APPENDIX H – QUALITATIVE GROUNDWATER ASSESSMENT

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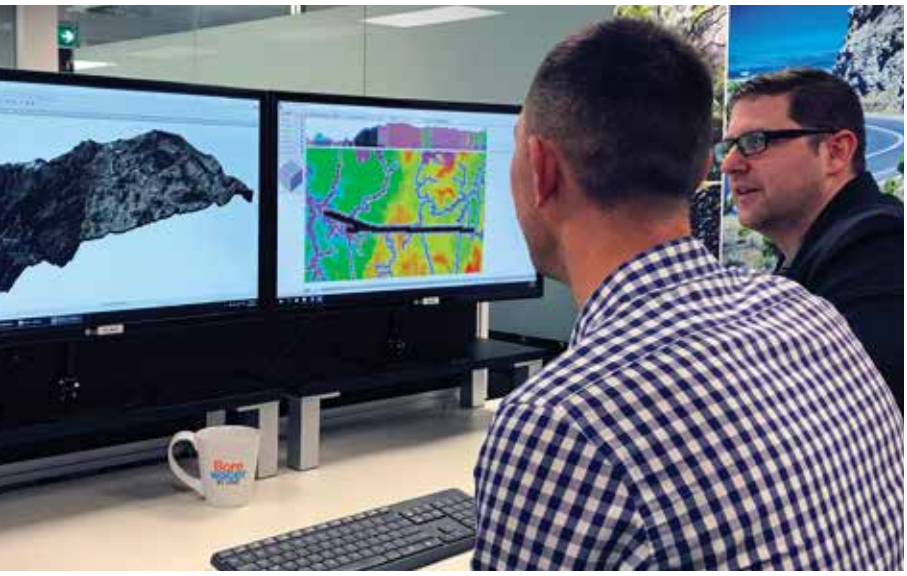
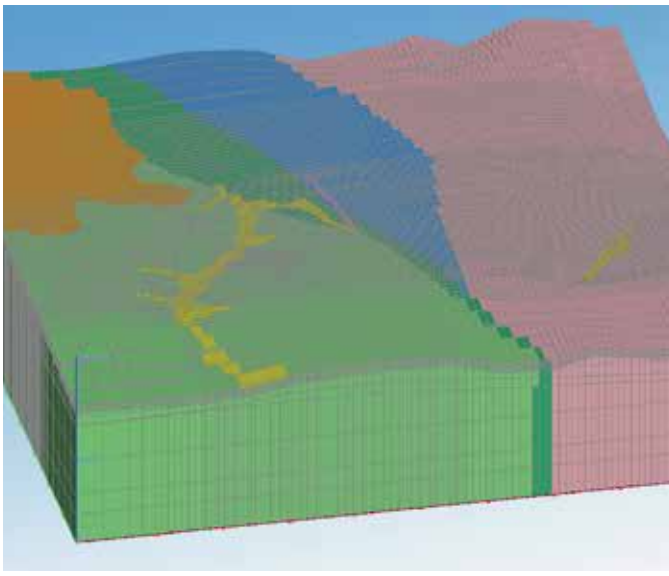
Luddenham Quarry Modification Report
DA 315-7-2003 MOD5

Qualitative Groundwater Assessment

Prepared for Coombes Property Group & KLF Holdings Pty Ltd
August 2020





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Groundwater Assessment

Luddenham Quarry – Modification 5

Report Number

J190749 RP#28

Client

Coombes Property Group and KLF Holdings Pty Ltd

Date

6 August 2020

Version

v1 Final

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Executive Summary

Coombes Property Group in partnership with KLF Holdings Pty Ltd are seeking to reactivate quarrying operations of an existing clay/shale quarry at 275 Adams Road, Luddenham (the site) through a modification of the existing State significant development consent (SSD) DA 317-7-2003. The modification includes a new stockpiling area, weighbridge and other site infrastructure, as well as other administrative changes. The modification does not seek to increase the approved quarry life nor the area or depth of the approved quarry footprint.

This Groundwater Assessment has been prepared to support the Modification Report for the reactivation of Luddenham Quarry.

