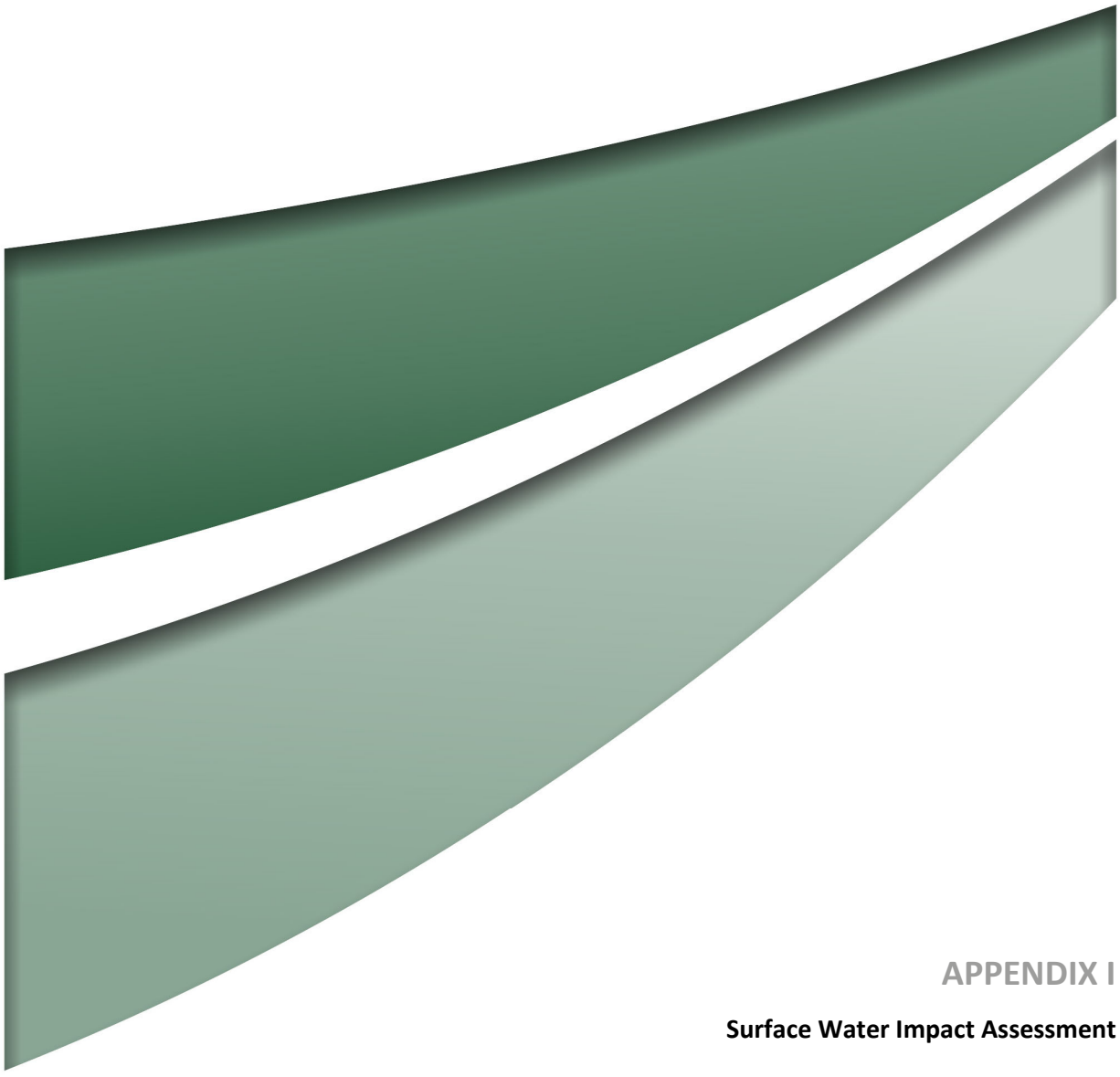


APPENDIX I

Surface Water Impact Assessment

umwelt
Environmental & Social Consultants

DARACON Group

SURFACE WATER IMPACT ASSESSMENT

Martins Creek Quarry Extension
State Significant Development Application

FINAL

May 2021

SURFACE WATER IMPACT ASSESSMENT

Martins Creek Quarry Extension
State Significant Development Application

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Buttai Gravel Pty Ltd

Project Director: Barbara Crossley
Technical Manager: Chris Bonomini

Report No. 3957C/R05
Date: May 2021

Newcastle

75 York Street
Teralba NSW 2284

T| 1300 793 267
E| info@umwelt.com.au

www.umwelt.com.au

This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
Final	Chris Bonomini	4/5/21	Barbara Crossley	4/5/21

Table of Contents

Tables

Charts

Figures

Appendices

1.0 Introduction

1.1 Background

The Martins Creek Quarry (the Quarry) is licensed by Buttai Gravel Pty Ltd, which is part of the Daracon Group (hereafter referred to as Daracon). The Quarry is an existing hard rock quarry situated within the Dungog Local Government Area (LGA), approximately 7 kilometres (km) north of Paterson and 28 km north of Maitland, New South Wales (NSW) (refer to **Figure 1.1**).

The Quarry was established in 1914 by the NSW Government Railways for the purpose of supplying railway ballast and other quarry materials to both the NSW railway network and Hunter Valley/Newcastle construction projects. Until late 2012, the Quarry has been operating continuously by various NSW Government transport departments, authorities and corporations.

In December 2012, Daracon secured a long term lease of the Quarry and have been extracting Latite Tuff to produce high quality aggregates, roadbase, ballast, gabion and other specified materials used in road, railway, concrete and civil construction. In 2014, Daracon submitted a development application for the Martins Creek Quarry Extension Project. An Environmental Impact Statement (EIS) was prepared and exhibited during late 2016 (Monteath & Powys, 2016). The development application is being assessed as a State Significant Development (SSD) (SSD No. 6612), requiring approval under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

Following detailed analysis of the EIS submissions, Daracon committed to key design changes and additional mitigation and management measures to minimise the Project's environmental and social amenity impacts. This included reductions in the proposed extraction limits, Quarry operating hours and truck movements.

Following community engagement and feedback during 2018 and 2019, and the change to Quarry operations in September 2019, Daracon has undertaken further quarry planning and design activities to optimise the use of the existing resource and minimise environmental and community impacts. As a result, the Revised Project now includes a number of additional amendments, including further reductions in road transportation volumes, peak hourly truck movements, operational hours, as well as a reduction in the Project disturbance footprint. As a result of this reduction in disturbance footprint, the Revised Project will no longer intercept a third order stream.

This Surface Water Impact Assessment (SWIA) was prepared by Umwelt Australia Pty Ltd (Umwelt) to inform the Revised Project's Amended Development Application and Response to Submissions (ADA & RTS).

1.2 The Revised Project

Table 1.1 includes the key features of the Revised Project that are relevant to the surface water assessment.

Table 1.1 Key Features of the Revised Project

Key Feature	Original Project (exhibited 2016)	Revised Project 2020
Extraction limit	1.5 Mtpa	1.1 Mtpa
Quarry operation approval term	30 years	25 years
Quarry extent	Proposed additional disturbance 82.8 ha (Conacher, 2016)	Proposed additional disturbance 66 ha associated with the proposed quarrying within the Project Area. (Note: as a result of the reduced disturbance footprint, the Revised Project will not intercept the third order stream that drains between the East and West Pit).
Road transport limit	Up to 1.45 Mtpa by road	Maximum 500,000 tpa by road
General Maintenance and Environmental Management Controls	Not specified	24 hours/7 days per week as required, including vehicles/trucks moving in and out of the site for maintenance purposes, as required

1.3 Revised Project SEARs and Agency Submissions

This SWIA has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) (dated 4 August 2016) and addresses the agency submissions relating to the previous water quality impact assessment (WQIA) (JM Environments, 2016) which was part of the EIS for the Original Project.

Table 1.2 presents the SEARs relating to surface water and where each element is addressed in this SWIA report. **Table 1.3** presents the agency submissions based on the previous WQIA (JM Environments, 2016) and where each submission is addressed in this SWIA report.

Groundwater impacts are addressed in a separate report *Martins Creek Quarry Groundwater Impact Assessment,* Australasian Groundwater and Environmental Consultants (AGE, 2020).

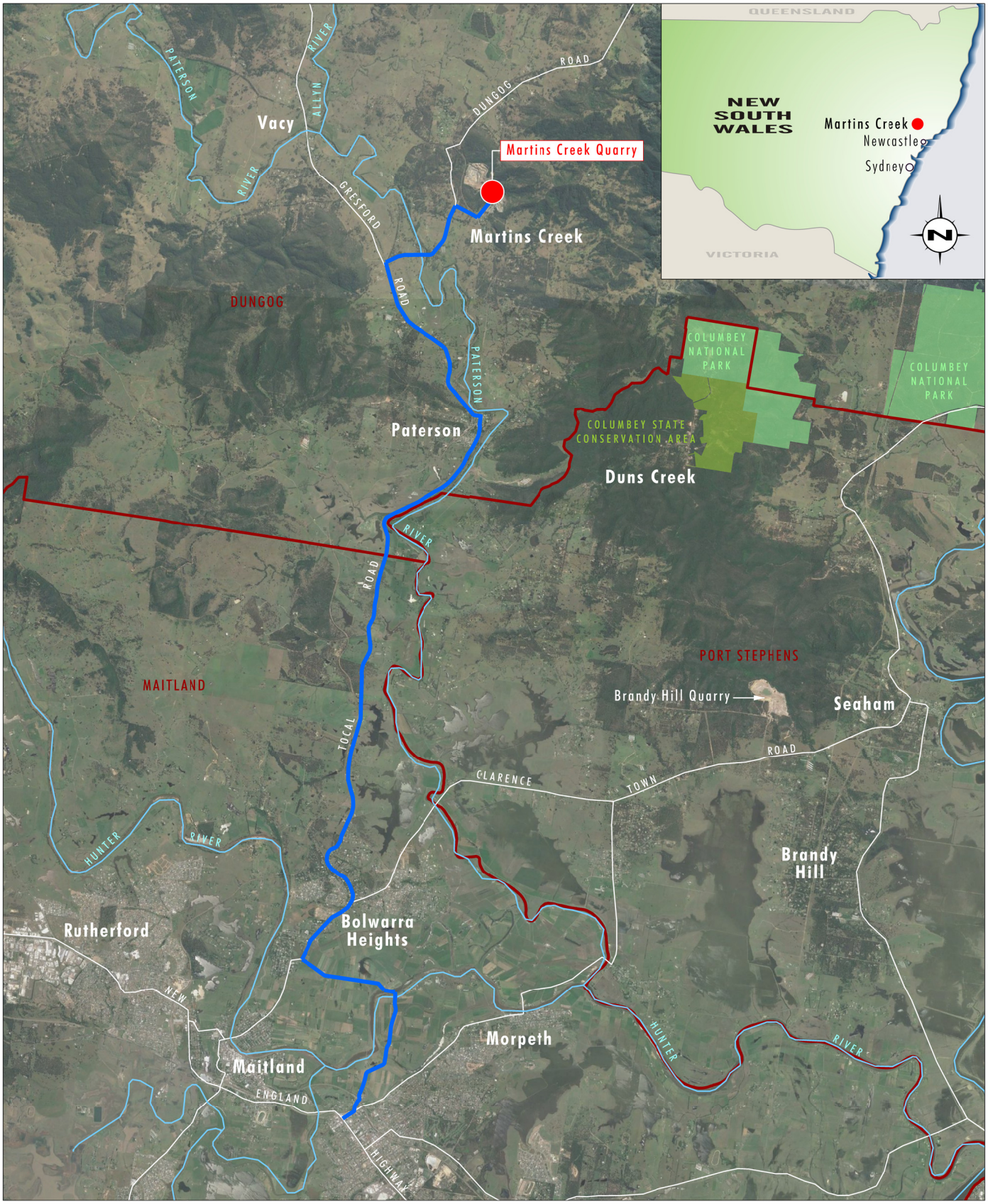


Image Source: Google Earth (2016)
Data Source: LPI (2019),
NSW National Parks and Wildlife Service (NPWS) Estate (Jan 2018)

0 2.0 4.0 6.0km
1:125 000

Legend

- Martins Creek Quarry
- Local Government Area Boundary
- Proposed Primary Haul Route

FIGURE 1.1

Locality Plan

Table 1.2 Secretary's Environmental Assessment Requirements

Agency	Requirement	Section
Department of Planning and Environment	An assessment of the potential impacts of the development on: • the quantity and quality of regional water supplies; • regional water supply infrastructure; and • affected licensed water users.	**Section 6.1**
	a detailed site water balance, including a description of site water demands, water disposal methods (inclusive of volume and frequency of any water discharges), water supply infrastructure and water storage structures;	**Sections 3.2** and **4.0**
	an assessment of proposed water discharge quantities and quality against receiving water quality and flow objectives;	**Section 6.1**
	identification of any licensing requirements or other approvals under the Water Act 1912 and/or Water Management Act 2000;	**Section 7.1.2**
	demonstration that water for the construction and operation of the development can be obtained from an appropriately authorised and reliable supply in accordance with the operating rules of any relevant Water Sharing Plan (WSP);	**Sections 4.3**, **6.1.2** and **7.1.2**
	a description of the measures proposed to ensure the development can operate in accordance with the requirements of any relevant WSP or water source embargo; and	**Sections 6.1.2** and **7.1.2**
	a detailed description of the proposed water management system (including sewage), water monitoring program and other measures to mitigate surface and groundwater impacts.	**Sections 3.2**, **6.2** and **7.2**
Dungog Shire Council	The Applicant should be required to prepare and implement a Site Water Management Plan for the development, which incorporates:	
	• a detailed description of the proposed water management system;	**Sections 3.2**, **6.2** and **7.2**
	• detailed assessment (including modelling) of the potential surface and groundwater impacts;	This SWIA.
	• a site water balance;	**Section 4.0**
	• an Erosion and Sediment Control Plan; and	**Section 3.1.2** and **Appendix 1**
	• a Surface Water Control and Monitoring Program.	**Sections 3.2**, **6.2**, **7.2** and **Appendix 1**
Department of Primary Industries - Water	Details of water proposed to be taken (including through inflow and seepage) from each surface and groundwater source as defined by the relevant water sharing plan.	**Sections 4.0**, **7.1.2** and **7.1.3**
	Assessment of any volumetric water licensing requirements (including those for ongoing water take following completion of the project).	**Section 7.1.2**
	The identification of an adequate and secure water supply for the life of the project. Confirmation that water can be sourced from an appropriately authorised and reliable supply. This is to include an assessment of the current market depth where water entitlement is required to be purchased (i.e. availability for purchase of water shares in the Paterson/Allyn Rivers water source).	**Sections 3.2**, **4.0** and **7.1.2**
	A detailed and consolidated site water balance.	**Section 4.0**

Agency	Requirement	Section
EPA	Water management issues associated with the proposal (surface water, impacts on receiving environments and general water usage), and actions that will be taken to avoid or mitigate impacts or compensate for unavoidable impacts.	**Sections 3.0**, **4.0**, **5.0**, **6.0** and **7.0**

