes prolific immediately west of the revised Project site. Groundwater contained within the Tertiary Basalt aquifer is managed under the Eastern Downs GMA. As previously explained, the water resource cap of the Eastern Downs GMA applies to abstraction for the mining, oil and gas industries.

### *Quaternary Alluvial Aquifers*

Quaternary alluvium across the revised Project site is limited in extent and thickness and is not considered to possess significant potential to supply water. The nearest alluvium supporting groundwater supplies is the Oakey Creek Alluvium to the south-east of the revised Project site where the alluvium reaches a maximum thickness of 60 m. The proposed mine pits will not intersect this aquifer, with the closest occurrence of the Alluvial aquifer occurring approximately 2 km from the southernmost proposed mining area. Oakey Creek is an ephemeral watercourse located approximately 10 km to the south-east of the revised Project area and has been characterised in previous studies as a losing stream, i.e. water flow in the

creek is not derived from groundwater, but rather shallow alluvial groundwater receives recharge from the creek.

### *Tertiary Basalt Aquifer*

Tertiary Basalts are present in the north and west of the revised Project site and become more prevalent to the west of the revised Project site, varying in thickness up to 90 m. These occurrences are the result of Tertiary lava flows which have infilled pre-Tertiary age palaeo channels (ancient former drainage systems). The basalts are discrete lava flows interbedded with clay horizons which have the potential to act as aquitards (impermeable layers) within the basalt aquifer.

NAC currently draws groundwater from the basalt aquifer for potable water supply under a licensed allocation of 160 ML/year. In general, NAC only uses around 11 ML/year from the basalt aquifer for potable water production (based on recorded 2012 abstraction). The basalt aquifer is used by local landowners, predominantly to the west of the site, for private water supply.

### *Walloon Coal Measures Aquifer*

The Walloon Coal Measures consist of grey and light grey shales, siltstones, fine clayey sandstones, carbonaceous shales, mudstones and coal seams. The coal seams are laterally continuous but are characterised by rapid lateral variation of the interseam sediment thickness. The Walloon Coal Measures comprises three major coal intervals – Waipanna, Acland-Sabine and Balgowan. The revised Project site will extract coal from the Acland-Sabine interval of the Lower Walloon Coal Measures.

The Walloon Coal Measures is a subartesian aquifer within the GAB of particular interest with regard to potential groundwater impacts from mining activities, as it is continuous across the revised Project site and surrounding area, and is widely exploited by surrounding properties for water supply.

At its deepest point the revised Project will mine down to approximately 75 m below ground surface (i.e. as the deepest economically recoverable coal). The Mine currently utilises groundwater that seeps into the active mine pits from the coal measures, mainly for dust suppression purposes.

### *Marburg Sandstone Aquifer*

The Marburg Sandstone is a confined subartesian aquifer. It underlies the Walloon Coal Measures and consists of sandstone, minor coal, and conglomerate rock types. The productive water bearing units are interbedded with low permeability rock units such as mudstone, siltstone and shale.

Aquitards (low permeability strata) within and below the overlying Walloon Coal Measures act as effective confining layers for the Marburg Sandstone aquifer which occurs at a depth of approximately 150 mBGL within the revised Project site, generally 75 m below the bottom of active mine pits.

In the past, the Mine regularly extracted groundwater from the Marburg Sandstone aquifer for coal washing. This practice has been significantly reduced following a water supply agreement with the Toowoomba Regional Council (TRC) for the supply of recycled water from the Wetalla Water Reclamation Facility (WWRF). Groundwater levels in the Marburg Sandstone aquifer in the vicinity of the revised Project site have and are predicted to continue to recover as a result of the significant reduction in abstraction.

### *Helidon Sandstone Aquifer*

The Helidon Sandstone aquifer lies approximately 500–600 m below ground level at the revised Project site and is isolated from the overlying aquifers by the relatively impermeable Evergreen Formation which is approximately 200 m thick. This subartesian aquifer is extensive within the area and is utilised for a number of large commercial/industrial abstractions within this portion of the Eastern Downs GMA (e.g. Beef City Abattoir).

In the past, the Mine regularly extracted groundwater from the Helidon Sandstone aquifer primarily for coal washing purposes. This practice has been significantly reduced following a water supply agreement with the TRC for the supply of recycled water from the WWRF. NAC will maintain its licence arrangements for the Helidon Sandstone aquifer as an emergency water supply. To facilitate this arrangement, NAC will run periodic abstraction campaigns up to a total of approximately 30 ML/year to keep pumping equipment operational. Groundwater levels in the Helidon Sandstone aquifer in the vicinity of the revised Project site are predicted to recover as a result of the significant reduction in abstraction.

As a condition of NAC's abstraction licence, groundwater modelling has been required to evaluate the impact of abstraction from the Helidon Sandstone aquifer and its interaction with other abstractions from this aquifer within the Eastern Downs GMA. This information has been reported to the then Department of Environment and Resource Management (DERM).

Based on the depth of the Helidon Sandstone Aquifer and the presence of a significant aquitard (Evergreen Formation), the mining of coal across the revised Project site is not anticipated to have any impact on water levels in this aquifer.

## 2.2. Current and Future Groundwater Use at the Mine

The Mine's main operational water supply is recycled water from the WWRF, which has been secured for the life of the revised Project through a long term agreement with the TRC. NAC also supplements its operational water supply with recycled water from its in-pit tailings dam, limited extraction from shallow groundwater sources (e.g. Tertiary Basalt for potable supply), and surface water captured in environmental and other dams. As previously explained, prior to the agreement with the TRC, groundwater was the main water source for the Mine.

NAC currently holds water licences to extract groundwater from the Tertiary Basalt, the Marburg Sandstone, and the Helidon Sandstone aquifers. NAC's actual groundwater abstraction from the Helidon Sandstone aquifer is well below its 710 ML allocation, with a recorded usage of about 17 ML in 2012.

The current allocation from the Marburg Sandstone aquifer is 271 ML/year. NAC reduced its original allocation of 571 ML/year from the Marburg Sandstone aquifer during 2009. Groundwater abstraction for 2012 amounted to 10.5 ML from the Marburg Sandstone. As explained previously, NAC has a licence to extract 160 ML/year from the Tertiary Basalt, but utilises around 11 ML/year.

Groundwater abstraction from the Marburg and Helidon Sandstone aquifers has reduced to a small percentage of the licensed allocation with the commissioning of the WWRF pipeline in 2009. As a result, the revised Project's dependence on the local Eastern Downs GMA is minimal, with the usage figures for 2012 being representative of future usage (including for the revised Project), alleviating potential long term pressure on these aquifers. The abstraction of water from the Tertiary Basalt aquifer for potable use at the revised Project site will continue at 2012 rates of around 11 ML/year. All NAC's groundwater abstraction is conducted within its legal allocated limits under the *Water Act 2000*.

## 2.3. Groundwater Use around the revised Project Site

A search of the Department of Natural Resources and Mines (DNRM) bore database was conducted to identify groundwater bores in the vicinity of the revised Project site. Table 2-1 summarises the bores identified from the DNRM database within a zone extending 8 km beyond the revised Project's mining lease application area (50232). The location of all bores outside the revised Project area, including the current Mine site, is shown on Figure 2-1 and Figure 2-2. It should be noted that it is considered highly likely that other non-registered bores may also exist.