ES1 Existing environment

The site is adjacent to the future Western Sydney Airport. Construction of the airport (including road infrastructure upgrades) has commenced. Commonwealth-owned land which will form part of the airport bounds the eastern and southern boundaries of the site.

Three monitoring bores were drilled and installed to a depth of approximately 30 m into the Bringelly Shale in 2009, with one bore up-hydraulic gradient (BSM1) as a background bore and two bores down-hydraulic gradient of the pit (BSM2 and BSM3). The nearest off-site groundwater bore is located approximately 1 km to the north-west of site.

The inferred groundwater flow direction is to the north-east mirroring the prevailing topography; however, it is noted that quarrying activities have disrupted natural groundwater flow, with some local groundwater flows likely to be towards the pit. A discrete low yielding seep has been observed over time in the south-facing high wall of the pit associated with bedding planes. Water ingress has previously been calculated to be less than 5 m^3/day (Douglas Partners 1993, VGT 2017).

Groundwater quality is near neutral, saline (total dissolved solids (TDS) of approximately 18,000 mg/L), and with elevated total nitrogen concentrations (NICS 2017). Relatively low concentrations of metals were also reported for the bores sampled, less than the relevant guideline values.

Groundwater quality results are distinct from the in-pit sump and Water Management Dam (WMD) water quality, with reported TDS values of 3,600 and 2,900 mg/L respectively (VGT 2017). The pH of the pit water and WMD was slightly alkaline (VGT 2017), somewhat different from the near neutral groundwater conditions. Thus, it is inferred that the pit water is primarily composed of direct rainfall and runoff as a result of rainfall.

The water balance results (EMM 2020b) show that groundwater inflows to the quarry pit are modelled to range from 4% (wet rainfall year) to 17% (dry rainfall year) of the annual inputs.

Given the depth of groundwater at site (12 to 16 m below ground level) and the low aquifer permeability it is unlikely groundwater provides baseflow to Oaky Creek and Cosgroves Creek. It is also unlikely that potential terrestrial groundwater dependent ecosystems (GDEs) have a high reliance on groundwater at/near the site due to the depth of groundwater and the low permeability of the aquifer.

ES2 Proposed water management

The proposed water management system for the site is presented by EMM (2020b). The key water management strategy adopted across the site is containment and management of potentially sediment-laden runoff from disturbed areas and reuse where feasible.

An existing Groundwater Monitoring Program (NICS 2017) will require review and updating, with appropriate assessment criteria and triggers for response and action to be considered. It is expected that the review and update of the GMP will be mainly administrative, with no new monitoring bores proposed to be installed.

ES3 Impact assessment

The proposed modification (MOD5) is not expected to result in an additional impact on groundwater as there are no proposed changes to the pit depth or extent.

It is considered that the proposed modification will not significantly impact on the local groundwater system and will meet the minimal impact considerations under the NSW Aquifer Interference Policy (NSW AIP) (2012). Further, ongoing groundwater monitoring would be undertaken during quarry operations to identify any changes to the local groundwater system that may occur.

It has also been assessed that the proposed modification will not impact on any neighbouring bores and will not significantly impact GDEs from changes in groundwater levels and quality, with surface water impacts anticipated to be the main driver of impacts on GDEs (eg via periodic licensed site discharges). This is considered to meet the minimal impact considerations under NSW AIP (2012).

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Figures

1 Introduction

1.1 Background

CFT No 13 Pty Ltd, a member of Coombes Property Group (CPG), has recently acquired the property at 275 Adams Road, Luddenham NSW (Lot 3 in DP 623799, 'the site') within the Liverpool City Council municipality. The site is located approximately 19 kilometres (km) north-west of the city of Liverpool, 25 km south-west of the city of Parramatta and approximately 43 km south-west of the city of Sydney, NSW. The site is host to an existing shale/clay quarry.