Table 1.3 Agency Submissions

Agency	Submission	Section
NSW Department of Planning and Environment	DPE (now DPIE) requests the following additional information is provided as part of the RTS: • Justification on why only three samples is considered sufficient to fully and accurately determine surface water quality conditions, or provision of a more comprehensive sampling regime; • Provide an assessment of the frequency, scale, and potential water quality impacts of planned and unplanned water discharges from the site; • Justification as to how the limited groundwater monitoring data (three events at four locations) is sufficient to fully and adequately characterise existing groundwater conditions, provision of a more comprehensive sampling regime.	**Sections 2.2** and **7.2.2.1** **Sections 4.3.4** and **6.1.1**
Hunter New England Health	The EIS does not address the source, retention and treatment of water to be used by the project for potable uses. Hunter New England Health has required a Drinking Water Management Plan to be part of the EIS. In addition, Hunter New England Health has also recommended the need for detailed surface and groundwater management plan to be prepared.	**Section 3.2.2** **Sections 3.1** and **3.2**
NSW Department of Primary Industries - Water	One of the Dams (Dam 4) does not meet the requirements for exemption of a water access licence and therefore may need a licence. To assist DPI Water in providing advice on this matter the following information is requested: • Justification for the proposed location of Dam 4. Clarification as to whether this is a 'clean' water dam, as it is represented in the water balance and further detail on any reuse of this water. • Detail on the separation of clean and dirty water diversions. • Clarification regarding whether Dam 3 is a 'clean' water dam, due to clean catchment references in the water balance, and further detail on any reuse of this water.	**Sections 3.1**, **3.2** and **7.1.2**
	The proponent will be required to offset 217 ML of additional loss of catchment in the Paterson/Allyn Rivers Water Source resulting from the proposed expansion through the attainment of Water Access License shares equal to the loss.	**Sections 7.1.2**
	The proponent should provide further detail on: • Current water holding in the western pit void. • Clean and dirty water diversions around the pits. • Change in catchment area in the final landform.	**Sections 3.1**, **3.2** and **7.1.2.5**

Agency	Submission	Section
	The proponent should develop an Erosion and Sediment Control Plan in consultation with DPI Water.	**Sections 3.1** and **3.2**
	Further information regarding the proposed diversion design and associated downstream impacts.	**Sections 3.1** and **3.2**
NSW Office of Environment and Heritage	Upon review of the flooding/floodplain management component of the EIS, OEH notes that the proposal will intercept first, second and third order streams which will impact on availability of water for downstream users. The Department of Primary Industries Water should provide advice in relation to this issue.	**Sections 3.2**, **4.0**, **6.1.2** and **7.1.2**
NSW Environment Protection Authority	Further detail on the management, operation and dewatering of dams within the site.	**Sections 3.1** and **3.2**
	Additional information on the chemical flocculants for use as a water treatment control.	**Sections 3.1**, **6.2** and **Appendix 3**
	Clarification of the maximum pump out rates applicable for the site.	**Sections 3.1** and **3.2**

1.4 Potential Surface Water Impacts

The Revised Project has the potential to have the following impacts on surface water resources:

- Capture of runoff from additional undisturbed catchments as a result of the interception of minor ephemeral streams that presently drain past the Quarry to the Paterson River.
- Degradation of downstream water quality as a result of:
    - ground disturbing activities leading to erosion and transport of sediment to downstream water users and water courses including the Paterson River
    - additional volumes of water being discharged from the Quarry licensed discharge points (refer to **Section 6.1.2**) to the downstream water users and water courses including the Paterson River
    - potential spills of hydrocarbons and other chemicals.
- Impacts on the Hunter Estuary wetlands Ramsar site (approximately 30 km downstream of the Quarry) as a consequence of changes in freshwater supplied downstream from the Revised Project site and water quality impacts.
- Increased import of potable water to meet production demands.

The potential surface water impacts listed are assessed in **Section 6.1**. Proposed controls and mitigation measures to manage the Project impacts are detailed in **Section 6.2**.

2.0 Surface Water Context

2.1 Catchment

2.1.1 Surface Hydrology

The Quarry lies within the Paterson River catchment downstream of the confluence with the Allyn River (refer to **Figure 2.1**). The Paterson River and Allyn River have total catchment areas of approximately 277 km^2 and 367 km^2 respectively (Hunter Water, 2018).

The Paterson River rises in Barrington Tops National Park and Chichester State Forest flowing in a south-easterly direction to the confluence with the Hunter River approximately 30 km downstream of the Quarry between Morpeth and Hinton. Lostock Dam impounds Paterson River flows to supply water for irrigation in the upper reaches of the catchment approximately 48 km downstream of the river's headwaters. The Paterson River tidal limit is defined by the Paterson Regulated River Water Sharing Plan (WSP) as a point 980 metres (m) downstream of Gostwyck Bridge which is downstream of the Quarry.

The Paterson River system flows through the fertile farming land of the Paterson River Valley and Paterson's Plains; descending 933 m over a 151 km course. The dominant non-agricultural land use in the catchment is timber production and the major agricultural industries are dairying, beef cattle and poultry production (Hunter Water, 2019).

Based on an average annual rainfall at Tocal of 938.8 mm, approximately 605 gigalitres (GL) of rainfall is received in the Paterson/Allyn Rivers catchment area each year.

There are two sub-catchments of the Project Area, both of which drain to the Paterson River (refer to **Figure 2.1**). The West Pit is located within the northern Project Area catchment, with runoff from a portion of this catchment now draining into the pit area. A first order ephemeral stream and a second order ephemeral stream drain runoff from the catchment north of the existing West Pit drain in a westerly direction converging with a number of other minor streams to form a fourth order stream that flows into the Paterson River approximately 1.5 km west of Quarry. To the south of the West Pit, an unnamed first order ephemeral stream drains runoff from a small undisturbed area to the south of the West Pit before converging with the other ephemeral streams to the west of Dungog Road, including the fourth order stream that flows into the Paterson River approximately 1.5 km west of Quarry (refer to **Figure 2.1**).

Runoff from the undisturbed catchment upslope of the existing processing area is drained by an unnamed second order ephemeral stream to the north of the existing Processing Area and an unnamed third order ephemeral stream also to the north of the existing Processing Area (refer to **Figure 2.1**). The streams converge near the north-west corner of the existing processing area with the combined third order stream flowing southerly via a culvert under the main haul road, then south-westerly and off-site at the south west corner of the Quarry site. This stream then joins a fourth order stream south of the Quarry site which then flows westerly into the Paterson River (5^{th} order) approximately 1.5 km west of Quarry (refer to **Figure 2.1**).

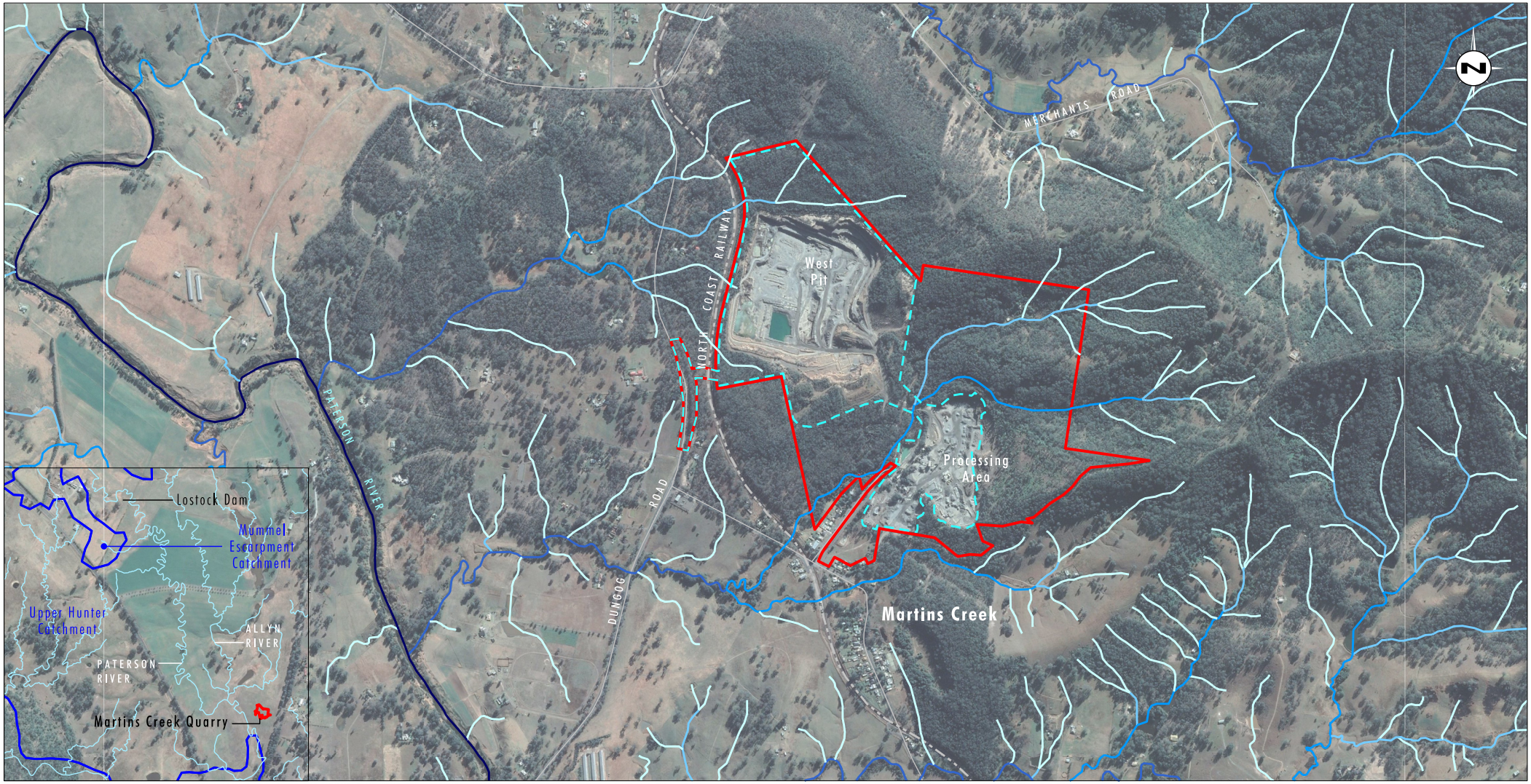


Image Source: Google Earth (Jan 2018)
Data Source: Daracon (2020), CANRI

0 0.25 0.5 1.0km
1:20 000

Legend

- Project Area
- Proposed Disturbance Area
- Catchment Area
- 1st Order Stream
- 2nd Order Stream
- 3rd Order Stream
- 4th Order Stream
- 5th Order Stream

FIGURE 2.1

Catchment Context

File Name (A4): R05/3957_061.dgn
20201109 16.37

2.1.2 Climate

The Quarry is located in the Paterson River Valley which has a temperate climate with warm to hot wet summers, lower winter rainfall and no dry season. There are three Bureau of Meteorology (BoM) stations recording climate data within a 10 km radius of the Quarry, being:

- Station 061349 - Gostwyck Bridge (approximately 1.5 km south-east of the Quarry), with available records (rainfall) from 2003 to present.
- Station 061096 – Paterson Post Office (approximately 5 km south of the Quarry), with available records (rainfall) from 1902 to present.
- Station 061250 – Tocal AWS (approximately 9 km south south-east of the Quarry), with available records (rainfall and evaporation) from 1967 to present.

  Note: AWS means Automatic Weather Station

A comparison of the available full year rainfall data from the three BoM stations was undertaken. While the Gostwyck Bridge station (station 061349) is located closest to the Quarry and could be considered the most representative of the Quarry climate, the rainfall data was found to have several years with large periods of missing records (approximately 16% overall for the period 2004 to 2016 with periods of missing data ranging from 1 to in excess of 50 days) and has therefore been disregarded. **Table 2.1** and **Table 2.2** present a comparison of the annual and monthly rainfall data for the Paterson Post Office (station 061096) and Tocal AWS (station 061250) for the period 1 January 1968 to 31 December 2018.

Table 2.1 Annual Rainfall Comparison (mm), 1968 to 2019

Statistic	Tocal AWS (061250)	Paterson Post Office (061096)
10th percentile	697	762
50th percentile	925	1020
90th percentile	1176	1310
Average	933	1016

Table 2.2 Monthly Average Rainfall Comparison (mm/day), 1968 to 2019

Month	Tocal AWS (061250)	Paterson Post Office (061096)
January	3.5	3.6
February	4.1	4.2
March	3.8	4.2
April	2.9	3.5
May	2.2	2.5
June	2.6	3.2
July	1.2	2.0
August	1.2	1.7
September	1.6	2.0
October	2.1	2.3
November	2.8	2.6
December	2.7	3.3

Paterson Post Office rainfall data exhibits higher annual rainfall statistics for dry (10th percentile), median (50th percentile), wet (90th percentile) and average rainfall years. Paterson Post Office rainfall data also exhibits higher average monthly rainfall than the Tocal AWS in all months except for November. The Gostwyck Bridge rainfall data for the period with a more complete data set (2008 to 2016) was also found to be higher on average than the Tocal AWS rainfall data and, as such, the Paterson Post Office rainfall is considered to be the most representative long term rainfall data set for the Quarry.

Table 2.3 presents the average monthly pan evaporation recorded at the Tocal AWS BoM station (station 061250) for the period 1967 to present. The Tocal AWS BoM station (station 061250) is the closest meteorological station to the Quarry that records pan evaporation. Average recorded pan evaporation rates demonstrate a typical trend of higher rates in the summer months and lower rates in the winter months.

Table 2.3 Monthly Average Evaporation (mm/day) at Tocal AWS BoM Station 061250

Month	Average Pan Evaporation (mm/day)
January	6.2
February	5.3
March	4.2
April	3.2
May	2.4
June	2.1
July	2.4
August	3.3
September	4.4
October	5.2
November	5.8
December	6.6

A weather station which collects rainfall data is situated at the Quarry, however only two full years of rainfall data are available, being 2018 and 2019, both of which were extremely low rainfall years. Given the long period of data available from the Tocal and Paterson sites and their relative close proximity to Martins Creek, this data is considered more representative of the long term rainfall patterns and has therefore been used in this SWIA rather than the site specific data.

2.1.3 Topography, Geology and Soils

NSW Land and Property Information's online topographic map shows that the Quarry is located on the south-west facing slopes of a ridge line/small mountain with an elevation of up to 150 mAHD (JM Environments, 2016). The Department of Mines Newcastle Geology Map (1:250,000, First edition 1966) indicates the Quarry lies above the Carboniferous Gilmore Volcanics Martins Creek Andesite Member Group (JM Environments, 2016). A detailed description of the geology of the Quarry is contained in *Martins Creek Quarry Geological Assessment* (VGT Environmental Compliance Solutions, 2020).

NSW Department of Land and Water Conservation's Newcastle Soils Landscape Series Sheet 9232 indicates Quarry is on the boundary of the Ten Mile Road and the Birdsview Colluvial Soil Groups (JM Environments, 2016). The Ten Mile Road Soil Group is on the western portion of Quarry and is described as undulating low hills on carboniferous sediments and acid volcanics in the Medowie Lowlands and Clarence Town Hills regions (JM Environments, 2016). The Ten Mile Road Soil Group has a high water erosion hazard, localised shallow soils, high run on and seasonal waterlogging and strongly to extremely acid soils of low fertility (JM Environments, 2016).

The Birdsview Colluvial Soil Group is on the eastern portion of the Quarry and is described as rolling to steep hills on Carboniferous sediments in the Paterson Mountains region (JM Environments, 2016). Slopes are up to 45%, local relief is 100 - 260 m and the elevation is up to 300 m (JM Environments, 2016). Soils of the Birdsville Colluvial Soil group comprise moderately deep (80 - 120 cm) well drained Yellow Podzolic Soils, with shallow (20 - 30 cm) well drained Bleached Loams and Lithosols on stony ridge crests, and deep (>200 cm) well drained Red Podzolic Soils where siltstones and deeply weathered polymictic conglomerates outcrop (JM Environments, 2016). The soils of the Birdsville Colluvial Soil group have the following qualities and limitations: steep slopes, mass movement hazard (localised), rock outcrop (localised), water erosion hazard, high run on, foundation hazard (localised) and shallow soils (localised) (JM Environments, 2016).