Table 2-1 DNRM Database - Bores within 8 km of New Acland Coal Mine[1]

| Aquifer | Existing bores | Proposed bores |
|---|---|---|
| Quaternary Alluvium | 159 | 0 |
| Tertiary Basalt | 81 | 0 |
| Walloon Coal Measures | 132 | 1 |
| Marburg Sandstone | 44 | 0 |
| Helidon Sandstone | 1 | 0 |
| Not defined[2] | 413 | 26 |
| Total: | 857 | |

Notes: 1. Not including bores listed as 'abandoned and destroyed'.

2. The DNRM database only identifies the source aquifers for around 50% of the bores within 8km of the mining leases.

The Walloon Coal Measures aquifer supplies both fresh and brackish water and is utilised extensively in the vicinity of the revised Project site for stock and domestic supply. It is considered likely that a large proportion of the bores identified in Table 2-1, for which source aquifer details are not available, abstract water from the Walloon Coal Measures aquifer. The DNRM bore data suggest that this aquifer generally produces yields between 0.1 L/sec and 5.4 L/sec, on average lower than yields from other aquifers in the database search area. Water quality is generally listed in the DNRM database as "potable" with some occurrences of "brackish" water for this aquifer.

Figure 2-1 shows a concentration of bores that abstract from the Oakey Creek Alluvium, which occurs 3-5km south and south-east of the revised Project site. Limited data on water quality in the Oakey Creek Alluvium indicates that the water is generally 'potable', as qualitatively listed in the DNRM database.

The expanse of Tertiary Basalt to the west and north-west of the revised Project site supports water supplies for stock watering and potable supply. Groundwater in the Tertiary Basalt aquifer is generally of potable quality. The yield from the basalt bores ranges from 0.1 L/sec to 15.6 L/sec but is typically less than 3 L/sec, and is highly dependent on the degree of fracturing encountered. Exploration activities by NAC's sister company, New Hope Exploration Pty Ltd, observed that water storage within the Tertiary Basalt aquifer was discretely located in association with fracture zones within the basalt. It is considered likely that some of the bores identified in Table 2-1 for which the source aquifer is not defined intersect the Tertiary Basalt aquifer.

The majority of the Marburg Sandstone bores are located to the east of the revised Project site (Figure 2-1). The DNRM bore database shows that this aquifer is generally qualitatively listed in the database as being of 'potable' quality, and yields range from 0.4 L/sec to 10.7 L/sec. It is considered likely that some of the bores identified in Table 2-1 for which the source aquifer is not defined intersect the Marburg Sandstone aquifer.

The nearest bore (apart from those owned and operated by NAC) which abstract from the Helidon Sandstone aquifer is located 6.5 km south of the revised Project site in the area of the Oakey township. Other known bores in accessing the Helidon Sandstone are located approximately 15 km to the east (Toowoomba Cooby Dam Bore and Hampton Irrigators), and 15 km to the south (Beef City Abattoir) of the revised Project site.

## 2.4. Predicted Impacts on Groundwater Levels and Users

As excavation of the revised Project's active mine pits proceeds below the Walloon Coal Measure's water table, groundwater will discharge into the pits. Dewatering of the Walloon Coal Measures aquifer will result in the lowering of groundwater levels in the aquifer in the immediate vicinity of the revised Project site. Groundwater levels in the Tertiary Basalt and Marburg Sandstone aquifers around the revised Project site will also be affected by dewatering the Walloon Coal Measures due to induced through-flow and leakage of groundwater from these aquifers to the Walloon Coal Measures.

Mining is planned to advance in a general north to south direction for the revised Project. The active mine pits will be excavated as a progressive series of strips that advance across the Walloon Coal Measures aquifer (resource area). As each active mine pit (new strip) advances, the previous strip is backfilled with mined material and rehabilitated. Following cessation of mining, groundwater will continue to discharge to the rehabilitated final voids, driven by evaporative discharge from the pit lakes that will form in the voids. A steady state equilibrium will be reached where the pit lake levels recover to an equilibrium where evaporation from the lakes balances groundwater inflow, at a level below that of the pre-mining water table.

The revised Project's EIS (SKM 2013) included the development and calibration of a transient groundwater flow model to predict groundwater drawdown in the surrounding aquifers over the life of the revised Project and following closure. The model is subdivided vertically into four separate layers which represent the separate hydrogeological units. The revised Project's timescale extends to 2030 and is incorporated within the model by using mining zones which are activated according to the mining schedule and de-activated as they are rehabilitated.

Impacts on groundwater levels will vary spatially over time as the mined area migrates across the revised Project site. The model predicts the greatest impacts on groundwater levels surrounding the revised Project will occur around 2030 at the end of mining. This corresponds to the Life of Mine Plan when the deepest areas of working will result in the most widespread drawdown.

Full details of the model, model calibration, predicted impacts on groundwater over the life of the revised Project are presented in Chapter 6 Groundwater Resources of the revised Project's EIS (SKM 2013) and the associated modelling report.

Predicted Impacts on the Walloon Coal Measures and Tertiary Basalt Aquifers – 2030

The predicted drawdown in the Walloon Coal Measures and Tertiary Basalt aquifers for the year 2030, which represents both the end of mining and the time of maximum predicted impact from the revised Project's operation, is presented in Figure 2-1. The figure shows the composite drawdown contours for layer 2 of the groundwater model which represents both the upper Walloon Coal Measures and the Tertiary Basalt aquifers which are considered to be

hydraulically connected. The extent of the basalt represented within the model is presented within this figure.

Figure 2-1 shows that drawdowns in excess of 5 m outside of the revised Project site are restricted to areas less than 3 km to the west and southwest. There are only 24 bores beyond the revised Project boundary that are predicted to experience drawdowns from mining activity greater than 5 m for the time of deepest working across the widest area (2030). This number of bores assumes that those bores in the DNRM database without defined source aquifers abstract water from the Walloon Coal Measures aquifer or the Tertiary Basalt aquifer. A shallower drawdown of between 2 and 5 m in the Walloon Coal Measures aquifer or the Tertiary Basalt aquifer is reasonably widespread to the west of the revised Project site, extending up to 7km from the lease boundaries.

Drawdowns of the order predicted in the Walloon Coal Measures and Tertiary Basalt aquifers are not considered to be significant in terms of affecting the yield or access to groundwater in existing bores abstracting from these aquifers. Importantly, current investigations demonstrate that the existing utilisation of groundwater sourced from the Walloon Coal Measures and Tertiary Basalt aquifers should not be significantly impacted by the revised Project.

### *Predicted Impacts on the Marburg Sandstone Aquifer – 2030*

Figure 2-2 presents the predicted drawdown in the Marburg Sandstone aquifer for the year 2030, which represents both the end of mining and the time of maximum predicted impact from the revised Project's operation. The Marburg Sandstone aquifer is situated approximately 75 m below the lowest level of working in the Walloon Coal Measures aquifer. Drawdowns are predicted to be much less in this aquifer beneath the active mine pits and do not exceed 3 m. Low levels of drawdown in the Marburg Sandstone aquifer (more than 1 m) are expected to propagate up to 5 km from the revised Project site.

Figure 2-2 indicates a limited number of Marburg Sandstone bores in the immediate vicinity of the revised Project site. However, it is acknowledged that some of the bores from the DNRM database shown on Figure 2-1 that have no details of their source aquifer may abstract from the Marburg Sandstone aquifer.