CPG owns, develops, and manages a national portfolio of office, retail, entertainment, land, and other assets. The company's business model is to retain long-term ownership and control of all its assets. CPG has the following staged vision to the long-term development of the site:

- Stage 1 Quarry Reactivation: **Solving a problem**. CPG intends to responsibly avoid the sterilisation of the remaining natural resource by completing the extraction of shale which is important to the local construction industry as raw material used by brick manufacturers in Western Sydney. Following the completion of approved extraction activities, the void will be prepared for rehabilitation.

- Stage 2 Advanced Resource Recovery Centre and Quarry Rehabilitation: **A smart way to fill the void**: CPG in partnership with KLF Holdings Pty Ltd (KLF) and in collaboration between the circular economy industry and the material science research sector, intends to establish a technology-led approach to resource recovery, management, and reuse of Western Sydney's construction waste, and repurposing those materials that cannot be recovered for use to rehabilitate the void. This will provide a sustainable and economically viable method of rehabilitating the void for development.

- Stage 3 High Value Employment Generating Development: **Transform the land to deliver high value agribusiness jobs**. CPG intends to develop the rehabilitated site into a sustainable and high-tech agribusiness hub supporting food production, processing, freight transport, warehousing, and distribution, whilst continuing to invest in the resource recovery R&D initiatives. This will deliver the vision of a technology-led agribusiness precinct as part of the Aerotropolis that balances its valuable assets including proximity to the future Western Sydney Airport (WSA) and Outer Sydney Orbital.

This report has been prepared for the Quarry Modification 5 application relating to the delivery of stage 1 above.

The existing consent has been modified three times (MOD1 to MOD3). A fourth modification application (MOD4) was withdrawn. The consent allows quarrying with a production rate of 300,000 tonnes per annum until 31 December 2024.

The consent includes quarry components that are on Commonwealth-owned land, which was leased by the previous operator, including the site access road, quarry support facilities and stockpiling areas. These quarry components on Commonwealth-owned land are no longer available for use by the quarry.

Figure 1.1 presents the location of the site in the regional context and Figure 1.2 presents the site in its local context including details of the proposed modification.

1.2 Project description

Quarry reactivation will require an approved modification (MOD5) to SSD DA 317-7-2003. The scope of the proposed modification is described in detail in Chapter 2 of the Proposed Modification Report and is summarised as follows:

- the use of the existing site access road from Adams Road by quarry vehicles;
- new stockpiling area, weighbridge and other site infrastructure within Lot 3 DP 623799;
- removal of activities on Lot 1 DP 838361 (adjacent to the eastern boundary of the site); and
- administrative modification of some other conditions of consent to align with current government policy and/or site conditions (ie reduced development footprint).

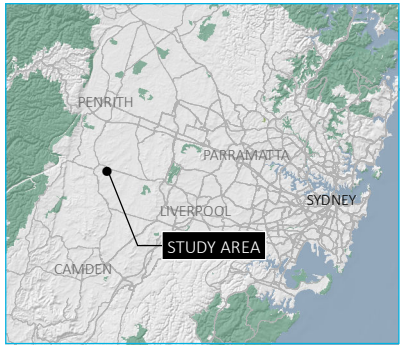
A recent resource estimation has indicated that the remaining resource in the approved quarry footprint is approximately 2 million tonnes. Based on the currently approved maximum annual extraction rate of 300,000 tonnes, extraction of clay-shale within the approved footprint could maintain production for approximately seven years from the recommencement of quarrying operations. The modification does not seek to increase the approved quarry life nor the area or depth of the approved quarry footprint.

1.3 Report objectives

This groundwater assessment has been prepared to support the Modification Report for the reactivation of the clay/shale quarry site. It characterises the existing environment and qualitatively considers the relative groundwater impacts of the approved and the modified project based on a desktop assessment. This groundwater assessment provides commitments to ongoing management and mitigation measures to minimise impacts to groundwater and assesses unavoidable residual impacts.

The objectives of the groundwater assessment are to:

- describe and characterise the existing groundwater environment;
- identify and assess impacts to groundwater as a result of the proposed modification; and
- develop management and mitigation measures to reduce the impacts to groundwater resources associated with the proposed modification.