2.2 Water Quality

2.2.1 NSW Water Quality Objectives

The NSW Water Quality Objectives (WQOs) have been developed to guide plans and actions to achieve healthy waterways. The WQOs are based on measurable environmental values for protecting aquatic ecosystems, recreation, visual amenity, drinking water and agricultural water. The WQOs for the Hunter River Catchment, which includes the Paterson River catchment, have been developed to achieve suitable water quality for the protection of:

- aquatic ecosystems
- visual amenity
- recreation
- livestock water supply
- irrigation water supply
- homestead water supply
- drinking water at point of supply
- aquatic foods.

Based on a review of the relevant WQOs values for the water uses listed above and the potential water quality impacts associated with the Quarry operation (refer to **Section 1.4**), the water quality parameters presented in **Table 2.4** have been included in the proposed surface water quality monitoring program (refer to **Section 7.2.2.1**. The WQOs presented in **Table 2.4** are the default trigger values presented in the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (Australian and New Zealand Environment and Conservation Council (ANZECC, 2000)) for physical and chemical stressors for south-east Australia for slightly to moderately disturbed ecosystems. While the ANZECC Guidelines have been superseded by the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia, 2018) (ANZG 2018), the default trigger values presented in **Table 2.4** are yet to be updated in ANZG 2018 and therefore remain applicable.

Table 2.4 Relevant Hunter River Water Quality Objectives

Parameter	Units	Water Quality Objective
pH	-	6.5 – 8.5[1]
Electrical Conductivity	µS/cm[2]	125 – 2,200[1]
Turbidity	NTU[3]	6 – 50[1]
NOx	mg/L	0.04[1]
Total Nitrogen (TN)	mg/L	0.5[1]
Total Phosphorus (TP)	mg/L	0.05[1]

Notes

1 Source: https://www.environment.nsw.gov.au/ieo/Hunter/maptext-03.htm#wq01

2 Conductivity of an electrolyte solution is measured in µS/cm: Microsiemens per centimetre. Conductivity is indicative of the concentration of total dissolved salts (TDS)

3 Turbidity is measured in NTU: Nephelometric Turbidity Units.

2.2.2 Environment Protection Licence Discharge Criteria

Specific Environment Protection Licence (EPL) (EPL 1378) criteria for the existing quarry operations relate to discharge water quality and monitoring and are detailed in **Table 2.5**.

Table 2.5 EPL 1378 Discharge Water Quality Criteria and Monitoring Frequency

Pollutant	100th Percentile[1] Concentration Limit	Units	Frequency of Monitoring
Oil and Grease	10 and none visible	mg/L	Daily during offsite discharge
pH	6.5 – 8.5	-	Daily during offsite discharge
Total Suspended Solids	50	mg/L	Daily during offsite discharge

Note

1. 100th percentile refers to all results.

2.2.3 Receiving Water Quality

The following receiving water quality data sources were reviewed as part of this SWIA.

- Three upstream water quality monitoring results for water sampled by JM Environments in 2015 from the Allyn River at Horns Crossing Bridge, which is immediately upstream of the confluence of the Allyn River with the Paterson River (shown as RW1 on **Figure 2.2**), including results for pH, Total Suspended Solids (TSS), Electrical Conductivity (EC), Total Recoverable Hydrocarbons (TRH).

- Three downstream water quality results for water sampled by JM Environments in 2015 from the Paterson River at Gostwyck Bridge (shown as RW2 on **Figure 2.2**) including results for pH, TSS, EC, TRH.

- 20 upstream (RW1) and 20 downstream (RW2) water quality monitoring results collected (up to July 2020) as part of Daracon's monthly baseline water quality monitoring program (monitoring program commenced January 2019) including results for pH, EC, TSS, turbidity and nutrients.

- Four water quality monitoring results for the second order and third order ephemeral streams upslope of the Quarry collected (up to July 2020) as part of Daracon's monthly baseline water quality monitoring program (monitoring program commenced January 2019, however, stream flow has only been available for sampling in February, March and April of 2020) including results for pH, EC, TSS, turbidity and nutrients.

Table 2.6 presents the water quality results for the water samples collected by JM Environments in 2015. **Table 2.7**. **Table 2.9** and **Table 2.8** present the water quality statistics for the Allyn and Paterson River monitoring data collected by Daracon and **Table 2.10** present the water quality statistics for the ephemeral streams monitoring data collected by Daracon.

Table 2.6 Receiving Water Quality, 2015[1]

Parameter	Units	Upstream – Allyn River (RW1)			Downstream – Paterson River (RW2)		
		4/2/15	18/2/15	4/3/15	4/2/15	18/2/15	4/3/15
pH	-	6.71	6.42	7.81	7.11	6.97	7.55
EC	µS/cm	148	268	155	218	306	200
TSS	mg/L	16	<5[2]	-[3]	16	<5[2]	-[3]
TRH	mg/L	<0.7[4]	<0.7[4]	-[3]	<0.7[4]	<0.7[4]	-[4]

Notes

1 Water Quality Impact Assessment – Martins Creek Quarry Extension Project (JM Environments, 2016)

2 Limit of detection for TSS is 5 mg/L

3 No result reported

4 Limit of detection for TRH is 0.7 mg/L

Table 2.7 Baseline Allyn River Upstream Water Quality

Statistic	pH	EC (µS/cm)	TSS (mg/L)	Turbidity (NTU)	NOx (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)
# Results	20	20	20	20	20	20	20	20	20
Minimum	7.3	136	1.2	2	0.007	-	0.006	0.1	0.05
20th Percentile	7.6	217	1.6	2	0.014	-	0.010	0.2	0.05
50th Percentile	7.7	301	3.7	4	0.020	-	0.015	0.3	0.05
80th Percentile	7.8	542	4.7	6	0.038	-	0.032	0.4	0.06
Maximum	7.9	831	15.0	12	0.300	0.005[1]	0.310	1.2	0.07

Notes

1. Only one result recorded above laboratory Limit of Detection

Table 2.8 Baseline Paterson River Downstream Water Quality

Statistic	pH	EC (µS/cm)	TSS (mg/L)	Turbidity (NTU)	NOx (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)
# Results	20	20	20	20	20	20	20	20	20
Minimum	7.3	170	1.2	2	0.005	-	0.009	0.2	0.05
20th Percentile	7.5	215	2.1	3	0.010	-	0.026	0.2	0.06
50th Percentile	7.6	239	3.4	6	0.050	-	0.062	0.3	0.06
80th Percentile	7.8	286	5.7	9	0.090	-	0.134	0.5	0.07
Maximum	8.1	481	14.0	30	0.400	0.012	0.420	1.2	0.08

Notes

1. Only one result recorded above laboratory Limit of Detection

Table 2.9 Ephemeral Stream Water Quality – General Parameters, 2020

Date	2nd Order Stream				3rd Order Stream			
	pH	EC (µS/cm)	TSS (mg/L)	Turbidity (NTU)	pH	EC (µS/cm)	TSS (mg/L)	Turbidity (NTU)
11/2/20	6.2	272	12.0	3	6.4	242	13.0	3
13/3/20	6.1	349	0.8	<2	6.3	338	1.3	2
22/4/20	6.1	313	0.9	<2	6.3	292	3.4	8
31/7/20	6.3	306	8.9	<2	6.3	298	7.4	2

Table 2.10 Ephemeral Stream Water Quality – Nutrients, 2020

Date	2nd Order Stream					3rd Order Stream				
	NOx (mg/L)	NO_2 (mg/L)	NO_3 (mg/L)	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)	NOx (mg/L)	NO_2 (mg/L)	Nitrate (mg/L)	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)
11/2/20	1.60	<0.005	1.60	3.0	<0.05	2.70	<0.005	2.70	4.6	<0.05
13/3/20	0.04	<0.005	0.04	0.5	<0.05	0.52	<0.005	0.52	1.1	<0.05
22/4/20	0.20	<0.005	0.21	0.7	<0.05	0.97	<0.005	0.97	1.3	<0.05
31/7/20	1.40	<0.005	1.40	3.0	<0.05	1.80	<0.005	1.80	3.7	<0.05

All 2015 EC results for the location upstream of the Quarry (RW1) are within the NSW WQO range (125 – 2,200 μS/cm) for the relevant WQOs, while one of the three 2015 pH results was just below the WQO range (6.5 – 8.5).

All 2015 EC and pH results for the location downstream of the Quarry (RW2) were within the respective NSW WQO ranges and all TRH results were below the limit of detection.

The higher 2015 TSS concentration results at both the upstream and downstream monitoring locations for 4 February 2015 may be attributed to sediment entrained in runoff from the broader catchment associated with significant rainfall in late January 2015 (40 mm on 28/01/15). TRH concentrations were all found to be below the laboratory limit of detection (LOD) of 0.7 mg/L for both the upstream and downstream monitoring locations.

All Allyn River upstream and Paterson River downstream baseline water quality monitoring results for pH and EC were within the respective NSW WQO ranges. No Allyn River or Paterson River turbidity or TSS results exceeded the respective WQO range/value.

NOx and TN concentrations in the Paterson River were typically low with very few results exceeding the respective WQOs:

- 6 of 20 downstream results and 2 of 20 upstream results exceeded the NOx WQO of 0.04 mg/L
- 3 of 20 downstream results and 3 of 20 upstream results exceeded the TN WQO of 0.5 mg/L

Only one TP result at the upstream Allyn River monitoring location exceeded the WQO of 0.05 mg/L, however, 8 of 20 results at the downstream monitoring location exceeded the WQO. The source of the elevated TP results at the downstream Paterson River monitoring location is not evident and all site water quality monitoring results recorded TP concentrations below the LOD (refer to **Section 2.2.4**).

All pH results for the Ephemeral 2nd and 3rd order streams were below the WQO range and is likely be attributable to the slightly to moderately acidic soils and decay of organic matter in the undisturbed upslope catchment.

NOx and TN concentrations in the ephemeral streams were recorded above the respective WQOs for all but one sample collected from Ephemeral 1. As these samples are collected from upstream of the Quarry, these elevated levels are not due to the Quarry and are representative of background conditions. TP results for the ephemeral streams were below the WQO of 0.05 mg/L.

2.2.4 Site and Discharge Water Quality

The following site water quality data sources were reviewed as part of this SWIA.

- Water quality results for water samples collected by JM Environments from both Dam 1 (two samples) and Dam 3 (one sample) (refer to **Figure 2.2**) including results for pH, TSS, EC, TRH.
- 12 water quality monitoring results for Dam 1 and 20 for Dam 3 collected as part of Daracon's monthly site water quality monitoring program (monitoring program commenced January 2019) including results for pH, TSS, turbidity, EC and nutrients.
- Discharge water quality monitoring records for Dams 1, 2 and 3 (refer to **Figure 2.2**) collected in accordance with EPL 1378 (refer to **Section 7.2**) with results for visual oil and grease (O&G), pH and TSS.

Table 2.11 presents the site water quality data for Dams 1 and 3 collected by JM Environments in 2015. **Table 2.12** and **Table 2.13** present the statistics for the site water quality monitoring data for Dams 1 and 3 collected by Daracon since 2019. Routine water quality monitoring is not undertaken for Dam 2 as runoff captured in Dam 2 is transferred to Dam 1 (refer to **Section 3.0**). Note that the water quality monitoring results presented in **Table 2.12** and **Table 2.13** were not for monitoring undertaken during discharge but are results of the ongoing monitoring for stored and untreated water.

Table 2.11 Site Water Quality, 2015

Parameter	Units	Dam 1		Dam 3
		4/2/15	18/2/15	4/2/15
pH	-	8.07	7.79	7.83
EC	µS/cm	357	489	529
TSS	mg/L	70	57	47
TRH	mg/L	<0.7	<0.7	<0.7

Source: JM Environments, *Water Quality Impact Assessment – Martins Creek Quarry Extension Project*, 2016

Note: There was no off-site discharge from either Dam 1 or Dam 3 at the time at the time the water quality samples were collected

Table 2.12 Dam 1 Site Water Quality, 2019 - 2020

Statistic	pH	EC (µS/cm)	TSS (mg/L)	Turbidity (NTU)	NOx (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)
# Results > LOR	12	12	12	12	12	11	12	12	0
Minimum	7.4	288	3.5	5	2.7	0.035	2.700	3.3	-
20th Percentile	7.8	379	12.2	9	3.8	0.056	3.760	4.1	-
50th Percentile	8.1	479	21.0	20	5.6	0.072	5.400	6.8	-
80th Percentile	8.6	546	31.6	30	7.3	0.140	7.300	8.7	-
Maximum	8.8	647	160.0	96	11.0	0.190	11.000	13.0	-

Notes:

- There was no off-site discharge from either Dam 1 or Dam 3 at the time the water quality samples were collected
- LOR is the laboratory Limit of Reading

Table 2.13 Dam 3 Site Water Quality, 2019 - 2020

Statistic	pH	EC (µS/cm)	TSS (mg/L)	Turbidity (NTU)	NOx (mg/L)	Nitrite (mg/L)	Nitrate (mg/L)	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)
# Results > LOR	20	20	20	16	20	20	20	20	0
Minimum	8.1	356	1.0	2	1.7	0.001	1.700	2.0	-
20th Percentile	8.4	390	4.0	4	3.3	0.010	3.280	4.0	-
50th Percentile	8.5	591	12.5	8	8.3	0.017	8.200	9.8	-
80th Percentile	8.7	751	23.4	17	12.0	0.081	12.000	14.0	-
Maximum	9.1	1020	75.0	50	14.0	0.230	14.000	17.0	-

Notes:

- There was no off-site discharge from either Dam 1 or Dam 3 at the time the water quality samples were collected
- LOR is the laboratory Limit of Reading

Table 2.14 and **Table 2.15** present the site discharge pH and TSS monitoring statistics respectively. Oil and grease result statistics have not been presented as all discharges were recorded as being free of visual oil and grease.

Table 2.14 Discharge Water pH, March 2013 to April 2020

Dam	Number of Results	Minimum	Average	Maximum
1 (LDP6)	162	6.7	7.9	8.4
2 (LDP7)	2	7.8	8.1	8.3
3 (LDP 8)	236	6.6	7.8	8.4

Table 2.15 Discharge Water TSS, March 2013 to April 2020

Dam	Number of Results	Minimum	Average	Maximum
1 (LDP6)	162	3	22	49
2 (LDP7)	2	14	29	43
3 (LDP 8)	236	1	10	57

Site water quality results presented in **Table 2.11** show that EC and pH results at the time of sampling were within the respective WQO ranges of 125 to 2,200 µS/cm and 6.5 to 8.5 respectively.

While the site water quality monitoring statistics presented in **Table 2.12** and **Table 2.13** indicate that site waters exceed the EPL (EPL 1378) discharge limit of 50 mg/L for TSS and 6.5 to 8.5 for pH (refer to **Section 7.2.1**), it is important to note that the water samples were collected from untreated water in Dam 1 and Dam 3 as part of the ongoing monitoring process. The Quarry operates water treatment processes prior to planned discharges. The discharge water quality results presented in **Table 2.14** and **Table 2.15** demonstrate that Quarry's water treatment infrastructure and dewatering management systems (refer to **Section 3.1**) are capable of consistently achieving discharge water quality criteria. Note that the maximum TSS concentration of 57 mg/L for Dam 3 was the only exceedance of the EPL discharge limit (50 mg/L) and occurred in March 2013.

All site water quality results for NOx and TN exceeded the WQOs with Nitrate contributing to the greater proportion of measured TN concentrations. However, nitrate concentrations were all below the 80% species protection guideline value published in *Updating nitrate toxicity effects on freshwater aquatic species* (NIWA, 2013) (as referenced in ANZG 2018 which indicates that the ANZECC 2000 guideline values were erroneous with respect to acute nitrate toxicity concentrations). Given the level of disturbance due to agricultural land use in the immediate downstream environment, a guideline value based on the 80% species protection level is considered appropriate. All site water quality results for TP were below the laboratory limit of reading (LOR).