Drawdowns of the order predicted in the Marburg Sandstone aquifer are not considered to be significant in terms of affecting the yield or access to groundwater in existing bores abstracting from the Marburg Sandstone aquifer. Importantly, current investigations demonstrate that the existing third party utilisation of groundwater sourced from the Marburg Sandstone aquifer should not be impacted by the revised Project.

### *Predicted Impacts on the Helidon Sandstone Aquifer*

The Helidon Sandstone aquifer is not represented in the groundwater model as it lies some 200 m below the base of the Marburg Sandstone aquifer, and separating these two units is the relatively impermeable Evergreen Formation. The revised Project site is therefore not anticipated to have any significant impact on the Helidon Sandstone aquifer. NAC's current abstraction from this aquifer has substantially reduced prior to the revised Project's implementation resulting in the recovery of groundwater levels and the alleviation of some resource pressure on this GAB aquifer.

### *Impacts on Groundwater Levels – Post Mining*

After cessation of mining in 2030, groundwater levels are predicted to gradually recover so that for the most part there is less than 5 m residual drawdown outside the revised Project's boundaries. Recovery to pre-mining conditions throughout the revised Project site is limited

by evapotranspirative losses from the depressed landforms (rehabilitated final voids). Due to the high regional potential evapotranspiration rate, groundwater discharge to the depressed landforms is predicted continue at a rate only slightly less (3.5 ML/day) to that in the last year of mine operation. Drawdown adjacent the last areas to be mined is predicted to remain relatively high (approximately 20 to 30 m) due to the ongoing evaporation-driven groundwater discharge into the depressed landforms. A pit lake is expected to form within the Manning Vale West depressed landform, but a lake may not form to any significant degree in the Willeroo depressed landform and is not expected to form at all in the Manning Vale East depressed landform. Groundwater level recovery within the depressed landforms remains at to 30 to 40 m below the level of the pre-mining water table in the long term, due to the ongoing evapotranspirative groundwater discharge. As a result, the depressed landforms form a depression of the potentiometric surface within the vicinity of the depressed landforms and act as a groundwater sink that will not permit any pooled water within or adjacent to the depressed landforms to flow outwards into the regional groundwater system.

The 1 m drawdown extent is predicted to remain at approximately 7 km from the revised Project boundary at its greatest (western) extent in the long term post-mining due to ongoing evapotranspiration-driven groundwater discharge to the depressed. However, the groundwater system is expected to recover post-mining to a new steady state-equilibrium such that no additional groundwater impacts are expected other than those that exist at the end of mining in 2030.

### *Impacts on Groundwater Quality*

The drawdown of groundwater levels in the Walloon Coal Measures aquifer around the revised Project's depressed landforms will result in the movement of groundwater towards these depressed landforms. The aquifers surrounding the revised Project site will continue to receive recharge via the same processes that occurred prior to the operational phase of the revised Project (via rainfall infiltration over time). Therefore, the groundwater quality in the vicinity of the revised Project site is not anticipated to be affected as a result of mining.

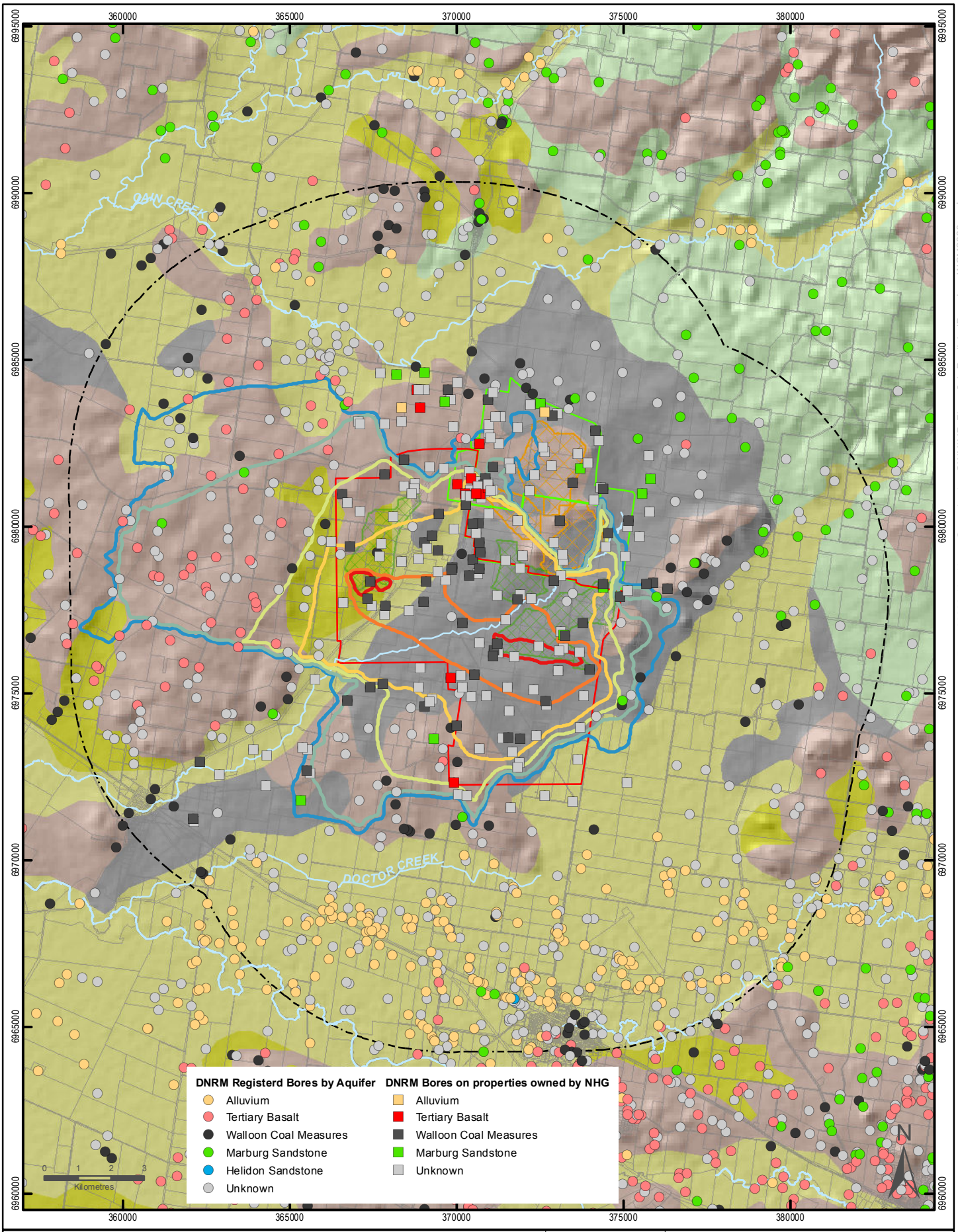
As the Marburg Sandstone aquifer is confined by the overlying Walloon Coal Measures, the potential for impacts on water quality within this aquifer from the revised Project's mining activity is considered negligible.