KEY

- Study area
- Western Sydney Airport
- Major road
- Minor road
- Vehicular track
- Watercourse/drainage line
- NPWS reserve (see inset)
- State forest (see inset)

Source: EMM (2020); DFSI (2017); ASGC (2006); Nearmap (2020)

0 0.5 1 km

GDA 1994 MGA Zone 56

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Locality plan

Luddenham Quarry - Modification 5
Groundwater Assessment
Figure 1.1

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KEY

- Study area
- Cadastral boundary

Proposed site modifications

- Approved extraction footprint
- Existing noise bunds
- Existing stockpiling area
- Extended stockpiling area
- Internal road
- Site entry infrastructure (incl. offices, amenities, weighbridge)
- Equipment laydown area

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Source: EMM (2020); DFSI (2017); GA (2011); Nearmap (2020)

0 50 100 m

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Proposed modification

Luddenham Quarry - Modification 5
Groundwater Assessment
Figure 1.2

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2 Assessment framework

2.1 Protection of the Environment Operations Act 1997

The NSW *Protection of the Environment Operations Act 1997* (POEO Act) is administered by the NSW Environment Protection Authority (EPA), which is the primary environmental regulator for NSW. Under the POEO Act, an environment protection licence (EPL) is required for 'scheduled activities', generally activities with potentially significant environmental impacts. Licence conditions may relate to pollution prevention and monitoring and can control the air, noise, water and waste impacts of an activity.

Scheduled activities occur as part of the quarry operations and the site was previously covered by EPL 12863, which has been suspended. Consultation with the EPA has commenced to determine whether reactivation and subsequent variation of this EPL or application for a new EPL is appropriate.

2.2 Water Management Act 2000

The NSW *Water Management Act 2000* (WM Act) is based on the principles of ecologically sustainable development and the need to share and manage water resources for future generations. The WM Act recognises that water management decisions must consider economic, environmental, social, cultural and heritage factors. It recognises that sustainable and efficient use of water delivers economic and social benefits to the state of NSW. The WM Act provides for water sharing between different water users, including environmental, basic landholder rights and licence holders. The licensing provisions of the WM Act apply to those areas where a water sharing plan (WSP) has commenced.

WSPs are statutory documents that apply to one or more water sources. They define the rules for sharing and managing water resources within water source areas. WSPs describe the basis for water sharing and document the water available and how it is shared between environmental, extractive and other uses. The WSPs outline the water available for extractive uses within different categories, such as local water utilities, domestic and stock, basic landholder rights, irrigation and industrial uses.

The WSPs relevant to the site are:

- *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011* – the Upper South Creek Management Zone within the Hawkesbury and Lower Nepean Rivers Water Source applies to the surface water in the vicinity of the site; and
- *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011* – the Sydney Basin Central Groundwater Source applies to groundwater in the vicinity of the site.

2.3 Mining Act 1992

The *NSW Mining Act 1992* (the Mining Act) regulates the operation of mines in NSW through the issue of mining licences. The site requires a mining licence to operate as clay/shale is a mineral as defined under the Mining Act. The licence, once issued, would contain conditions related to the monitoring of groundwater.

2.4 NSW Aquifer Interference Policy (2012)

The purpose of the Aquifer Interference Policy ('the Policy') is to explain the role and requirements of the Minister administering the WM Act in the water licensing and assessment processes for aquifer interference activities under the WM Act and other relevant legislative frameworks. The Policy clarifies the requirements for obtaining water licences for aquifer interference activities and establishes considerations in assessing and providing advice on whether greater than minimal impacts might occur to a key water-dependent asset.

3 Existing environment

3.1 Surrounding land use

The site is bordered to the east and south by the future Western Sydney International Airport site. Construction of the airport (including road infrastructure upgrades) has commenced. Agricultural properties (grazing and intensive agriculture, eg poultry) are present to the north and west, with the closest occupied property located approximately 70 m north of the quarry's access road. Workers Hubertus Country Club and pistol range are located immediately west of the site.