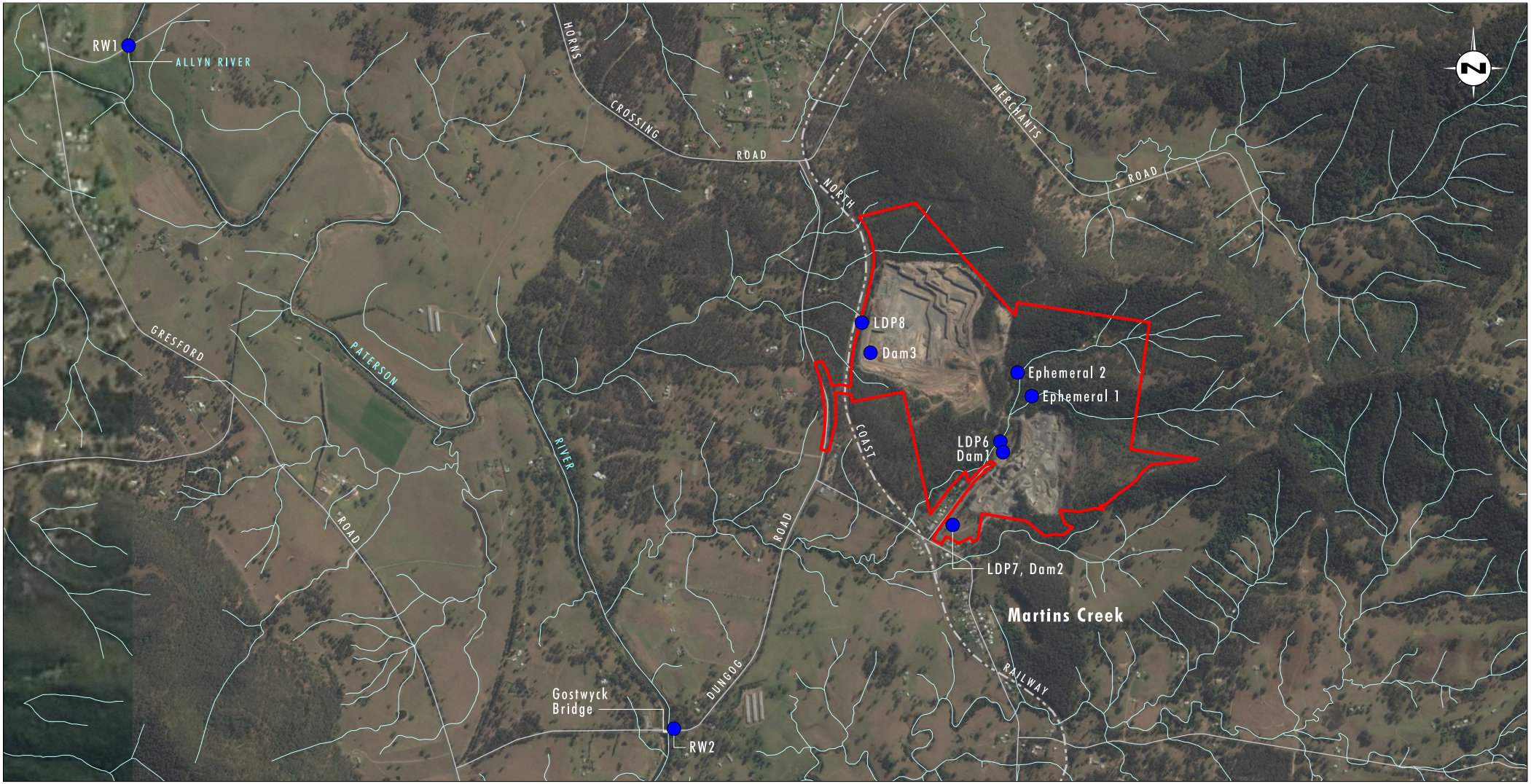


Image Source: Google Earth (Jan 2018)
Data Source: Daracon (2020)

0 0.25 0.5 1.0km
1:25 000

Legend

- Project Area
- Water Quality Monitoring Locations

FIGURE 2.2

Water Quality Monitoring Locations

2.3 Water Extraction

The *Water Management Act 2000* is the key piece of legislation for water resource management in NSW. Under the Act, WSP have been developed to protect the environmental health of water sources, whilst securing sustainable access to water for all users. The WSPs specify maximum water extractions and allocations and provide licenced and unlicensed water users with a clear picture of when and how water will be available for extraction.

The Quarry is located within the area regulated by the Hunter Unregulated and Alluvial Water Sources WSP which commenced in 2009. The WSP is divided in three Extraction Management Units (EMU); the Greater Hunter EMU, the Hunter Regulated River Alluvium EMU and the Lake Macquarie EMU. Further, the Alluvial Water Sources WSP is divided into 40 water sources corresponding to sub-catchment boundaries. The Quarry is located within the Paterson/Allyn Rivers Water Source of the Greater Hunter EMU.

2.4 Water Users

Licensed surface water users potentially impacted by Quarry operations are all located within the Paterson Regulated River Water Source, the Paterson/Allyn Rivers Water Source and the Paterson River Tidal Pool Water Source. A search of the NSW Water Register indicates that for the 2019/2020 financial year there were 375 Water Access Licences (WAL) with a total of 25,523.9 unit shares allocated in the Paterson Regulated River Water Source, the Paterson/Allyn Rivers Water Source and the Paterson River Tidal Pool Water Source areas. There are 18 WALs (with a combined 943.5 unit shares) in the Paterson Regulated River Water Source and Paterson River Tidal Pool Water Source for properties in the river reach downstream of the Quarry to the railway bridge at Paterson. The associated works approvals for the WALs indicate that all are for irrigation purposes with two also indicating industrial use water demands.

3.0 Water Management

3.1 Existing Water Management

3.1.1 Quarry Water Management System

The existing Quarry Water Management System (WMS) (refer to **Figure 3.1** and **Figure 3.2**) is characterised by three primary catchments, each with a licensed discharge point (LDP) under NSW Environment Protection Licence (EPL) 1378 as detailed in the Quarry Stormwater Management Control Plan (SWMCP) (refer to **Appendix 1**):

- Dam 1 catchment includes the Processing Area and undisturbed upslope catchment. Offsite discharge is via LDP 6. Dam 1 has a capacity of 13 ML which is in excess of the runoff containment requirements of *Managing Urban Stormwater – Soils and Construction Volume 2E: Mines and Quarries* (the Blue Book Volume 2E). A sediment basin servicing a catchment with a duration of disturbance in excess of three years in a standard receiving environment is required to contain the runoff from a five day 90th percentile rainfall event; allowing for 12 months of sediment storage as calculated using the Revised Universal Soil Loss Equation (RUSLE), the required capacity of Dam 1 would be 5.96 ML.

- Dam 2 catchment includes the administration offices, southern stockpile area and undisturbed upslope catchment. Runoff captured in Dam 2 is typically transferred to Dam 1 for either reuse or treatment and offsite discharge, however, surplus water complying with EPL discharge criteria may be discharged directly from Dam 2 via LDP 7. Dam 2 has a capacity of 0.9 ML which does not meet the runoff containment requirements of *The Blue Book Volume 2E*. As for Dam 1, a sediment basin servicing a catchment with a duration of disturbance in excess of three years in a standard receiving environment is required to contain the runoff from a five day 90th percentile rainfall event; allowing for 12 months of sediment storage as calculated using the RUSLE, the required capacity of Dam 2 would be 1.85 ML. The capacity of Dam 2 will be increased to meet these requirements as part of the Revised Project.

- Dam 3 catchment includes the West Pit and undisturbed upslope catchment and captures groundwater inflows to the pit in addition to surface runoff. Offsite discharge is via LDP 8. A diversion bank is located along the northern edge of the West Pit to minimise the volume of surface runoff from the upslope undisturbed catchment that can enter the quarry WMS. Dam 3 is the West Pit sump and has a capacity in excess of 400 ML, however, the holding of large quantities of water within the West Pit may impede extractive operations in and around the storage area.

The purpose of the WMS is to contain potentially contaminated water within the Quarry WMS for reuse or treatment (if required) to achieve water quality discharge criteria prior to release via the LDPs. Water is reused on site for haul road dust suppression and some Processing Plant demands. Where possible, clean water is directed around disturbed areas, however, in some areas clean and dirty water have not been separated, as this is impractical due to the steep terrain upslope of the Quarry.

Dam 1 is equipped with a permanent water treatment system and mobile water treatment equipment (pumps, hoses and chemical dosing equipment) is available to treat water in Dams 2 and 3 to enable water discharged from LDPs 6, 7 and 8 to meet the water quality criteria specified in EPL 1378 (refer to **Section 7.2.1**). However, surplus water captured in Dam 2 is typically transferred to Dam 1 for treatment prior to discharge. Water is recirculated from Dam 3 through the Holding Dam (refer to **Figure 3.1**) during water treatment to provide mixing and enhanced water quality prior to discharge via the recirculation piping/hoses to LDP 8. The *Martins Creek Quarry Dewater Procedure* (refer to **Appendix 2**) describes the detailed operation of the dams and the processes undertaken to discharge water off-site via the LDPs.

If there is a surplus of water in the Quarry WMS and the quality of water stored does not meet EPL discharge criteria (TSS and/or pH), water is dosed with appropriate chemicals and recirculated to ensure adequate mixing. Flocculants are dosed to aid settling of solids and sulphuric acid dosing is used to lower the pH. Safety data sheets (SDSs) for the chemicals used for water treatment on site are attached in **Appendix 3**.

The maximum discharge rates from Dams 1, 2 and 3 are listed in **Table 3.1**. **Table 3.2** presents the annual number of days on which discharge occurred and the annual discharge volumes for Dams 1, 2 and 3 for the period 2014 to 2019. **Table 3.3** presents average and maximum daily discharge volumes from the site dams.

Table 3.1 Discharge Rates from Dams

Dam	Maximum Discharge Rate (L/s)
1	70
2	1
3	140

Table 3.2 Annual Discharge Frequency and Volume, 2014 to 2019

Year	Dam 1		Dam 2		Dam 3	
	Frequency (days)	Volume (ML)	Frequency (days)	Volume (ML)	Frequency (days)	Volume (ML)
2014	22	25.3	2	0.6	-	-
2015	37	69.3	-	-	24	80
2016	28	53.3	-	-	53	103
2017	21	31.6	-	-	42	59
2018	26	38.5	-	-	85	105
2019	25	34.1	-	-	27	37
TOTAL	**161**	**255.4**	**2**	**0.6**	**231**	**384**

Note: During the period for which the data is presented, five discharges from Dam 3 and three discharges from Dam 1 did not have a discharge volume recorded.

Table 3.3 Daily Discharge Statistics, 2014 to 2019

Water Storage	Average Discharge Volume (ML/day)	Maximum Discharge Volume (ML/day)
Dam 1	1.6	3.0
Dam 2	0.3	0.3
Dam 3	1.7	4.3

Note: During the period for which the data is presented, three discharges from Dam 3 and four discharges from Dam 1 did not have a discharge volume recorded.

3.1.2 Erosion and Sediment Controls

There are a number of small catchment areas within the Quarry site that require management for erosion and sediment control (ESC). ESC, inspection checklists and maintenance record sheets for these catchments are provided in the Quarry SWMCP (refer to **Appendix 1**). The SWMCP also details ESC for pre-strip areas which include sediment fencing, temporary sediment basin(s) and hydro-mulching. As part of the Revised Project, Daracon will revise the ESC, inspection checklists and maintenance record sheets presented in the existing SWMCP and include them in a site Soil and Water Management Plan (SWMP) that will consider the existing SWMCP, findings from this SWIA and the *Martins Creek Groundwater Impact Assessment (AGE, 2020)*.

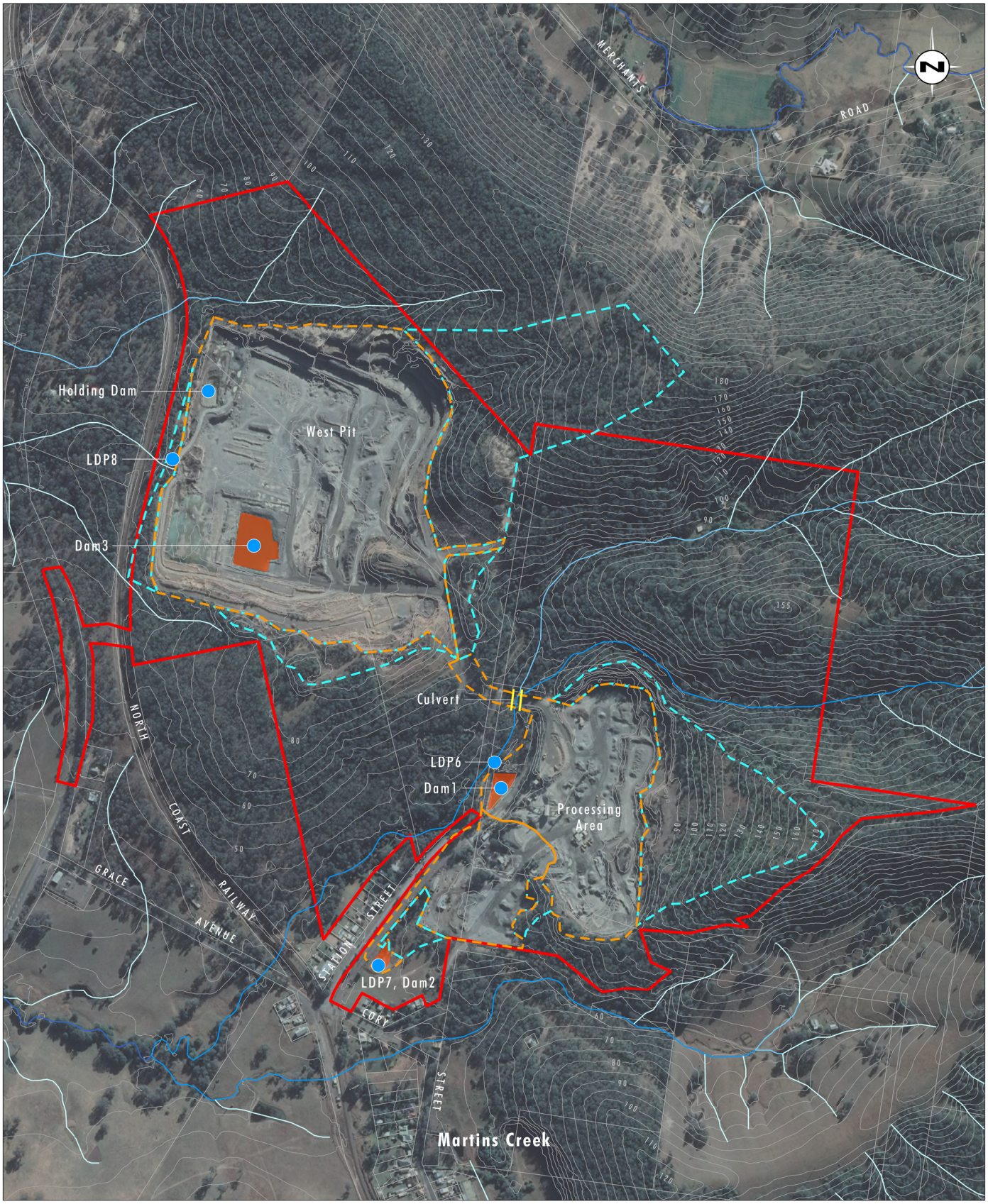


Image Source: Google Earth (Aug 2018)
Data Source: Daracon (2020)
Note: 5m Contour Interval

0 100 250 500m
1:10 000

Legend

- Project Area
- Clean Water Management System Catchment
- Dirty Water Management System Catchment
- Dirty Water Dam
- Water Quality Monitoring Locations
- 1st Order Stream
- 2nd Order Stream
- 3rd Order Stream
- 4th Order Stream
- Culvert