### *The operational phase of the revised Project is not expected to impact on groundwater quality.*

Water captured within the revised Project's depressed landforms (former final voids) possesses the potential to be saline owing to inflows of saline groundwater from the Walloon Coal Measures aquifer. This captured water may be further concentrated over time due to the region's high evaporation rate which exceeds the rate of groundwater inflow. Similarly, dilution of the captured water is expected during extended periods of rainfall. The depressed landforms will act as groundwater sinks with a permanent drawdown relative to the surrounding aquifer, and as a result, will not permit pooled water to flow outwards into the regional system. Therefore, any pooled saline water should remain confined within the depressed landforms and not have an impact on the water quality of the surrounding aquifers.

From an acid rock drainage perspective, it is unlikely that any water captured in the revised Project's depressed landforms will become acidic from oxidation of pyrites in the Walloon Coal Measures aquifer because of the neutralising effect of the surrounding sediments which are naturally alkaline. To date, NAC has not experienced any occurrences of acid rock drainage at New Acland Coal Mine.

Groundwater quality will continue to be monitored throughout the life of the revised Project to identify trends and assess whether impacts are occurring over time.




**LEGEND**

**Predicted Drawdown Contour (m)**

- 1
- 2
- 5
- 10
- 20
- 30

- Watercourse
- New Acland Coal Mine - Stage 3
- New Acland Coal Mine Stage 3 - 8km Buffer
- New Acland Coal Mine
- Cadastre
- Stage 3 Pit Areas
- Existing Permission

**Dominant Geology**

- Basalt (Tm)
- Alluvium (Qa)
- Colluvium (TQs)
- Walloon Subgroup (Jw)
- Marburg Sandstone (Jbm)

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**NEW ACLAND COAL MINE STAGE 3 PROJECT**

**Figure 2-1 - Predicted Drawdown in the Walloon Coal Measures & Tertiary Basalt 2030 (End of Mining)**

Scale 1:150,000 on A4

Projection: Australian Geodetic Datum – Zone 56 (AGD84)

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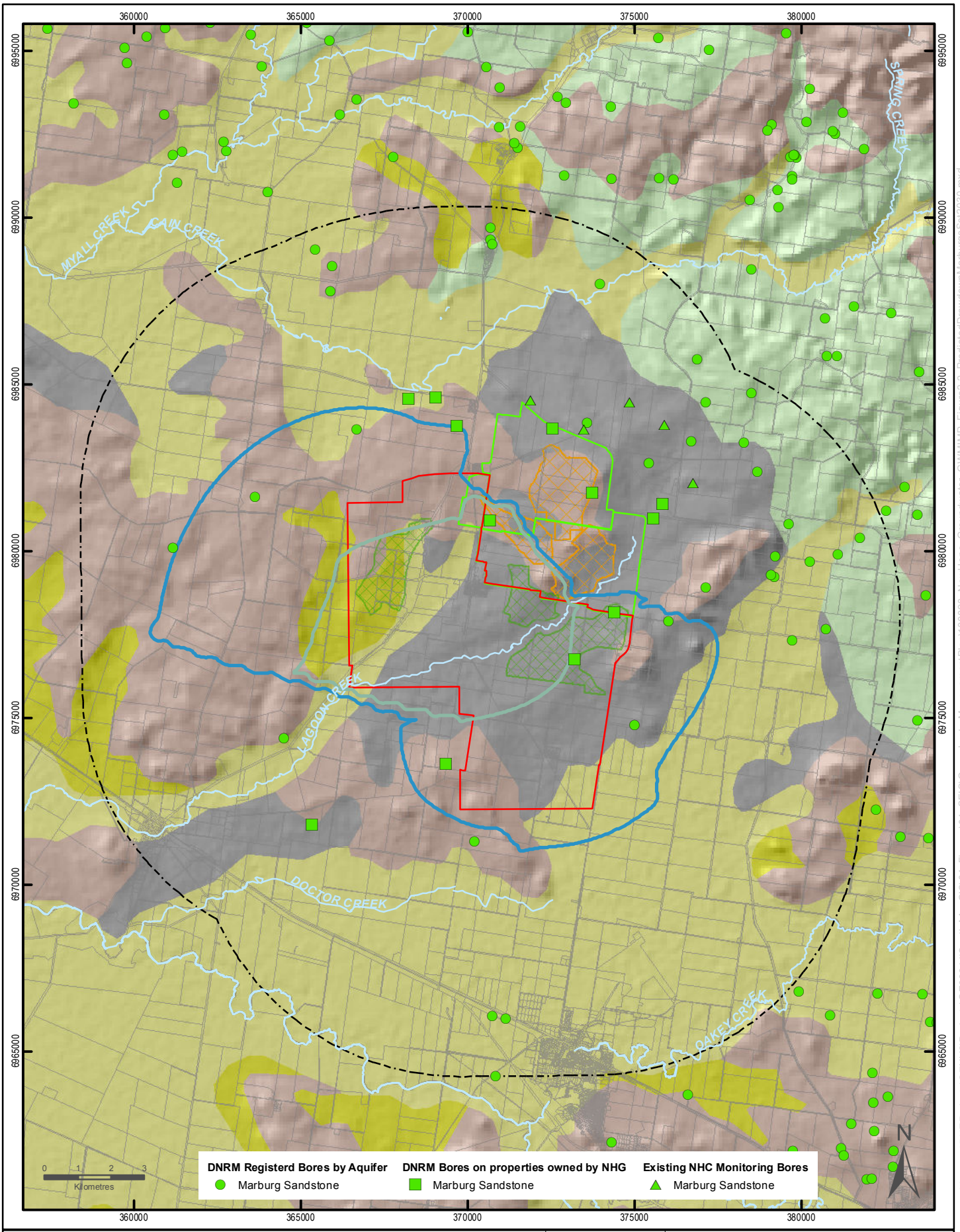


**LEGEND**

**Predicted Drawdown Contour (m)**
- 1
- 2
- 5
- 10
- 20
- 30

- Watercourse
- New Acland Coal Mine - Stage 3
- New Acland Coal Mine Stage 3 - 8km Buffer
- New Acland Coal Mine
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**Dominant Geology**
- Basalt (Tm)
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- Colluvium (TQs)
- Walloon Subgroup (Jw)
- Marburg Sandstone (Jbm)

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**NEW ACLAND COAL MINE STAGE 3 PROJECT**

**Figure 2-2 - Predicted Drawdown in the Marburg Sandstone 2030 (End of Mining)**

Scale 1:150,000 on A4
Projection: Australian Geodetic Datum – Zone 56 (AGD84)

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# 3. Groundwater Monitoring Program

## 3.1. Existing Groundwater Conditions

Baseline groundwater monitoring was undertaken as part of the revised Project's EIS (SKM 2013). The methodology undertaken for the assessment of groundwater resources included:

- the review of geological, hydrogeological and groundwater quality data collected for the current Mine;
- the review of other background data available on local hydrogeology and groundwater use;
- the installation of four production and 11 observation bores to characterise the local hydrogeology around the revised Project site;
- the undertaking of aquifer pumping tests to determine aquifer parameters; and
- the formulation of a hydrogeological conceptual model to serve as the basis for a numerical model.

The detail of the baseline groundwater assessment is presented within Chapter 6 Groundwater Resources of the revised Project's EIS (SKM 2013).

Baselines have been defined for monitoring bores associated with the groundwater monitoring program for existing operations at New Acland Coal Mine. Long term monitoring of bores for the expanded groundwater monitoring program which covers the revised Project will be undertaken to establish bore-specific groundwater level and quality baselines. The Life of Mine Plan will allow sufficient time for parameter baselines to be established in advance of any potential impacts from mining across the revised Project area.