3.2 Topography

The site elevation is approximately 80 m Australian Height Datum (m AHD) and predominantly flat, with gently sloping relief falling generally from the south-west to the north-east. There is an approximate 10 m fall across the 500 m distance between the western and eastern site boundaries.

3.3 Climate

Climate data collected from Badgerys Creek Automatic Weather Station ((site number 67108), located approximately 3 km to the south-east of the site, indicates that the site is located in a temperate region, with mean maximum temperatures ranging between 17.5°C (July) and 30.3°C (January) and mean minimum temperatures of between 4.1°C (July) and 17.3°C (January).

Patched point climate data was obtained from the Scientific Information for Land Owners (SILO) database hosted by the Science Division of the Queensland Government's Department of Environment and Science. SILO patched point data consist of interpolated estimates based on historically observed data from Bureau of Meteorology (BOM) weather stations. For this assessment, SILO data was obtained for the 'Badgerys Creek McMasters F.Stn' station (BOM station number 67068), which is located 1 km north-east of the site.

The SILO patched point data between 1889 and 2019 indicates that the average annual rainfall is 756 mm with average annual evaporation 1,470 mm.

3.4 Geology and soils

The Luddenham area lies within the central part of the Sydney Basin, which is comprised of several sedimentary strata including thick coal seams in the greater region and the extensive and continuous Hawkesbury Sandstone. These sandy sediments and the regional depression of the basin allowed the formation of shaly and silty strata (Wianamatta group) which includes the Ashfield and Bringelly Shales that are several hundred metres thick and form the bulk of the mineral resource of the site.

The Penrith 1:100,000 geological map indicates that the site is underlain by Bringelly Shale of the Wianamatta Group, comprising shale, claystone, laminite and sandstone, with rare coal and tuff.

Quaternary alluvium (sand, silt and clay) is identified to the north and west of the site, consistent with the alignment of Cosgroves Creek to the west and the northern reaches of Oaky Creek.

The soils at the site are identified as residual soils of the Blacktown soil landscape. A Preliminary Site Investigation for the proposed footprint of the resource recovery centre which is located in the northern portion of the subject property site (EMM 2020a) reported salinity potential as 'Very High' while Acid Sulfate Soils (ASS) have an 'Extremely Low' probability of occurrence.

3.5 Water management and monitoring

A Groundwater Management Plan was prepared for the site by Larry Cook and Associates Pty Ltd in February 2009. A groundwater monitoring bore network was installed in January 2009 consisting of three monitoring bores. Groundwater monitoring of the site was formalised in a Groundwater Monitoring Program (NICS 2017) which includes detail of groundwater monitoring and testing, rainfall monitoring, groundwater inflow monitoring, potential groundwater impacts, monitoring targets and effects, sampling frequency and parameters, assessment criteria and trigger levels, and protocols on impact reporting, data management and reporting.

Further discussion of the groundwater monitoring bore network at the site is given in Section 3.7.1.

3.6 Hydrology

The site is located within the Oaky Creek catchment. Oaky Creek forms the eastern boundary of the site and has a total contributing catchment area of approximately 382 ha adjacent to the quarry. The creek rises approximately 2 km south of the site and flows generally in a northerly direction. The creek continues downstream of the site for approximately 0.9 km before joining Cosgroves Creek. Downstream of the confluence with Oaky Creek, Cosgroves Creek flows for approximately 7 km before its confluence with South Creek, which ultimately contributes to the Hawkesbury River and Broken Bay. The total catchment area of Cosgroves Creek at the confluence with South Creek is approximately 2,163 ha.

There are a number of farm dams and retention ponds on the properties surrounding the site.

The site and immediate surrounds are comprised of four main sub-catchments:

1. a well vegetated grassed paddock of approximately 2.8 ha situated to the north of the quarry;

2. a portion of the unsealed internal road along the northern boundary and adjacent to the Water Management Dam (WMD) drains to the dam (total area of 0.8 ha);

3. Oaky Creek is an ephemeral watercourse characterised by a meandering shallow channel surrounded by dense vegetation, debris and scoured pools. At the north-eastern corner of the site, Oaky Creek drains to an online dammed storage, assumed to be built 50 to 70 years ago; and

4. remaining site areas including the existing and proposed stockpiling areas, proposed equipment laydown area, site entry infrastructure and remaining internal roads, extraction footprint and a minor portion of a neighbouring property's grassed area all drain to the quarry pit. These areas are predominantly disturbed catchment, totalling 12.9 ha.