FIGURE 3.1

Existing Water Management System Plan

File Name (A4): R05/3957_063.dgn
20201029 10.24

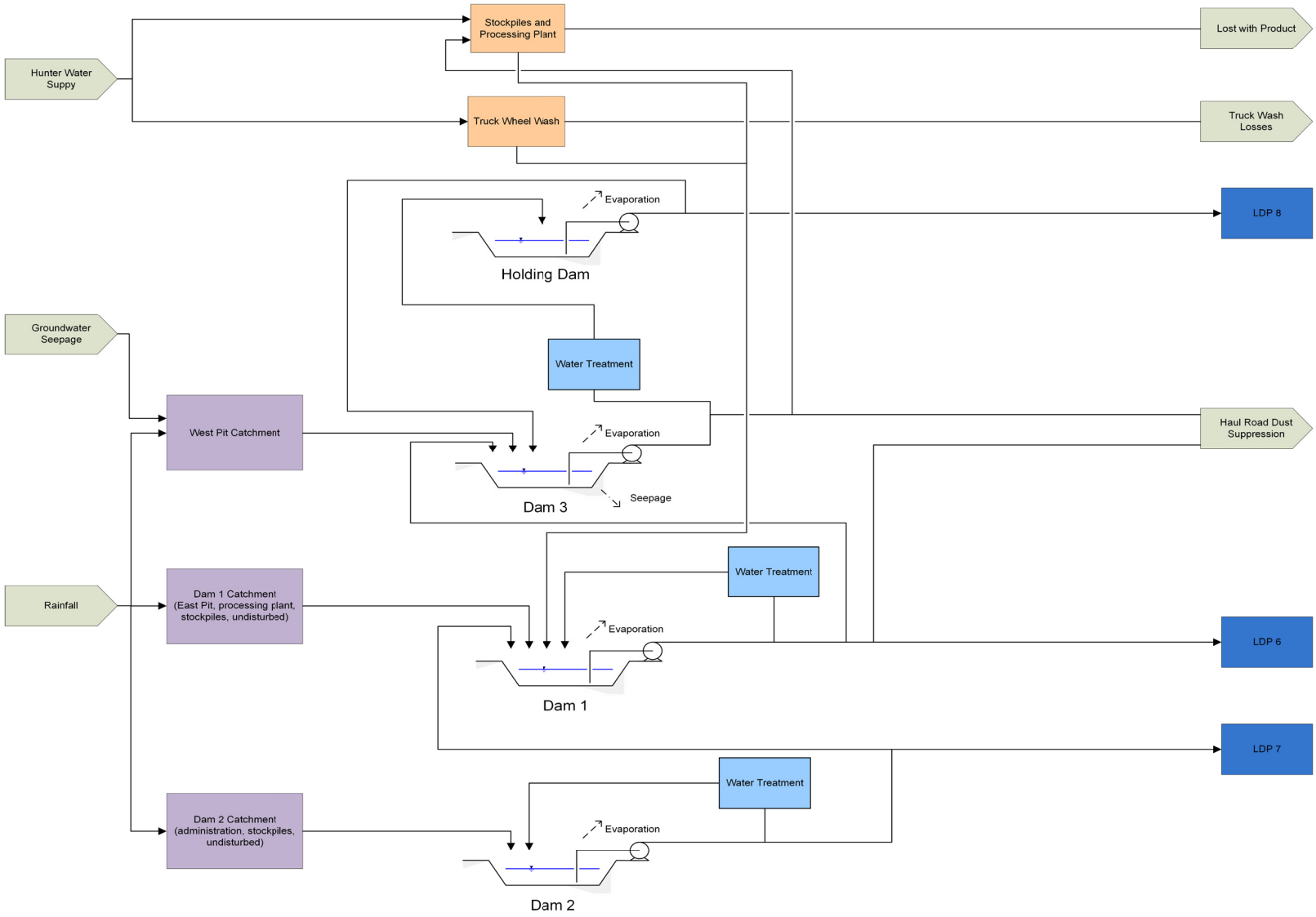


FIGURE 3.2

Existing Water Management System Schematic

3.1.3 Amenities Water Management

Water for amenities purposes is supplied via a tank connected to the Hunter Water potable water supply and gravity fed to the amenity buildings.

Amenities wastewater is collected in a tank and periodically removed from site by a licensed contractor.

Daracon will document the functionality of the amenities water management system and associated procedures and inspections in the SWMP.

3.2 Proposed Water Management

3.2.1 Quarry Water Management System

The proposed Quarry WMS will incorporate additional upslope catchment as shown on **Figure 3.3**, extended open cut pit catchments, an additional pit sump within the East Pit (as indicated on **Figure 3.3**) and associated pumps and pipes. Two first order streams and a second order stream formed by the convergence of the two first order streams will be intercepted by the northerly progression of the West Pit. The headwaters of a first order stream at the south eastern corner of the West Pit will also be intercepted by the expanded West Pit. The East Pit extraction area will have minimal lateral expansion outside of existing disturbed areas and there will be no additional upslope catchment or streams intercepted by the East Pit.

Daracon has investigated options to divert the streams to be intercepted around the proposed West Pit, however, due to the steep terrain these options were found to be infeasible. Diversions to direct clean water from the first and second order stream catchments around West Pit would require disturbance in the upslope undisturbed catchment outside of the proposed disturbance boundary and provide construction challenges in the steep terrain. Hence, due to the impracticality of providing clean/dirty water diversions, clean and dirty water will not be separated – similar to the existing site operations. Dam 2 will be increased in capacity to comply with Blue Book Volume 2E requirements (refer to **Section 3.1.1**)

Figure 3.3 presents a plan of the proposed Year 25 WMS of the Revised Project and **Figure 3.4** presents a schematic of the proposed Year 25 WMS. Runoff captured in the new East Pit sump will be transferred to Dams 1 or 3 for reuse, or treatment and off-site discharge (as required) in accordance with EPL 1378.

The proposed WMS will be documented in the Quarry SWMP outlined in **Section 3.1.2**. Relevant aspects of the *Martins Creek Groundwater Impact Assessment (AGE, 2019)* that is being prepared separately to this SWIA will also be included in the SWMP.

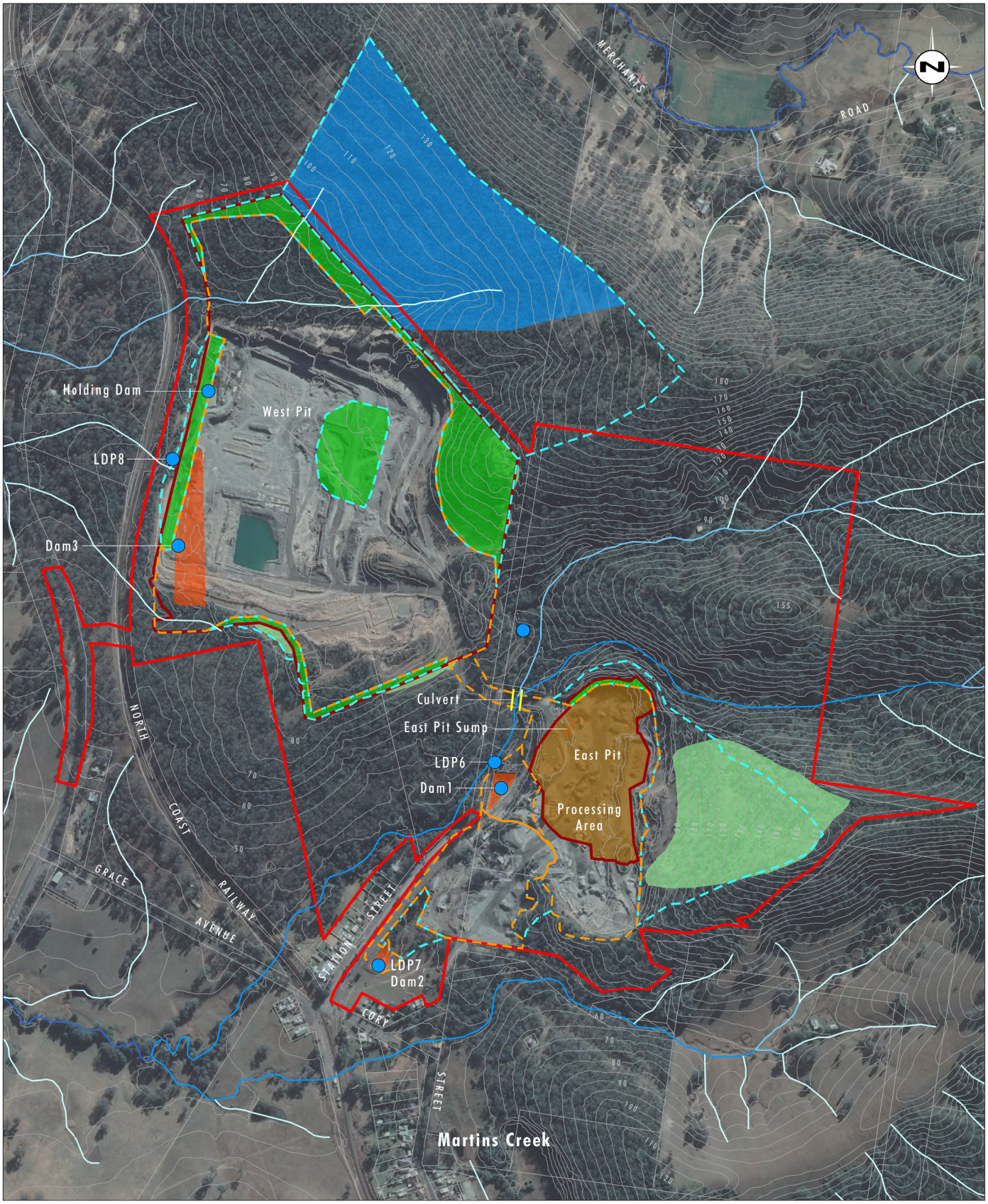


Image Source: Google Earth (Aug 2018)
Data Source: Daracon (2020)
Note: 5m Contour Interval

0 100 250 500m
1:10 000

Legend

- Project Area
- Clean Water Management System Catchment
- Dirty Water Management System Catchment
- Dirty Water Dam
- Additional Intercepted Catchment
- Year 25 Pit Extent Boundary
- Water Quality Monitoring Locations
- Active Quarry Area
- Rehabilitation Area
- Previous Rehabilitation Area
- 1st Order Stream
- 2nd Order Stream
- 3rd Order Stream
- 4th Order Stream
- Culvert

FIGURE 3.3

Proposed Water Management System Plan Year 25

File Name (A4): R05/3957_065.dgn
20201029 10.26

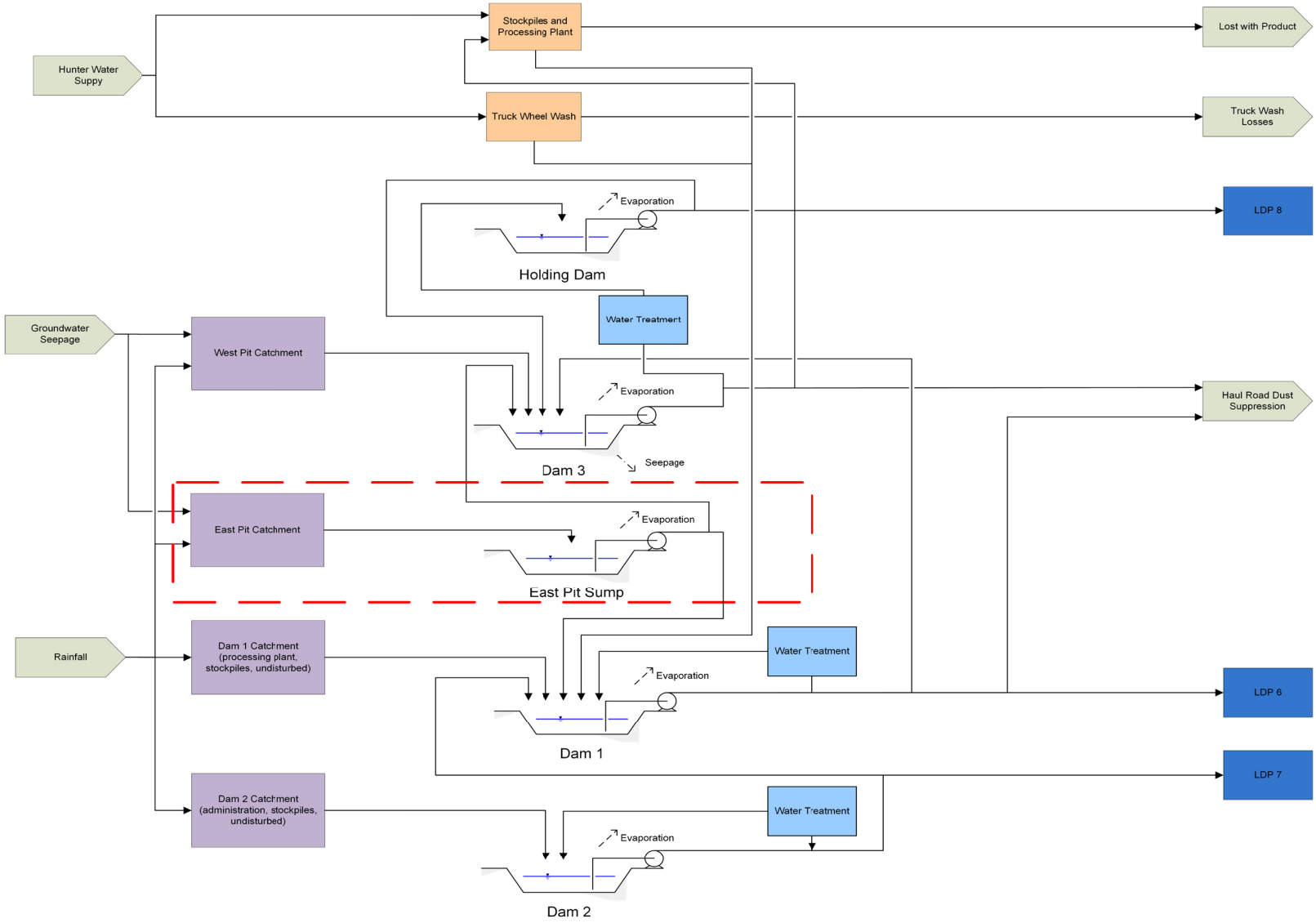


FIGURE 3.4

Proposed Water Management System Schematic Final Staging

3.2.2 Amenities Water Management

Water for amenities purposes will continue to be supplied via a tank connected to the Hunter Water potable water supply and gravity fed to the amenity buildings. The Quarry will implement an inspection and water quality testing program to ensure amenities water quality meets the Australian Drinking Water Guidelines – Version 3.5 (ADWG) (National Health and Medical Research Council, 2011).

Amenities wastewater will continue to be collected in a tank and periodically removed from site by a licensed contractor.

The Quarry will document the functionality of the amenities water management system and associated procedures and inspections in the SWMP.

4.0 Operational Water Balance

A daily time step water balance model (the Model) was developed in GoldSim to simulate the performance of the Quarry WMS for the existing Quarry WMS and the proposed Quarry WMS. Model inputs, assumptions and results are detailed in the following sections.

4.1 Model Inputs

4.1.1 Water Sources and Demands

Quarry water sources are:

- WMS catchment runoff
- Groundwater inflows to the West Pit and East Pit and
- Potable water from the Hunter Water Corporation (HWC) reticulated supply.

4.1.2 Water Demands

Quarry water demands include:

- Haul road dust suppression, some Processing Plant and manufactured sand washing plant demands supplied by stormwater captured in Dams 3 or 1.
- Processing Plant (including conveyors, pug mill and truck wash) and stockpile dust suppression supplied from the HWC reticulated supply.
- Evaporation from dam surfaces.
- Seepage/recharge to groundwater.