### *Groundwater Levels in the Walloon Coal Measures across the revised Project Site*

Groundwater level data for the Walloon Coal Measures aquifer across the revised Project site indicate that currently the general direction of groundwater flow is southerly, falling from an elevation of around 430 mAHD in the north to 390 mAHD in the south. This direction of flow is consistent with a fall in the topographic elevation and geological dip across the revised Project Site. The long term data for monitoring bores indicate that the current mining operations on ML 50170 (Stage 1) and ML50216 (Stage 2) are not currently having a significant drawdown impact on groundwater levels in the Walloon Coal Measures aquifer within the revised Project site.

### *Groundwater Quality*

A groundwater monitoring program is currently undertaken in accordance with EA EPML00335713 for the current mining operation. This monitoring has provided sufficient data to define bore-specific baseline concentrations for the monitored parameters, and these are detailed in the regular groundwater monitoring reports prepared by independent consultants, Waste Solutions Australia (WSA). NAC's current groundwater monitoring program is regulated by the the Department of Environment and Heritage Protection (DEHP). In 2012, WSA prepared a comprehensive review of groundwater quality monitoring undertaken to date at the Mine in order to review and if necessary establish new groundwater quality background limits. This report is presented as Appendix A.

### *Walloon Coal Measures Aquifer*

Water quality for the Walloon Coal Measures aquifer shows typically neutral to slightly alkaline pH, with values generally falling within the potable range (6.5 to 8.5). Electrical conductivity (EC) values range from 530 µS/cm to 11,700 µS/cm but more typically range from 3,000 µS/cm to 6,000 µS/cm, reflecting the slightly brackish to brackish nature of the groundwater where naturally occurring sodium and chloride are the dominant ions. The majority of the bores currently monitored have total dissolved solids (TDS) levels below 4,000 mg/L, which indicates the quality is suitable for watering livestock. At TDS levels between 4,000 mg/L and 10,000 mg/L, animals may have an initial reluctance to drink but should adapt to these conditions without adverse effects.

Water supplies from Walloon Coal Measures aquifer include some of potable quality but the typically brackish nature of the groundwater from this aquifer means supplies are mainly used for stock watering.

### *Tertiary Basalt Aquifer*

The bores in the Tertiary Basalt aquifer currently monitored under the existing groundwater monitoring program yield water of essentially neutral pH (between 7.0 and 8.0). Salinity in the Tertiary Basalt aquifer is generally lower than the Walloon Coal Measures aquifer, with EC and TDS ranging from 1,400 µS/cm to 4,300 µS/cm and 870 mg/L to 2,900 mg/L, respectively.

## 3.2. Groundwater Monitoring Program

The groundwater monitoring program for the revised Project combines the current monitoring program for the existing Mine with an extended network of monitoring bores enclosing the revised Project area. Data collected from the groundwater monitoring program will:

- be operated in accordance with the revised Project's approved EA;
- be collated into six monthly and annual reviews of groundwater monitoring;
- be used in the continued development and refinement of groundwater impact assessment criteria and investigation triggers;
- enable verification and refinement of the groundwater modelling predictions presented in the revised Project's EIS (SKM 2013); and
- be collated into a database that will be made available to the administering authority on request.

The groundwater monitoring program conforms to Conditions C21 to C33 of the current EA EMPL00335713 for New Acland Coal Mine. Table 3-1 summarises the bores that will be monitored, monitoring parameters, and frequency. The groundwater monitoring program combines the existing monitoring bores together with an additional 15 bores that have been installed around the revised Project area. In addition, a further 14 bores will be added to the monitoring network which brings the total number of bores included in the groundwater monitoring program to 44. Proposed additional monitoring bore locations have been chosen based on model drawdown predictions and presence of aquifers and receptors of interest. The monitoring program for new bores will be established prior to the commencement of the revised Project's mining schedule to ensure there is sufficient baseline information on groundwater levels and quality for those bores.

Table 3-1 Groundwater Monitoring Schedule

| Monitoring Point | Aquifer | Parameter and Monitoring Frequency |
|---|---|---|
| **Bores monitored under current monitoring program (Compliance and Reference bores)** | | |
| 2289P | Coal Measures | Groundwater levels: **monthly**.<br>Groundwater quality: **six monthly** to include:<br>Al, As, Ca, Se, Cl, Cu, F, Fe, Total N, K, Mg, Mn, Na, SO4, HCO3, TDS, EC, pH |
| 2291P | Coal Measures | |
| 18P | Coal Measures | |
| 25P | Basalt | |
| 26P | Coal Measures | |
| 27P | Coal Measures | |
| 28P | Coal Measures | |
| 843 | Basalt | |
| 848 | Coal Measures | |
| 81P | Coal Measures | |
| 82P | Coal Measures | |
| 83P | Coal Measures | |
| 84P | Basalt | |
| BMH1 | Basalt | |
| CSMH1 | Coal Measures | |
| **Existing Stage 3 monitoring bores to be incorporated into the revised Project's monitoring program** | | |
| 109P | Basalt | Groundwater levels: **monthly**.<br>Groundwater quality: **six monthly** to include:<br>Al, As, Ca, Se, Cl, Cu, F, Fe, Total N, K, Mg, Mn, Na, SO4, HCO3, TDS, EC, pH |
| 112PGC | Coal Measures | |
| 114P | Coal Measures | |
| 116P | Coal Measures | |
| 119PGC | Coal Measures | |
| 120WB | Coal Measures | |
| 121WB | Coal Measures | |

| Monitoring Point | Aquifer | Parameter and Monitoring Frequency |
|---|---|---|
| **Proposed additional monitoring points which will be monitored as part of the revised Project's monitoring program** | | |
| 1A | Basalt | Groundwater levels: **monthly**.<br>Groundwater quality: **six monthly** to include:<br>Al, As, Ca, Se, Cl, Cu, F, Fe, Total N, K, Mg, Mn, Na, SO4, HCO3, TDS, EC, pH |
| 1B | Coal Measures | |
| 2A | Basalt | |
| 2B | Coal Measures | |
| 3A | Basalt | |
| 3B | Coal Measures | |
| 4A | Basalt | |
| 4B | Coal Measures | |
| 4C | Marburg Sandstone | |
| 5A | Oakey Creek Alluvium | |
| 5B | Coal Measures | |
| 6 | Coal Measures | |
| 7A | Basalt | |
| 7B | Coal Measures | |
| 8 | Mine Pit Backfill | |

Aluminium (Al), Arsenic (As), Selenium (Se), Copper (Cu), Fluorine (F), Iron (F), Total Nitrogen (Total N), Manganese (Mn); Calcium (Ca), Chloride (Cl), Potassium (K), Magnesium (Mg), Sodium (Na), Sulphate (SO4), Bicarbonate (HCO3), Carbonate (CO3), Total Dissolved Solids (TDS), Electrical Conductivity (EC); Acidity/Alkalinity (pH).

The locations of the monitoring bores in Table 3-1 are presented in Figure 3-1. The final location of the proposed additional bores may vary slightly depending on land access and proximity to local groundwater users. These bores will be individually identified in accordance with the bore naming convention at the revised Project site.