3.7 Hydrogeology

3.7.1 Groundwater monitoring

Several previous hydrogeological investigations have been undertaken for the site including:

- D.J. Douglas & Partners Pty Ltd, 1993, *Report on Hydrogeological Assessment for the Luddenham Quarry*, prepared for Mitchell McCotter & Associates Pty Ltd; and

- VGT Pty Ltd, 2017, *Groundwater Study for the Luddenham Clay-Shale Quarry*, prepared for EPIC Mining.

A groundwater monitoring bore network was installed prior to quarrying to understand the hydrogeology at the site and to monitor for potential impacts. Three monitoring bores (refer Figure 3.1) were drilled and installed to a depth of approximately 30 m into the Bringelly Shale with the overlying unconsolidated material cased off. The monitoring bores were sited with one bore up-hydraulic gradient (BSM1) as a background bore (to the quarry footprint) and two bores down-hydraulic gradient of the pit (BSM2 and BSM3). The two down-hydraulic gradient bores are located along the eastern downslope perimeter of the quarry, outside the 40 m vegetated riparian zone associated with the western banks of Oaky Creek. The nearest off-site groundwater bore is located approximately 1 km to the north-west of site.

The most recent groundwater standing water levels (SWLs) measured in the bores were in May 2017, ranging from 58.36 m AHD (bore BSM1) in the south-west to 46.83 m AHD to the north-east (bore BSM3), with the inferred groundwater flow direction to the north-east mirroring the prevailing topography. However, it is noted that quarrying activities have disrupted natural groundwater flow, with some local groundwater flows likely to be towards the pit.

Hydraulic properties of the Bringelly Shale were quantified using slug tests after monitoring bore installation (NICS 2017). Analysis of the slug tests identified low hydraulic conductivities in the order of 0.005 m/day to 0.16 m/day. A discrete low yielding seep has been observed over time in the south-facing high wall of the pit associated with bedding planes. No other seeps have occurred to date on the western, northern and eastern pit faces. Water ingress has previously been calculated to be less than 5 m^3/day (Douglas Partners 1993, VGT 2017).

The most recent (May 2017) groundwater monitoring event indicated that groundwater was near neutral, saline (total dissolved solids (TDS) of approximately 18,000 mg/L), and with elevated total nitrogen concentrations (NICS 2017). Relatively low concentrations of metals were also reported for the bores sampled, less than the relevant guideline values. Note that, although bore BSM2 was sampled, it was considered that rainfall runoff had impacted this previously damaged bore, thus resulting in un-representative groundwater quality results.

An in-pit sump has been installed to the north of the pit, with an approximate water level of 39 m AHD. It is anticipated that the continual development of the quarry pit will induce local groundwater flows into the pit, creating a local groundwater sink.

Groundwater quality results are distinct from the in-pit sump and WMD water quality, with reported TDS values of 3,600 and 2,900 mg/L respectively (VGT 2017). The pH of the pit water and WMD was slightly alkaline (VGT 2017), somewhat different from the near neutral groundwater conditions. Thus, it is inferred that the pit water is primarily composed of direct rainfall and runoff as a result of rainfall.

3.7.2 Water balance modelling

A water balance model was developed for the proposed water management system. The water balance model was developed in GoldSim version 12.1 (GoldSim Technologies 2017), and is detailed in the Surface Water Assessment for MOD5 (EMM 2020b).

The inputs to the quarry pit were modelled to consist of:

- direct rainfall onto the surface of the pit;
- runoff from contributing catchments as a result of rainfall; and
- groundwater intercepted by the quarry pit.

Inflows to the quarry pit were modelled to be pumped to the WMD on a daily basis. To minimise the risk of off-site discharges, transfers from the pit to the WMD were limited to the available capacity within the WMD.