4.2 Underlying Data and Assumptions

4.2.1 Runoff Model

Catchment runoff has been calculated using the Australian Water Balance Model (AWBM) based on daily rainfall records from the Paterson Post Office BoM station (station 061096) and average monthly evaporation from the Tocal AWS BoM station (station 061250) (refer to **Section 2.1.2**). Catchment types and AWBM parameters used in the rainfall runoff model are presented in **Table 4.1**.

Table 4.1 Catchment Types and AWBM Parameters

Catchment	Surface Store Area Split			Surface Store Capacities			BFI[1]	Kb[2]	Ks[2]	Evap%[4]
	A1	A2	A3	C1	C2	C3				
Undisturbed	0.134	0.433	0.433	12	122	245	0.22	0.991	0.5	100
Disturbed	0.185	0.430	0.385	20	50	30	0.05	0.985	0.0	85
Pit	0.185	0.430	0.385	5	10	20	0.05	0.985	0.0	85

Notes

[1] Base flow index [2] Baseflow recession constant [3] Surface runoff recession constant [4] Pan factor to potential evapotranspiration

4.2.2 Groundwater Inflows

Estimates of groundwater inflows to the operating Quarry pits for a number of operational stages and climatic scenarios in the *Martins Creek Groundwater Impact Assessment* (the GIA) (AGE, 2020). Estimated inflows are provided for a range of scenarios for wet and dry years with low and high hydraulic gradients which are dependent on antecedent rainfall. The GIA (AGE, 2020) indicates that the most likely groundwater inflow rates are for a wet year with low hydraulic gradient and a dry year with a high hydraulic gradient and the average of these two scenarios for each modelled operational stage has been used as the groundwater inflow in the Model. Groundwater inflows to the West Pit for the modelled operational stages are presented in **Table 4.2**. It has been assumed that due to evaporative losses and in-pit groundwater recharge, only 75% of the groundwater inflows presented in **Table 4.2** report to Dam 3 as pumpable flow. The 75% inflow reduction factor has been applied in the Model.

Table 4.2 Groundwater Inflows to West Pit

Operational Stage	Inflow (ML/year)
Existing	6.6
Year 15	9.2
Year 20	8.4

4.2.3 Site Demands

Site water demands were estimated as follows:

- Evaporation from water storage surfaces based on average monthly evaporation from the Tocal AWS BoM station (station 061250) and a pan factor of 0.75 which is considered to be a representative factor for estimating evaporation for the local climate.
- Water demands for haul road dust suppression has been estimated based on an evaporation – rainfall deficit, i.e.:
    - if rainfall exceeds pan evaporation then there is no dust suppression demand; or
    - if evaporation exceeds rainfall, the dust suppression demand is equal to pan evaporation minus rainfall
    - Modelled processing water demands are presented in **Table 4.3**.

Table 4.3 Modelled Water Demands

Operating Stage	Production (tonnes/year)	Potable Water Demand (ML/year)	Stormwater Reuse (ML/year)
Existing Approved	449,000	23.8[1]	9.9[2]
Year 15	1,100,000	58.4[3]	24.2[3]
Year 20	1,050,000	55.7[3]	23.1[3]

Notes:

1. Existing approved potable demand based on measurements undertaken during an efficiency assessment by Hunter Water during the period October 2017 to November 2018
2. Existing approved stormwater reuse demand based on crusher and wash plant demands published in *Water Quality Assessment Martins Creek Quarry Extension Project* (JM Environments, 2016)
3. Year 15 and Year 20 water demands based on a proportional increase in demand with increased production, noting the production schedule is indicative and Year 15 is assumed to reach peak production.

4.3 Water Balance Results

4.3.1 Calibration

The rainfall runoff model was calibrated to give an average annual runoff from undisturbed catchments equal to the average annual runoff of 0.95 ML/ha/year for the area estimated using the NSW Farm Dams Calculator (Water NSW, 2020)).

As no water inventory data was available, calibration of the existing water balance scenario was based on the measured discharge volumes from Dams 1 and 3 for the 2016, 2017 and 2018 years (refer to calibration results presented in **Table 4.4**). Water storage discharge trigger set points and discharge rates were varied to achieve a satisfactory calibration. Proposed water inventory monitoring (refer to **Section 7.2.2.2**) will be undertaken to allow future water balance calibration to be undertaken with a view to refining AWBM parameters to more closely reflect WMS catchment runoff characteristics. This will improve the ability of the water balance to inform ongoing operational water management planning and final landform design.

Table 4.4 Water Balance Calibration Results

Year	Recorded Discharges (ML)			Modelled Discharges (ML)			Variance (ML)	Variance %
	Dam 1	Dam 3	Total	Dam 1	Dam 3	Total		
2016	53.3	103	156.3	34.8	130.6	165.4	9.1	6%
2017	31.6	59	90.6	26.3	73.2	99.5	8.9	10%
2018	38.5	105	143.5	34.9	102.6	137.5	-6	-4%
Total	**123.4**	**267**	**390.4**	**96**	**306.4**	**402.4**	**12**	**3%**

4.3.2 Gross Water Balance

Table 4.5 presents the statistical 10th, 50th and 90th percentile gross water balance results (excludes controlled discharges and potable water imports) for the Existing, Years 15 and 20 operating scenarios. The Year 15 scenario was modelled as based on the indicative production schedule, it represents the first design stage that is estimated to reach the maximum production rate of 1,100,000 tonnes/year and water demands. The Year 20 scenario has been modelled as it represents the maximum extent of the Quarry WMS and based on the indicative production schedule is expected to have a lower production rate (1,050,000 tonnes/year) than Year 15 and a worst case with respect to rainfall runoff inflows. While Year 25 has an equivalent WMS catchment to Year 20 and lower production, there will be no extraction in the West Pit and as such, the requirement for discharge will be limited given the large available water storage capacity in the West Pit void.

Table 4.5 Gross Water Balance Results (ML)

Stage	10th Percentile	50th Percentile	90th Percentile
Existing	9.4	105.6	201.2
Year 15	-22.7	95.5	218.4
Year 20	-29.0	89.6	214.4

Gross water balance results indicate that the Existing operation would typically have a water surplus in most years. Years 15 and 20 are predicted to operate with a water surplus in median to wet years while being in deficit in dry years. The results for the existing operation are consistent with the requirement for the Quarry to discharge excess water off-site. The additional inflows from undisturbed upslope catchments in Years 15 and 20 are predicted to be offset by increased operational demands (processing and haul road dust suppression) resulting in marginally smaller surpluses in median to wet years.

Table 4.6 presents the average annual volumes of surface runoff captured in the Quarry WMS for the Existing, Year 20 and Final Staging operations. Based on average values, the surface runoff captured in the Quarry WMS is predicted to increase by up to approximately 28 %.

Table 4.6 Average Annual Catchment Runoff Captured in WMS

Stage	Captured Runoff Volume (ML/year)
Existing	183.4
Year 15	232.8
Year 20	234.0

Table 4.7 presents the net water balance results for the modelled rainfall year closest to gross water balance 50th percentile prediction for the Existing, Years 15 and 25 operation.

Table 4.7 Median Year Net Water Balance Results (ML/year)

Parameter	Existing	Year 15	Year 20
Inflows			
Catchment runoff	180.6	225.8	226.7
Groundwater	4.9	6.9	6.3
Potable water	33.8	75.3	71.9
Total Inflows	***219.4***	***307.9***	***304.9***
Outflows			
Evaporation	-1.8	-3.1	-3.2
Dam 1 Discharge	-33.4	-27.9	-26.9
Dam 3 Discharge	-103.0	-145.3	-138.8
Haul Road Dust Suppression	-41.2	-44.9	-54.2
Lost with Product	-33.7	-82.5	-78.8
Uncontrolled discharges	-2.3	-1.5	-1.5
Total Outflows	***-215.5***	***-305.2***	***-303.4***
Change in Storage	**3.9**	**2.8**	**1.5**
Net Water Balance	**0.0**	**0.0**	**0.0**

4.3.3 Potable Water Import

Table 4.8 presents the predicted minimum, average and maximum potable water imports for the Existing, Years 15 and 20 operating scenarios.

Table 4.8 Potable Water Import (ML/year)

Stage	Minimum	Average	Maximum
Existing	24.1	35.8	51.7
Year 15	62.6	76.9	96.3
Year 20	58.9	76.1	99.4

Reliance on potable water imports will increase due to the increase in operational demands (processing and haul road dust suppression) compared to the existing approved operation. Expanding the range of processing demands that may utilise captured stormwater rather than potable water only and maintaining higher water inventories within the WMS would reduce potable water demands.

4.3.4 Discharges

Table 4.9 presents the predicted minimum, average and maximum annual controlled discharge volumes for the Existing, Years 15 and 20 operating scenarios. **Table 4.10** presents the predicted average annual number of days that controlled discharges will occur.

Table 4.9 Controlled Discharges (ML/year)

Stage	Minimum	Average	Maximum
Existing	19.7	139.4	306.8
Year 15	17.4	169.9	385.9
Year 20	18.6	171.4	388.1

Table 4.10 Average Annual Number of Controlled Discharge Days

Stage	Modelled Average Controlled Discharge Days
Existing	60
Year 15	93
Year 20	87

Modelling results indicate that in average and high rainfall years total controlled discharge volumes will increase by up to approximately 29% (based on the values presented in **Table 4.9**). The average number of days that controlled discharges will occur is predicted to increase by up to approximately 55% compared to the number of controlled discharge days predicted by modelling for the Existing operation (based on the values presented in **Table 4.10**).

For average conditions the large proportion of the additional volume of water captured in the Quarry WMS as a result of the Project is predicted to be returned to the downstream environment via controlled discharges. For the Years 15 and 20 scenarios it is predicted that on average, approximately 62% and 63% of the additional runoff captured in the Quarry WMS will be returned to the downstream environment via controlled discharges respectively.

Table 4.11 presents the predicted minimum, average and maximum uncontrolled discharge volumes respectively for the Existing, Years 15 and 20 operating scenarios. **Table 4.12** presents the predicted minimum, average and maximum uncontrolled discharge (i.e. spills from sediment dams during high rainfall events exceeding dam capacity) frequencies respectively for the Existing, Years 15 and 20 operating scenarios.

Table 4.11 Uncontrolled Discharges (ML/year)

Stage	Minimum	Average	Maximum
Existing	0.0	7.9	62.0
Year 15	0.0	6.4	59.6
Year 20	0.0	6.4	59.7

Table 4.12 Uncontrolled Discharge Frequency[1] (events/year)

Stage	Minimum	Average	Maximum
Existing	0	2	6
Year 15	0	1	4
Year 20	0	1	4

[1] *The 'frequency' of uncontrolled discharge events rather than days is used as such events may occur across more than one day but will be reported as a single event.*

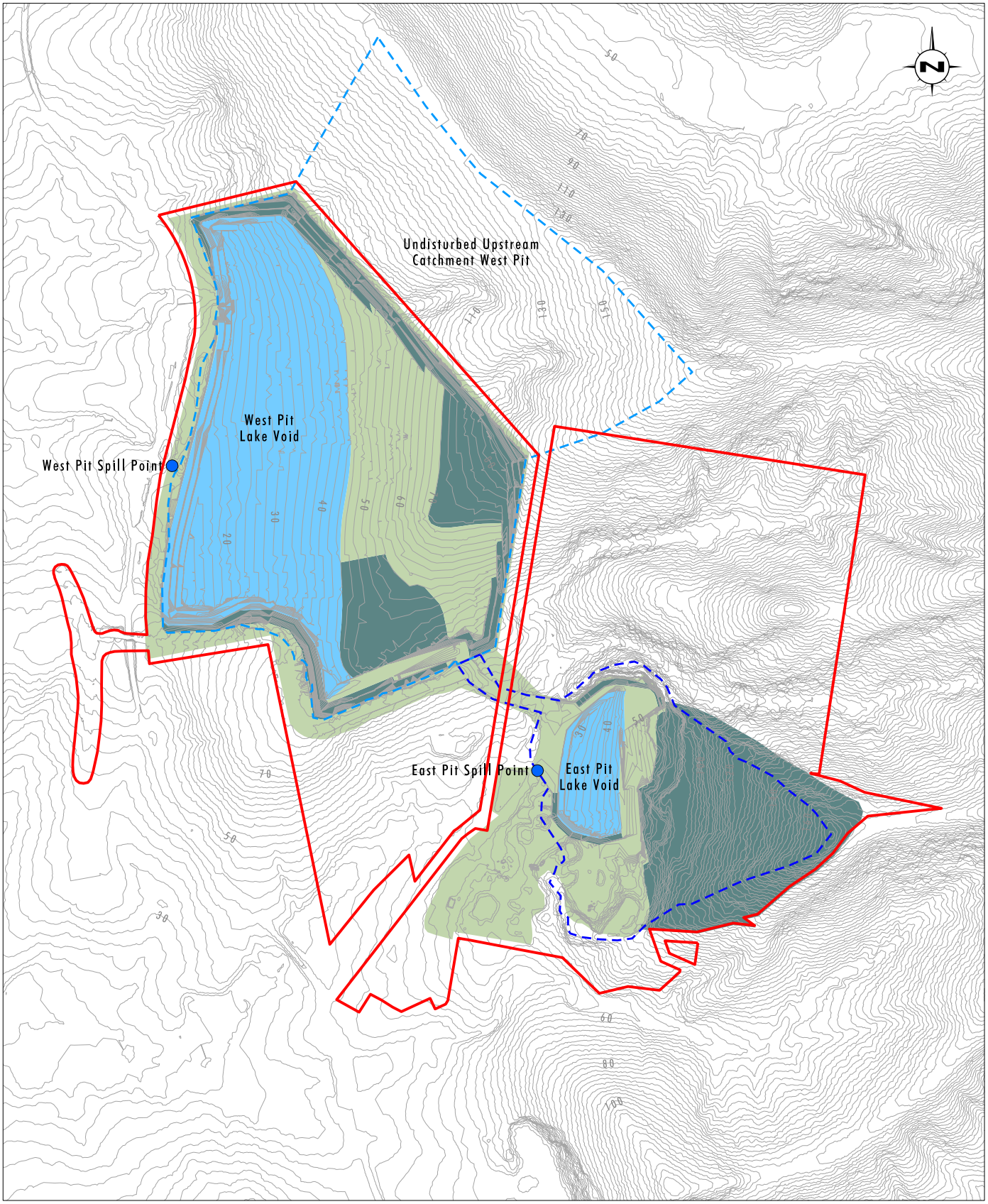
The volume and frequency of uncontrolled discharges for the Years 15 and 20 operating scenarios are predicted to be slightly reduced compared to the Existing operation. This is a result of the proposed increase in Dam 2 capacity to meet Blue Book Volume 2E requirements (refer to **Section 3.1.1**). No uncontrolled discharges were predicted from uncontrolled discharges from Dam 3 (i.e. the West Pit) and the frequency of uncontrolled discharges from Dams 1 and 2 is less than the expected frequency of two to four spills per year indicated in Volume 2E of the Blue Book for sediment basins sized for a 90th percentile five day rainfall event.

5.0 Final Landform and Void Water Recovery

5.1 Final Landform

The final landform will generally reflect the Year 25 Quarry stage plan incorporating final voids with two separate water storages, the West Pit Void and the East Pit Void. Dams 1 and 2 will both be backfilled during the Quarry rehabilitation phase. The Quarry infrastructure areas (processing plant, workshops and administration) will be removed/demolished at the end of the Quarry extraction phase and these areas will be revegetated. ESCs for areas undergoing rehabilitation will remain in place until an adequate vegetation cover is established.

The pit voids will remain as exposed hard rock surfaces with a high runoff potential. Groundwater inflows to the West Pit Void and East Pit Void are expected to continue at an equivalent rate to those predicted for the operational Quarry phase when the stored water elevations are low, with the inflow rate decreasing as void water elevations increase. **Figure 5.1** presents the conceptual final landform plan showing catchments and final void lakes.