The existing Mine EA reference bores (BMH1 and CSMH1) are located within the predicted zone of groundwater drawdown from operation of the revised Project. NAC will accordingly re-assess the location of these reference bores and if necessary install new reference bores outside the revised Project's predicted zone of groundwater drawdown.

The groundwater monitoring network will:

- be installed and maintained by a person possessing appropriate qualifications and experience in the fields of hydrogeology and groundwater monitoring program design to be able to competently make recommendations about these matters;

- be constructed in accordance with methods prescribed in the latest edition of "Minimum Construction Requirements for Water Bores in Australia" (National Uniform Drillers Licensing Committee, 2012) by an appropriately qualified driller; and
- include a sufficient number of 'bores of compliance' that are located at an appropriate distance from potential sources of impact from mining activities and provide the following:
    - representative groundwater samples from the uppermost aquifer;
    - background water quality in hydraulically up-gradient or background bore(s) that have not been affected by any mining activities conducted by NAC; and
    - the quality of groundwater down gradient of potential sources of contamination including groundwater passing the relevant bore(s) of compliance.

Groundwater monitoring will be undertaken by appropriately qualified personnel. Groundwater level measurements, sample collection, storage and transportation will be undertaken in accordance with procedures conforming to the current industry standard: AS/NZS 5667.1, .11 1998.

The data gathered from the groundwater monitoring program will be collated into a database which will include:

- a site plan showing sample locations;
- tabulated results of the monitoring compared with applicable background/trigger levels;
- all data collected during each monitoring round;
- a record of chain of custody of the samples from sampling through to analysis;
- laboratory analysis certificates;
- groundwater monitoring program reports, and
- a description of the procedures, methods and calculations used.

Groundwater sample analysis will continue to be undertaken by a laboratory accredited by the National Association of Testing Authorities (NATA). Field measurement of water quality parameters is undertaken using appropriate field equipment that is maintained and calibrated in accordance with the manufacturer's recommendations.

- Data collected from landholder bores, wells, and waterholes will be used in conjunction with the groundwater impact investigation procedure to determine if contingency measures are required.

### *Alluvium*

- The nearest alluvium with significant groundwater supplies is associated with Oakey Creek in the south-west of the revised Project site. A new monitoring bore installed at location 5A (Figure 3-1) will monitor groundwater levels and quality in the Oakey Creek Alluvium. Groundwater levels in the coal measures between the active mine pits and the Oakey Creek Alluvium will be monitored at bores 119PGC and 116P and directly beneath the alluvium at Location 5B.

### *Basalt*

- Eight basalt bores will be monitored, including five new bores strategically located in areas of predicted drawdown and/or sensitive receptors (Figure 3-1). Groundwater levels will be monitored on a monthly basis and samples will be collected and submitted for the analytical suite set out in Table 3-1 every six months.

### *Coal Measures*

- The groundwater monitoring program includes 22 coal measures bores of which seven are new (Table 3-1 and Figure 3-1). Groundwater levels will be monitored on a monthly basis and samples will be collected and submitted for the analytical suite set out in Table 3-1 every six months.

### *Marburg Sandstone*

The Mine currently abstracts groundwater from the Marburg Sandstone aquifer for the purpose of coal washing. NAC currently possesses an allocation of 271 ML/year for this aquifer. For the revised Project's future operation, abstraction from the Marburg Sandstone aquifer will range around 10 ML/year for maintenance purposes. A new groundwater monitoring bore will be installed southwest of the revised Project site to monitor this aquifer and confirm predictions of minimal impacts.

### *Landholder Bores*

NAC will undertake a landholder bore assessment program to characterise each and every private bore predicted to be impacted by operation of the revised Project. The assessment program will collect information such as bore condition, usage, source aquifer, and water level and quality information. Following this assessment program, groundwater monitoring will be undertaken at selected landholder bores surrounding the revised Project site, following consultation with relevant landholders. Primarily this will include monitoring of groundwater levels and quality in order to assess potential impacts from mine dewatering. Landholder bores targeted for monitoring will primarily be those taking water from the coal measures and basalt but may include some bores in the Marburg Sandstone or alluvial aquifers.

## 3.3. Groundwater Impact Prediction, Validation and Review

Chapter 6 Groundwater Resources of the revised Project's EIS (SKM 2013) included the development of a multilayer time variant groundwater flow model to simulate the effects of mining activities on the local aquifers and to estimate the potential quantity of groundwater inflow to the active mine pits and depressed landforms

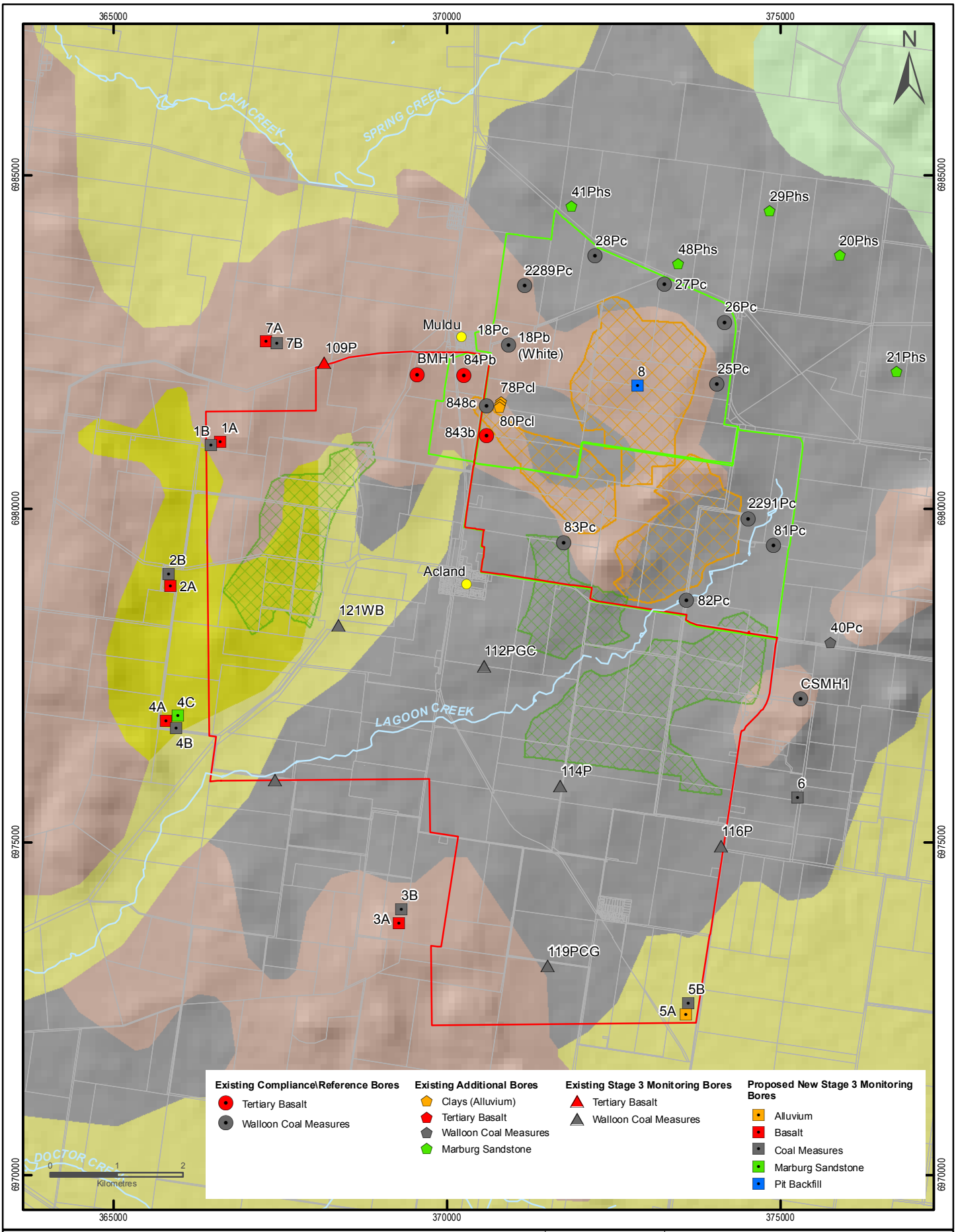
During the life of the revised Project, data collected through the groundwater monitoring program, will be used to update and refine this model and it's predictions to reflect the actual activities undertaken on site (e.g. mine development and sump locations) and the results of regular groundwater monitoring.