The results of the water balance modelling for inputs to the quarry pit are summarised in Table 3.1.

Table 3.1 Summary of annual water balance inputs to the quarry pit

	Dry (10th percentile) rainfall year	Median (50th percentile) rainfall year	Wet (90th percentile) rainfall year
	ML/year	ML/year	ML/year
INPUTS			
Rainfall[1]	3.1	4.8	6.8
Catchment runoff[2]	5.7	13.8	34.1
Groundwater inflows[3]	1.8	1.8	1.8
Total inputs to quarry pit	**10.6**	**20.4**	**42.7**

1. Using BOM data
2. Estimated using the Australian Water Balance Model (see EMM 2020b)
3. Assumed to be a constant 5 m^3/d (Douglas Partners 1993)

The water balance results show that groundwater inflows to the quarry pit are modelled to range from 4% (wet rainfall year) to 17% (dry rainfall year) of the annual inputs.

3.7.3 Groundwater dependent ecosystems

High potential terrestrial groundwater dependent ecosystems (GDEs) (ecosystems that rely on the subsurface presence of groundwater) were inferred at the eastern boundary of the site and south-east of the site associated with Oaky Creek, and to the north-west of the site consistent with the alignment of Cosgroves Creek (BOM 2020) (see Figure 3.1). The desktop assessment provided by BOM (2020) is a coarse resolution spatial mapping tool provided across Australia, and potential GDEs to be assessed on a site-specific basis.

Given the depth of groundwater at site (12 to 16 m below ground level) and the low aquifer permeability it is unlikely groundwater provides baseflow to Oaky Creek and Cosgroves Creek. It is also unlikely that potential terrestrial GDEs have a high reliance on groundwater at/near the site due to the depth of groundwater and the low permeability of the aquifer.

KEY

- Study area
- Cadastral boundary
- High potential terrestrial GDE (based on BOM 2020)
- Groundwater monitoring bore
- In-pit sump

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Source: EMM (2020); DFSI (2017); GA (2011); Nearmap (2020); BOM (2020)

0 50 100 m

GDA 1994 MGA Zone 56

N

Groundwater features

Luddenham Quarry - Modification 5
Groundwater Assessment
Figure 3.1

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4 Impact assessment

The proposed modification (MOD5) is not expected to result in an additional impact on groundwater as there are no proposed changes to the pit depth or extent.

There will be no additional groundwater impacts from the surface modifications, ie:

- the use of the existing site access road from Adams Road by quarry vehicles;
- new stockpiling area, weighbridge and other site infrastructure within Lot 3 DP 623799;
- removal of activities on Lot 1 DP 838361 (adjacent to the eastern boundary of the site); and
- administrative modification of some other conditions of consent to align with current government policy and/or site conditions (ie reduced development footprint).

Potential groundwater impacts of the quarry reactivation include:

- potential impacts on the local groundwater system;
- potential interference on groundwater levels in any neighbouring bores, with the closest bore 1 km north-west of site; and
- potential impacts on any GDEs due to changes in groundwater levels and quality.

These potential impacts have been qualitatively assessed in the following sections.

4.1 Potential impacts on the local groundwater system

The quarry is hosted by the Bringelly Shale. This formation possesses low hydraulic conductivity associated with the fine-grained shale and claystone. The groundwater has a moderate to high salinity (TDS of 16,000 mg/L) which means that it is generally too saline even for the watering of stock. The elevated groundwater salinity has also been encountered in similar locations south of this area (NICS 2017). As stated in Section 3.7, the amount and rate of groundwater inflow to the quarry pit will be low.

It is considered that the proposed modification will not significantly impact on the local groundwater system, and will meet the minimal impact considerations under NSW AIP (2012). Further, ongoing groundwater monitoring would be undertaken during quarry operations to identify any changes to the local groundwater system that may occur.

4.2 Potential interference on groundwater levels in any neighbouring bores

As a consequence of the composition and fine grain size of the Bringelly Shale, low to very low permeability and the known poor quality of the groundwater, there are no known registered bores that extract groundwater from the Bringelly Shale within a 1 km radius of the quarry.