Data Source: Daracon (2020)
Note: Contour Interval 2m

0 100 250 500m
1:10 000

Legend

- Project Area
- East Pit Catchment
- West Pit Catchment
- Spill Point
- Rehabilitation Area - Native and Pasture Grass
- Rehabilitation Area - Native and Pasture Grass with Pockets of Woodland Species
- Pit Void Lake

FIGURE 5.1

Final Landform Plan

5.2 Final Void Recovery

A final void storage recovery water balance model was developed in GoldSim modelling software to assess whether the West Pit Void and East Pit Void will fill and spill to the downstream environment and the anticipated post operational surface water licensing requirements. Based on the final staging landform the West Pit Storage will have a capacity of approximately 2,890 ML and spill at an elevation of 45 mAHD while the East Pit Storage will have a capacity of approximately 290 ML and spill at 50 mAHD (refer to **Figure 5.1**).

The climate data and runoff model parameters used for the operational water balance model (refer to **Section 4.2.1**) have been used for the final void recovery modelling. As groundwater outflows from the West Pit Void and East Pit Void were not provided in the GIA, groundwater inflows and outflows have been excluded from the final void recovery water balance model. Modelling of groundwater outflows will be undertaken in the future to allow incorporation of both groundwater inflows and outflows in the final void recovery model for Quarry closure planning. It should be noted that groundwater inflows to the final voids will initially be similar to the seepage flows to the operational quarry pits which are less than 5% of the surface water runoff inflows to the pits. As the void water levels rise above the water table, groundwater inflows from the upslope highwall face will reduce and recharge rates to the groundwater source via the pit floor and downslope highwall face will increase. Accounting for groundwater inflows to the final voids, and recharge from the final voids to the groundwater source, is not expected to result in an appreciable difference to the modelled final void recovery rates or estimated surface water take estimates

The final void water balance model predicts that the water elevation in the West Pit Void will take approximately 22 years to reach spill level (45 AMHD) and the East Pit Void will recover within eight years to reach spill level (50 mAHD). **Chart 5.1** and **Chart 5.2** present the final void water elevation recovery results and the spill elevations for the West Pit Void and East Pit Void respectively.

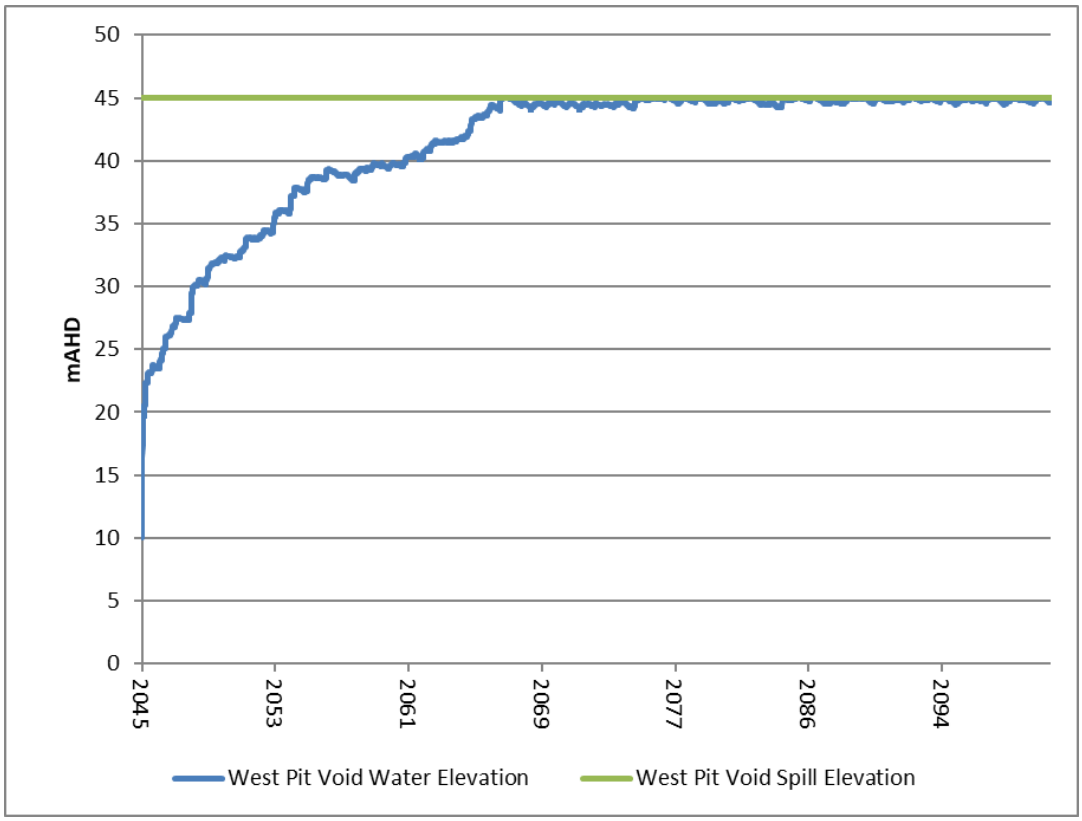


Chart 5.1 West Pit Void Recovery

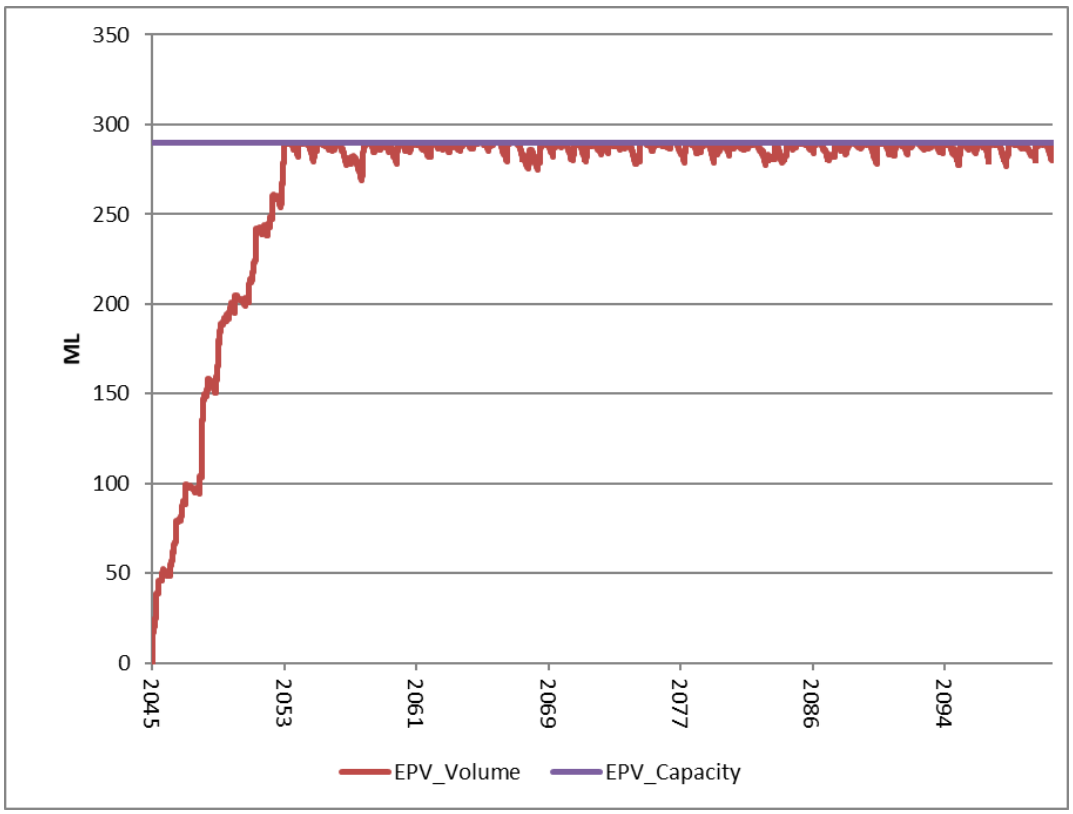


Chart 5.2 East Pit Void Recovery

Table 5.1 and **Table 5.2** present the annual rainfall runoff inflow statistics for the West Pit Storage and East Pit Storage respectively. **Table 5.3** and **Table 5.4** present the annual spill volume statistics for the West Pit Storage and East Pit Storage respectively.

Table 5.1 West Pit Storage Rainfall and Runoff Inflows

Statistic	Inflows (ML/year)
Minimum	112.4
10th Percentile	200.6
50th Percentile	295.2
90th Percentile	433.5
Maximum	536.8
Average	**301.0**

Table 5.2 East Pit Storage Rainfall and Runoff Inflows

Statistic	Inflows (ML/year)
Minimum	23.1
10th Percentile	37.0
50th Percentile	60.9
90th Percentile	88.9
Maximum	115.6
Average	**62.0**

Table 5.3 West Pit Storage Spill Volumes

Statistic	Volume Spilled (ML/year)
Minimum	0.0
10th Percentile	0.0
50th Percentile	0.0
90th Percentile	148.8
Maximum	289.4
Average	**37.4**

Table 5.4 East Pit Storage Spill Volumes

Statistic	Volume Spilled (ML/year)
Minimum	0.0
10th Percentile	0.0
50th Percentile	20.9
90th Percentile	56.0
Maximum	83.8
Average	**25.6**

The predicted annual average volume of water spilled from the final voids of approximately 63.1 ML is less than the average annual runoff for an area equivalent to the final void catchment of 84.6 ML/year. However, the proposed ongoing surface water quantity monitoring program (refer to **Section 7.2.2.2**) will be used to develop a detailed understanding of Quarry WMS catchment runoff characteristics and groundwater inflows which will allow refinement of the final void recovery model and provide greater confidence in ongoing surface water licensing predictions.

6.0 Surface Water Impacts and Mitigation Measures

6.1 Surface Water Impacts

6.1.1 Water Quality

Historical controlled discharge water quality results demonstrate that the Quarry consistently meets the EPL (EPL 1378) discharge criteria (refer to **Sections 2.2.1** and **2.2.2**). While controlled discharge volumes and frequencies are predicted to increase (refer to **Section 4.3**), the discharged water quality is expected to continue to meet EPL criteria as:

- the same water treatment processes and controlled discharge management practises will continue to be implemented; and
- it is not proposed to increase the daily discharge rates and the site water treatment processes and controlled discharge management practises have been demonstrated to achieve EPL water quality criteria at historical discharge rates (refer to **Section 2.2.4**).

Further, with proposed additional water storage on-site, the maximum volume of uncontrolled discharges is predicted to decrease slightly (refer to **Table 4.12**) which will have a positive impact on downstream water quality.

6.1.2 Water Quantity

The Project will result in an increase in the capture of upslope catchment runoff in the Quarry WMS. The increase in surface runoff captured within the Quarry WMS (including runoff from the disturbed quarry catchment) is expected to increase by up to approximately 28%. However, water balance modelling predicts that on average between 60 to 75% of the additional captured runoff is returned via controlled discharges to the downstream environment (refer to **Section 4.3**). Therefore, the impacts on flows to downstream water users during operations are expected to be negligible with respect to flows in the Paterson River. Surface water licensing implications associated with the capture of additional upslope catchment are addressed in **Section 7.1**.

The volume of potable water imported is expected to increase on average by approximately 110% relative to the existing quarry operation as a result of the increase in operational demands (processing and haul road dust suppression). Daracon will include a potable water usage reduction strategy in the revised SWMP following approval and a program for implementation of water savings measures will be developed within 12 months of commencement of operations. Ongoing potable water usage reduction performance will be reported as part of the Annual Review process.

6.1.3 Stream Stability

Water balance modelling predicts an increase in controlled discharge water volumes (up to 29%) and frequencies (up to 52%). However, peak discharge flow rates (i.e. pumped flow rates from Dams 1, 2 and 3) will remain unchanged. Significant volumes of water will be captured in the Quarry pits after periods of high or prolonged rainfall. This water may impede extraction activities and therefore off-site discharge will potentially be required for prolonged periods. For example, between 14 January 2016 and 14 March 2016 the Quarry discharged approximately 110 ML of water on 47 days from the site following a major rainfall event with no reported stream stability impacts.

Given peak discharge flow rates will remain unchanged and previous periods of prolonged discharges did not cause stream stability issues, impacts on stream stability are expected to be negligible.

6.1.4 Hunter Estuary Wetlands Ramsar Site

The Revised Project site is located within the Paterson River catchment that is part of the broader Hunter River catchment that has an area of approximately. The maximum modelled discharge (6.5 ML/day) from the Quarry represents approximately 1% of the mean recorded Paterson River flow (628 ML/day) at the WaterNSW Gostwyk gauging station (site 210079) and would represent an even smaller percentage of total Paterson River discharge to the Hunter River approximately 29 km further downstream.

The estimated average annual flow to the Hunter Estuary is 1,971,000 ML/year (NSW Department of Water and Energy, 2009). Based on an average daily flow, the maximum predicted quarry discharge of 6.5 ML would represent 0.12% of total flow to the Hunter Estuary.

Given the significant distance from the Quarry to the downstream Hunter Estuary Wetlands Ramsar site, discharges will be greatly diluted and any impacts (including water quality and a reduction in freshwater flows) on the Hunter Estuary Wetlands Ramsar site are expected to be negligible.

6.2 Proposed Mitigation

The following mitigation measures are proposed to minimise impacts on surface water resources:

- Capture of stormwater runoff within the Quarry WMS and treatment of water (flocculation, coagulation and pH correction) with the existing water treatment systems to meet EPL discharge criteria prior to off-site discharge.

- Implementation of ESCs in accordance with Landcom's *Managing Urban Stormwater Volume 1* (Landcom, 2004) and *Volume 2E Mines and Quarries* (DECC, 2008) (the Blue Book) during stripping/development of new extraction areas or any other ground disturbing activities. This will include increasing the capacity of Dam 2 to meet Blue Book Volume 2E requirements.

- Ongoing water quality monitoring upstream and downstream of the Quarry and the development of site specific water quality trigger values in accordance with ANZG 2018. The site specific trigger values will be used to initiate investigation in the event of any deviations in receiving water quality from the normal water quality range.

- In the event of water source restrictions, Daracon will limit production to ensure environmental controls (i.e dust suppression) are maintained as a priority with the available water supply.

The updated SWMP for the Quarry which will include the proposed WMS, revised ESCs, amenities water management details, the proposed surface water monitoring program and TARPs will ensure that Daracon actively monitor the effectiveness of the WMS and update water management practices on a regular basis (as required).

7.0 Licensing, Monitoring and Reporting

7.1 Licensing

7.1.1 Environment Protection Licence

The Quarry is a scheduled activity under the *Protection of the Environment Operations Act 1997* (POEO) and operates under EPL 1378. Specific discharge criteria and monitoring requirements relating to water in the EPL are provided in **Table 2.5** and reporting requirements are provided in **Section 7.3.1**.

7.1.2 Surface Water

7.1.2.1 Background

MCQ is located within the Paterson River catchment downstream of Lostock Dam and upstream of the Paterson River tidal limit which is defined as a point 980 m downstream of Gostwyck Bridge. Water licensing in this catchment is governed by the *Water Management Act 2000* under the Hunter Unregulated and Alluvial Water Sources WSP which commenced in 2009. The Alluvial Water Sources WSP is divided in three EMU; the Greater Hunter EMU, the Hunter Regulated River Alluvium EMU and the Lake Macquarie EMU. Further, the WSP is divided into 40 water sources corresponding to sub-catchment boundaries.

The Revised Project will result in the interception of a first and second order drainage lines to the north of the West Pit. These drainage lines are located within the Paterson/Allyn Rivers Water Source of the Greater Hunter EMU. At present, runoff from upslope undisturbed catchments conveyed by these drainage lines flow in a westerly direction through farmland to the Paterson River. The interception of this part of the sub-catchment will result in runoff from approximately 16 ha of additional undisturbed upslope catchment entering the Quarry WMS. The option for diversion around the Quarry was investigated but not considered feasible due to the steep upslope terrain (refer to **Section 3.2.1**).