The need to review and update the revised Project's model will depend on the stage of the revised Project's mine development, changes in the depth of working, and availability and results of new monitoring data. For example, at the conclusion of the installation program for new monitoring bores for the revised Project, the data collected from the monitoring program will be used to immediately refine the model and produce a revised impact assessment. Table 3-2 presents the proposed schedule for groundwater impact prediction, validation and review. The results of any groundwater model verification and refinement, or the justification that this action is not necessary, will be documented, and as required, presented to DEHP

(regulatory authority under the *Environmental Protection Act 1994*) and/or NRM (regulatory authority under the *Water Act 2000*).

Table 3-2 Schedule for Groundwater Impact Prediction, Validation and Review

| Model Revision | Timing |
|---|---|
| Initial Review | At the conclusion of the revised monitoring network installation program |
| 2nd Review | After one (1) year of operation of the revised Project |
| 3rd and subsequent Reviews | Every three (3) years or if deemed necessary under the Groundwater Impact Investigation Procedure as described in **Section 4.2** |




**LEGEND**

- Towns and Localities
- Watercourse
- New Acland Coal Mine
- New Aland Coal Mine-Stage 3
- Existing Permission
- Stage 3 Pit Areas
- Cadastre

**Dominant Geology**

- Basalt (Tm)
- Alluvium (Qa)
- Colluvium (TQs)
- Walloon Subgroup (Jw)
- Marburg Sandstone (Jbm)

NEW HOPE GROUP

SKM

**NEW ACLAND COAL MINE STAGE 3 PROJECT**

**Figure 3-1 - Proposed Monitoring Locations**

Scale 1:75,000 on A4

Projection: Australian Geodetic Datum – Zone 56 (AGD84)

Produced: 10/01/2014 Path: \\skmconsulting.com\BNEProjects\QENV2\Projects\QE06644\SpatialArcGIS\01_Figures\01_SEIS\GroundwaterManagementPlan\131113_NewHope_Groundwater_GWMMP_Figure3-1_ProposedMonitoringLocations.mxd

# 4. Groundwater Impact Triggers and Investigation Protocols

## 4.1. Groundwater Impact Criteria and Triggers

Groundwater monitoring will be undertaken for the revised Project in accordance with the groundwater monitoring program. Impact assessment criteria for groundwater levels and quality, where not already established, will be developed using statistical analysis of the baseline data and the predicted effects presented in the revised Project's EIS (SKM 2013).

Triggers will be used to determine if the groundwater impact investigation procedure should be initiated.

These triggers include:

- breaching of relevant conditions of the EA;
- substantial variance from the predicted groundwater drawdown effects presented in the revised Project's EIS (SKM 2013) or subsequent impact assessment updates; or
- when a legitimate complaint is received from a local landholder who is a groundwater user.

### *4.1.1. Groundwater Quality Triggers*

Nine bores (18P, 27P, 28P, 843, 848, 81P, 82P, 83P and 84P) within the groundwater monitoring program have had background concentrations defined for the water quality parameters set out in Table 4-1. The upper and lower background concentrations were defined on the basis of six-monthly sampling over a four-year period and are reported in Appendix A. The groundwater monitoring requirements of the current EA EPML00335713 for the Mine sets limits for each of the water quality parameters included within the groundwater monitoring program (Table 4-1).

Table 4-1 Groundwater Quality Monitoring Limits

| Parameter | Limit |
|---|---|
| Aluminium (Al)<br>Arsenic (As)<br>Selenium (Se)<br>Copper (Cu)<br>Fluoride (F)<br>Iron (Fe)<br>Total nitrogen (N)<br>Manganese (Mn) | + / - 20% of background concentration |
| Calcium (Ca)<br>Chloride (Cl)<br>Potassium (K)<br>Magnesium (Mg)<br>Sodium (Na) | + / - 10% of background concentration |

| Parameter | Limit |
|---|---|
| Sulphate (SO4)<br>Bicarbonate (HCO3)<br>TDS | |
| Electrical conductivity (EC, µS/cm) | +/- 0.5 for coal measures aquifers, +/-1 for basalt aquifers |

Groundwater quality monitoring limits for new monitoring bores (including all Stage 3 monitoring bores) will be established and used following collection of a minimum of three years of data and appropriate analysis. As groundwater quality limits are established, they will be used in reporting requirements.

### *4.1.2. Groundwater Level Triggers*

The current groundwater level trigger set out in EA EPML00335713 – C26 for current mining operations will continue to apply. The EA states:

"..on lease groundwater levels must be monitored and compared with two bores located off-lease and within the same aquifer. The difference in the variation of drawdown from on-lease bores compared to the variation in off-lease bores within any one month sampling period should be no greater than one metre. Where a difference of more than one metre is identified and that difference is not the result of pumping of licensed bores, the administering authority must be notified within 14 days of completion of monitoring".

Four off lease Tertiary Basalt aquifer monitoring bores and five off lease Walloon Coal Measures aquifer monitoring bores will form an essential component of the 44 monitoring bores included in the groundwater monitoring program.

Groundwater level triggers will also be set on the basis of predicted drawdown in the Walloon Coal Measures and Tertiary Basalt aquifers. The selection of key monitoring bores will be based on at least two years of monthly groundwater level monitoring data. Modelled predictions of drawdown in the Walloon Coal Measures and Tertiary Basalt aquifers at these locations will be defined. When 75% of the predicated drawdown at these monitoring bores has been observed for three consecutive monthly monitoring events, the groundwater impact investigation protocol will be triggered.

### *4.1.3. Landholder Complaints*

In the event that a legitimate groundwater-related complaint is received from a local landholder, the relevant data will be reviewed by an appropriately qualified person who will determine if the groundwater impact investigation protocol should be initiated. Each new complaint will be compiled into a register and updated as required based on the management actions completed. The complaints register will be maintained for audit purposes.

## 4.2. Groundwater Impact Investigation Procedure

The groundwater impact investigation procedure will be implemented in response to an exceedence of a relevant trigger (groundwater quality or groundwater level) or a legitimate complaint from a landholder (groundwater related). The relevant data set will be reviewed by an appropriately qualified environmental specialist who will determine if further investigation

is necessary. The groundwater impact investigation procedure will follow the following framework.