It has, therefore, been assessed that the proposed modification will not impact on any neighbouring bores and will meet the minimal impact considerations under NSW AIP (2012).

4.3 Potential impacts to GDEs from changes in groundwater levels and quality

High potential terrestrial GDEs were identified at the eastern boundary of the site and south-east of the site associated with Oaky Creek, and further to the north-west of the site consistent with the alignment of Cosgroves Creek. Oaky Creek and the associated potential GDE are likely primarily sustained by surface water with smaller, periodic licensed site discharges. It is unlikely groundwater provides baseflow to Oaky Creek and Cosgrove Creek, and also unlikely that potential terrestrial GDEs have a high reliance on groundwater at/near the site due to the depth of groundwater and the low permeability of the aquifer.

As detailed in the Surface Water Assessment for MOD5 (EMM 2020b), occasional discharges from the WMD to Oaky Creek will occur when the water stored on site exceeds the demand of dust suppression activities. The water balance model predicted a total discharge of 4.4 ML/year for the typical median (50th percentile) rainfall events.

It has, therefore, been assessed that the proposed modification will not significantly impact GDEs from changes in groundwater levels and quality, with surface water impacts anticipated to be the main driver of impacts on GDEs (eg via periodic licensed site discharges). Any potential impacts to GDE from changes in groundwater levels and quality are considered to meet the minimal impact considerations under NSW AIP (2012).

5 Management measures

The proposed water management system for the site is presented in the Surface Water Assessment for MOD5 (EMM 2020b). The key water management strategy adopted across the site is containment and management of potentially sediment-laden runoff from disturbed areas and reuse where feasible. The key features of the water management system include:

- diversion of runoff from undisturbed catchments away from disturbed areas and off site;
- collection of all potentially sediment-laden runoff from disturbed areas of the site within the quarry pit and the Water Management Dam;
- use of captured runoff for dust suppression of unsealed roads and disturbed areas; and
- discharge of excess water from the site via a licensed discharge point to Oaky Creek.

Following approval of the proposed modification, the water management plan for the site will be updated to include the new water management strategy for the quarry, in consultation with the NSW Department of Planning, Industry and Environment – Water and the EPA.

The updated water management plan will address any specific development consent or licence conditions and would also include:

- baseline monitoring data results;
- objectives and performance criteria including trigger levels for investigating any potentially adverse impacts associated with water management;
- details of the monitoring, inspection and maintenance programs;
- reporting procedures for the results of the monitoring program; and
- actions to respond to any exceedances of the performance criteria.

This water management plan will include a:

- Surface Water Monitoring Program;
- Groundwater Monitoring Program;
- Erosion and Sediment Control Plan; and
- Irrigation Management Plan.

The existing Groundwater Monitoring Program, as described in Section 3, will be reviewed and updated as required, with appropriate assessment criteria and triggers for response and action to be considered. It is expected that the review and update of the GMP will be mainly administrative, with no new monitoring bores proposed to be installed.

All monitoring will continue to be undertaken in accordance with the *Approved Methods for Sampling and Analysis of Water Pollutants in New South Wales* (DEC 2004).

6 Conclusion

CPG/KLF propose to reactivate operations at an existing shale and clay quarry at 275 Adams Road Luddenham. A modification to the existing development consent SSD DA 317-7-2003 is required to facilitate quarry reactivation, including a new site access road, new stockpiling area, weighbridge and other site infrastructure, as well as other administrative changes. The modification does not seek to increase the approved quarry life, production rate or the area or depth of the approved quarry footprint.

The proposed modification is not expected to result in an additional impact on groundwater as there are primarily surface modifications, with no changes proposed to the pit depth or extent. It has been assessed that the approved project and the proposed modification poses a low risk to the local groundwater system, neighbouring bores and groundwater levels and quality associated with GDEs.

The quarry's water management plan will be updated to include the new water management strategy for the site, with the existing Groundwater Monitoring Program to be reviewed and updated, which is expected to be mainly an administrative process with no new monitoring bores proposed to be installed.

References

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