- If a trigger or trend is identified in a data set, the first step will be to verify the data if it appears anomalous. A resample/re-test/re-measure will be conducted where appropriate.
- Where monitoring results indicate that a groundwater level has breached the reporting trigger, the administering authority must be notified within 14 days of completion of monitoring or as otherwise stated in the revised Project's EA.
- In relation to groundwater quality triggers, if the groundwater contaminant trigger levels defined in Table 2 are exceeded then an investigation into the potential for environmental harm will be completed and sent to the administering authority within 3 months of receiving the analysis results (Condition C29 EPML00335713).
- Once the validity of the breach in groundwater level triggers or a landholder complaint has been verified, a preliminary assessment will be undertaken by an appropriately qualified specialist involving the evaluation of the monitoring results/complaint in conjunction with mining activities being undertaken at the time, baseline groundwater monitoring results, groundwater data for surrounding locations, local use of groundwater, the prevailing and preceding meteorological conditions, and other factors affecting the local hydrogeological regime.
- The preliminary investigation may deem that further additional investigation and monitoring is required to determine the cause of the 'activation' of the trigger and whether or not it is directly related to mining activities.
- If the investigations deem that triggers have been 'activated' as a result of mining activities, contingency measures may need to be implemented.
- Additional monitoring may be implemented to measure the effectiveness of contingency measures (i.e. if deemed necessary).
- In the event that trigger levels or impact assessment criteria continue to be exceeded, further investigations may be undertaken (i.e. a process of continual improvement or adjustment of the relevant triggers if warranted).
- The results of any breaches of trigger levels and investigations will be documented for reporting and audit purposes.
- If a definite case of material or serious environmental harm or the potential for material or serious environmental harm is clearly established by a groundwater investigation into an exceedance of a relevant trigger (groundwater quality or groundwater level) or a legitimate complaint, NAC will ensure the notification requirements of Section 320 of the *Environmental Protection Act 1994* are fully addressed.

## 4.3. Mitigation

In the event that a formal groundwater investigation conclusively identifies that the revised Project's mining operations have adversely impacted a neighbouring groundwater user (affected groundwater user), NAC will attempt in 'good faith' to negotiate suitable mitigation measures in a timely manner to rectify the identified groundwater problem. NAC may involve an appropriately qualified environmental specialist to assist with development of the mitigation measures. The development of suitable mitigation measures will be based on the outcomes of an appropriate scientific investigation.

Possible mitigation measures that may be applied by NAC include:

- the refurbishment of an existing groundwater bore;
- the installation of a new groundwater bore;
- the establishment of an alternative water supply arrangement; and/or
- the use of another mutually agreed form of mitigation.

NAC will ensure as a minimum that the proposed mitigation measures are acceptable to the affected groundwater user, and if acceptable, will enter into a legal agreement for the installation of the proposed mitigation measures at NAC's expense. NAC will also ensure the proposed mitigation measures are commensurate with the identified groundwater loss.

NAC may be required to install interim mitigation measures until the permanent mitigation measures have been developed and installed. As required, NAC will seek agreement with the affected groundwater user and pay all reasonable cost for the use of any interim mitigation measures.

If agreement cannot be reached with the affected groundwater user in relation to the proposed mitigation measures, NAC will facilitate some form of legal disputes resolution for the matter.

NAC will ensure the administering authority is fully advised about the details and progress of these types of groundwater matters.

NAC is committed to rectifying all groundwater problems that are legitimately attributed to the revised Project's mining operations through proper scientific evaluation, in an appropriate timeframe, using accepted and practical mitigation measures, and to the satisfaction of the affected groundwater user.

## 4.4. Groundwater Complaints Management Process

Groundwater complaints that are believed to be attributed to the operation of New Acland Coal Mine (Mine) should be immediately reported to NAC. Groundwater complaints may be reported verbally by telephone (1 800 882 142 or Oakey Community Office: 07 4691 3445) or in writing using e-mail (community@newhopegroup.com.au) or letter (New Acland Coal Pty Ltd, PO Box 47, Ipswich, Qld 4305). NAC has provided its near neighbours with general and special 24 hour contact numbers. NAC will continue this practice for the revised Project.

The general details of the groundwater complaint need to be provided at the time of reporting the complaint to NAC. NAC will make all reasonable efforts to ensure the reported groundwater complaint is managed in a timely and appropriate manner. NAC's Environmental Officer (EO) is responsible for environmental complaints management at the Mine.

NAC will record the details of the groundwater complaint in the Mine's complaint database (register) and review this information. As required, NAC will re-contact the complainant about the groundwater complaint to obtain all the necessary details to decide the next course of action. Depending on the severity of the groundwater complaint, NAC as a courtesy may also advise the Toowoomba Office of the DEHP about the matter. As required, the New Hope Group's Corporate Environmental Team may assist with management of the groundwater complaint.

NAC's investigation of the groundwater complaint is designed to establish the legitimacy of the complaint, and if legitimate, whether the Mine is directly or indirectly responsible for the

complaint. If current evidence or further scientific investigation establishes NAC is responsible for the groundwater complaint, NAC will advise the complainant, the Toowoomba Office of the DEHP and follow the mitigation strategy outlined in Section 4.4 of this Plan. If current evidence or further scientific investigation establishes NAC is not responsible for the groundwater complaint, NAC will advise the complainant in a timely manner, and depending on circumstances, the Toowoomba Office of the DEHP.

At the cessation of the complaint investigation process, NAC will record all the relevant details about the groundwater complaint in the Mine's complaint database, including all management actions undertaken, the final outcomes of the complaint investigation process, the details of any required follow-up or on-going management actions, and whether the complaint is 'closed off' to the satisfaction of the complainant. NAC maintains the Mine's complaint database for issue analysis, regulatory and audit purposes.

Importantly, NAC is committed to working with its near neighbours to resolve genuine issues as they arise in relation to the operation of the Mine.

# 5. Review and Improvement Process

## 5.1. Review of the Groundwater Monitoring and Impact Management Plan

NAC will conduct an annual review of the environmental performance of the revised Project. The annual review will address the performance of the GMIMP and will:

- include a comprehensive review of the monitoring results and complaints records for the revised Project over the year, including a comparison of these results against the:
- relevant statutory requirements, limits or performance measures/criteria,
- monitoring results of previous years, and
- relevance to the revised Project's EA;
- identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;
- identify any trends in the monitoring data over the life of the revised Project;
- identify any discrepancies between the predicted and actual impacts of the revised Project, and analyse the potential cause of any significant discrepancies (Validate model);
- describe mitigation measures that have or are being implemented to address breaches of any groundwater impact triggers; and
- review the condition and extent of the groundwater monitoring network in the context of meeting its objectives.

Over the lifespan of the revised Project (approximately 16 years of working) and the post closure monitoring period, it is inevitable that groundwater monitoring bores will become unserviceable and need to be replaced. NAC will proactively maintain the groundwater monitoring network, replacing bores as necessary, and use the regular review of monitoring data to inform the location of additional monitoring bores, if required.

As required, NAC may update or revise the GMIMP based on the outcomes of the annual review process. The DEHP will be consulted in relation to any significant changes to the GMIMP and as necessary will be re-issued any new versions of the document.

# Appendix A Waste Solutions Australia (2012) - Establishment of Groundwater Quality Background Limits