In a submission regarding the EIS for the Original Project lodged in 2016, the NSW Department of Primary Industries (DPI) Water (now NRAR) indicated the proponent would be required to offset the additional loss of catchment in the Paterson/Allyn Rivers Water Source through the attainment of Water Access Licence (WAL) shares equal to the loss. DPI Water nominated the licensable volume to be 217 ML based on the assessment of catchment surface water loss presented in the WQIA (JM Environments, 2016) supporting the EIS. It is important to note, however, that the original Quarry expansion plans resulted in the interception of a second and third order stream to the east of the West Pit which would have resulted in runoff from approximately 106 ha of additional upslope undisturbed catchment entering the Quarry WMS. The Revised Project avoids the interception of these streams and significantly reduces the clean catchment intercepted by the extension relative to that assessed in the EIS.

The previous WQIA adopted a water balance approach to estimate the expected annual loss of surface water flows (i.e. an estimated loss of 217 ML) to the Paterson River based on the quarries final and most extensive stage. This approach considered the runoff from all catchment areas (disturbed and undisturbed), the Quarry dust suppression water demands, evaporative losses from dams and controlled discharges from the Quarry WMS to the downstream environment. However, a different approach to surface water licensing is being proposed as part of this SWIA and is detailed in the following sections.

7.1.2.2 Licensing Exemptions

Water take associated with the first and second order streams during the operation phase of the Revised Project is considered exempt based on the following schedules in the Water Management (General) Regulation 2018:

Schedule 4

12 Excluded works

(1) Any landholder—in relation to the taking of water from or by means of an excluded work referred to in item 1, 2, 3, 4, 6, 7 or 9 in Schedule 1 that is situated on the land, for the purposes and in the circumstances specified in Schedule 1 in respect of the work.

Schedule 1

3 Dams solely for the capture, containment and recirculation of drainage and/or effluent, consistent with best management practice or required by a public authority (other than Landcom or the Superannuation Administration Corporation or any of their subsidiaries) to prevent the contamination of a water source, that are located on a minor stream.

The *Water Management (General) Regulation 2018* provides the following definition of minor streams:

> ***minor*** *stream means:*
>
> *(a) any stream or part of a stream:*
>
> *(i) the location of which is represented on any of the topographic maps listed in Part 2 of Schedule 2, and*
>
> *(ii) that is a first or second order stream, or part of such a stream, as determined in accordance with the system set out in Part 1 of Schedule 2, and*
>
> *(iii) which does not maintain a permanent flow of water, being a visible flow which occurs on a continuous basis, or which would so occur if there were no artificial abstractions of water or obstruction of flows upstream, and*
>
> *(iv) which does not at any time carry flows emanating from a third, fourth or higher order stream as determined in accordance with the system set out in Part 1 of Schedule 2, and*
>
> *(b) any stream or part of a stream the location of which is not represented on a topographic map listed in Part 2 of Schedule 2.*
>
> *For the purposes of paragraphs (a) (i) and (b), the streams are shown as watercourses on the topographic maps according to the legend.*

The Quarry pits, due their interception of the first and second order stream and requirement for water to be managed to prevent pollution risks is an excluded work. Water take that falls directly within the Quarry area is therefore not 'water take' which is licensable. Intercepted catchment from 'clean' upstream or upslope areas is however licensable subject to harvestable rights consideration.

7.1.2.3 Harvestable Rights

Harvestable rights under the *Water Management Act 2000* allow a land holder to capture up to 10% of the average annual runoff on their property. The harvestable rights for a property is estimated based on the total area of the land holding and the average annual runoff (in ML/ha/year) for the location. As indicated in **Section 5.2** the harvestable right for the Quarry land parcels with a total area of 123.5 ha is estimated to be 11.7 ML/year.

7.1.2.4 Background to Water Access Licence Shares

There is a total of 3,924 shares allocated across 109 WALs including domestic and stock, major utility and unregulated river in the Paterson/Allyn Rivers water source. Since implementation of the Hunter Unregulated and Alluvial WSP in 2009, maximum allocations of water have been made available in the Paterson/Allyn Rivers water source, i.e. at least 1 ML/share.

There are two management zones in the Paterson/Allyn Rivers water source:

- the Allyn River with a volume of 3,677.5 ML
- the Paterson River Tributaries with a volume of only 246.5 ML.

While the Quarry is located in the Paterson River Tributaries management zone, the Hunter Unregulated and Alluvial WSP indicates that access licence dealings are generally allowed to be undertaken in a downstream direction. As the Quarry is located downstream of the Allyn River management zone it is likely that permanent entitlement could be purchased from the Allyn River volume. Further the *Report card for Paterson/Allyn Rivers water source* (NSW Department of Water and Energy, 2009) indicates that trading within the water source is permissible subject to assessment. Water NSW confirmed via email correspondence on 26 February 2019 that transfer of unregulated category water from the Allyn Water management zone to the Paterson Water management zone is allowed under the *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009*.

A review of recent water trading in the Paterson/Allyn Rivers water source by Elders Ltd indicates that it is likely that permanent entitlement in the water source could be obtained if required. **Appendix 3** contains correspondence from Elders with regard to water trading and share availability in the Paterson/Allyn Rivers water source as well as correspondence from Water NSW regarding the transfer of shares from the Allyn Water management zone to the Paterson Water management zone.

7.1.2.5 Final Landform

The final landform will incorporate the West Pit Void and the East Pit Void as per the Year 25 Quarry stage plan (refer to **Figure 5.1**). If the voids to be retained as part of the final landform were to reach a long term equilibrium water level where inflows to the voids (rainfall runoff and groundwater seepage) are balanced by evaporative losses then there would be an ongoing surface water licensing requirement of approximately 84.6 ML/year less the land holding harvestable rights entitlement of 11.7 ML/year (refer to **Section 7.1.2.3**). This is based on an overall final void catchment area of approximately 89 ha and a local average annual runoff of 0.95 ML/ha/year (*NSW Farm Dams Calculator*). Should the voids fill and spill to the downstream environment, the surface water licensing requirement would be reduced by the average annual volume of water spilled from the voids.

A final void recovery water balance (refer to **Section 5.2**) indicates that the average annual volume of water spilled from the final voids is less than the average annual runoff for an area equivalent to the final void catchment (i.e. 84.6 ML/year). When taking into account the harvestable right of 11.7 ML/year for the land holding (refer to **Section 7.1.2.3**), the estimated ongoing long term surface water licensing requirement for the final landform would be approximately 9.8 ML/year. There will be a greater licensing requirement for the period prior to when the final voids fill and commence spilling downstream. The final void recovery water balance predicts that the East Pit will fill to spill level after approximately eight years (prior to West Pit) following the Quarry closure. Up until this time, the surface water licensing requirement will be 84.6 ML/year. The licensing requirement after 8 years and up until the West Pit commences spilling (which is predicted to occur after approximately 22 years) is estimated to be 59.0 ML/year (based on predicted average East Pit spill volumes of 25.6 ML/year). A review of recent water trading in the Paterson/Allyn Rivers water source indicate permanent licence entitlements could be obtained (refer to **Section 7.1.2.4**).

The proposed ongoing surface water quantity monitoring program (refer to **Section 7.2.2.2**) will be used to develop a detailed understanding of the Quarry WMS catchment runoff characteristics and groundwater inflows which will allow refinement of the final void recovery model and provide greater confidence in ongoing surface water licensing predictions. Modelling of groundwater outflow from the final voids will also be undertaken to inform the final void recovery model and closure planning.

7.1.3 Groundwater

Daracon hold groundwater licence 20BL173933 which was issued under Part V of the *Water Act 1912* on 29 January 2016. Licence 20BL173933 entitles Daracon to intercept up to 33 ML/year of groundwater as a result of quarry extraction activities.

Groundwater impacts are addressed in the *Martins Creek Groundwater Impact Assessment (AGE, 2020)* which has been prepared separately to this SWIA.

7.2 Monitoring

7.2.1 Environment Protection Licence

EPL monitoring requirements are presented in **Table 2.5**.

7.2.2 Surface Water

7.2.2.1 Water Quality

Surface water quality monitoring at the Quarry includes discharge water quality monitoring in accordance with EPL 1378 as well as regular monitoring of ESCs as provided in the SWMCP (refer to **Appendix 1**).

Since January 2019, Daracon has been undertaking receiving water quality monitoring in the Allyn River upstream and Paterson River downstream of the Quarry (refer to **Figure 2.2** and **Section 2.2**). Monthly receiving water quality monitoring will be undertaken for a minimum of 24 months for the parameters listed in **Table 7.1** to develop receiving water quality guideline values in accordance with ANZG 2018. This SWIA includes data up to July 2020, however monthly monitoring is ongoing to provide a 24-month baseline dataset. The frequency of receiving water quality monitoring will be reviewed after 24 months with a view to reducing the frequency to quarterly should upstream and downstream results prove to be consistent. Trigger Action Response Plans (TARPs) will be developed to provide clear guidelines for Daracon personnel to follow in the event receiving water quality is measured outside the site specific guideline value range. The TARPs will be included in the site SWMP.

Table 7.1 Receiving Water Quality Monitoring

Pollutant	Units	Frequency of Monitoring
Oil and Grease	mg/L	Monthly
pH	-	
Electrical Conductivity	µS/cm	
Total Suspended Solids	mg/L	
Turbidity	NTU	

7.2.2.2 Water Quantity

Table 7.2 outlines the water inventories and flows that will be monitored.

Table 7.2 Water Quantity Monitoring

Parameter	Measurement Methodology	Units	Frequency of Monitoring
Site Water Storage Inventories (Dam 1, Dam 2, Dam 3 and West Pit Sump)	Water surface elevation measured with GPS in Dam 3 and West Pit Sump Dam 1 and Dam 2 are equipped with a staff gauge indicating water level. Inventory (volume) calculated based on storage level- volume relationship for each water storage.	ML	Monthly
Water Transfers (Between Dam 1, Dam 2, Dam 3 and West Pit Sump)	Record pumping time for transfers and calculate volume based on pump duty flow rate	ML	During transfers
Water Usage	Potable water by flow meter Reuse captured stormwater ○ Haul Rd dust suppression: number of water cart fills and water cart capacity ○ Processing: flow meter	ML	Monthly Daily Monthly
Controlled Discharge Volume (LDP6, LDP7 and LDP 8)	Flow meter or pump rate and run time.	ML	Daily during discharge
Groundwater Inflow	Estimated based on site water balance.	ML	Quarterly

7.2.3 Amenities Water

Potable water from the amenities water reticulation system will be sampled on a six monthly basis. Amenities water will be analysed to ensure the water meets the requirements of the ADWG (National Health and Medical Research Council, 2011).

The amenities water supply tank will be inspected on a monthly basis for any potential contamination with organics or other materials.

7.3 Reporting

7.3.1 Environment Protection Licence

Daracon are required to complete and submit an Annual Return to the NSW Environment Protection Authority (EPA) that includes a summary of water discharges, monitoring, any complaints and a statement of compliance with EPL conditions.

In the event that an incident occurs that threatens or causes environmental harm such as a discharge of water that does not meet EPL criteria, Daracon must notify the EPA immediately after becoming aware of the incident. Daracon must also provide a written report to the EPA within seven days of the date on which the incident occurred.

7.3.2 Annual Review and Incidents

Daracon will submit an Annual Review to DPIE that will include a summary of the Quarry WMS performance. The Annual Review will include the annual site water balance results, receiving water and discharge water quality monitoring results and details of any incidents or complaints. If an environmental incident involving surface water occurs the relevant authorities (including DPIE, the EPA and DoI Water) will be notified and reports provided as required.

8.0 Conclusion

The Project will result in the increased capture of runoff from the undisturbed catchment upslope of the Quarry. However, it is predicted that 62 to 74% of the additional runoff captured within the Quarry WMS during operations will be returned via controlled discharges to the downstream environment (refer to **Section 4.3**). Overall, impacts on downstream water availability associated with the Project are expected to be negligible and similar to the existing Quarry operation.

The total volume of water discharged off-site via the Quarry LDPs is predicted to increase by up to 29% and the average number of controlled discharge days is predicted to increase by up to 52%. However, it is not proposed to increase the peak discharge flow rate. Given that this flow rate has not caused stream stability issues during past periods of prolonged discharges, impacts on downstream stream stability associated with the Revised Project are expected to be negligible and equivalent to the existing Quarry operation.

While the controlled discharge volumes and frequencies are expected to increase, the Quarry water treatment systems have proven to consistently produce discharge water quality within EPL criteria. Further, the maximum volume of uncontrolled discharges (typically having higher TSS concentrations) are expected to decrease. As such, the impacts associated with discharge water quality for the Revised Project are expected to be negligible and equivalent or reduced when compared to the existing Quarry operation.

As the impacts associated with Project on water quantity, stream stability and water quality are expected to be negligible, the impacts on downstream water users are also expected to be negligible and equivalent to the existing Quarry operation.

The final landform will incorporate two final voids (West Pit and East Pit) that are predicted to fill with runoff from upslope catchments and remain as permanent water bodies that will periodically spill to the downstream environment (refer to **Section 5.2**). The average annual volumes of water spilling from the voids are predicted to be less than the average annual regional runoff from the final voids catchments. When taking into account the harvestable right of 11.7 ML/year for the land holding (refer to **Sections 7.1.2.3** and **5.1**), the predicted ongoing surface water licensing requirement of approximately 9.8 ML/year once the voids reach spill level. Prior to this, the surface water licensing requirement is predicted to be 84.6 ML/year for the first eight years following closure when both voids are still filling. The licensing requirement after eight years and up until the West Pit commences spilling (which is predicted to occur after approximately 20 years) is estimated to be 59.0 ML/year (based on predicted average East Pit spill volumes of 25.6 ML/year).

As there will be no ongoing ground disturbance within the final landform, runoff to the final voids will be from upstream undisturbed catchments and rehabilitated disturbed areas and hard rock surfaces. The impact of groundwater inflows to the final voids on water quality is expected to be negligible given the relatively small volume of groundwater inflows compared to rainfall runoff inflows. As such, final void water quality is expected to be similar to that of runoff from the surrounding catchment.

The updated SWMP for the Quarry which will include the proposed WMS, revised ESCs, amenities water management details, the proposed surface water monitoring program and TARPs will ensure that Daracon actively monitor the effectiveness of the WMS and update water management practices on a regular basis (as required).

9.0 References

Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra, 2018)

Australian and New Zealand Guidelines for Fresh and Marin Water Quality (Australian and New Zealand Environment and Conservation Council, 2000)

Martins Creek Quarry Geological Assessment (VGT Environmental Compliance Solutions, 2020).

Martins Creek Quarry Groundwater Impact Assessment (Australasian Groundwater and Environmental Consultants, 2020)

Managing Urban Stormwater, Soils and Construction, Volume 1 (Landcom, 2004)

Managing Urban Stormwater, Soils and Construction, Volume 2E Mines and quarries (Department of Environment and Climate Change, 2008)

Maximum Harvestable Right Calculator, *https://www.waternsw.com.au/customer-service/water-licensing/basic-water-rights/harvestable-rights-dams/maximum-harvestable-right-calculator* (Water NSW, 2020)

NSW Water Quality Objectives Hunter River, https://www.environment.nsw.gov.au/ieo/Hunter/maptext-03.htm#wq01 (NSW Office of Environment and Heritage, 2020)

Water Sharing Plan – Hunter unregulated and alluvial water sources: Background document (NSW Department of Water and Energy, 2009)

Paterson and Allyn Rivers Overview https://www.hunterwater.com.au/Water-and-Sewer/Water-Supply/Dams-and-Catchments/Paterson-and-Allyn-Rivers.aspx (Hunter Water, 2019)

Report card for Paterson/Allyn Rivers water source (NSW Department of Water and Energy, 2009)

Water Quality Impact Assessment - Martins Creek Quarry Extension Project (JM Environments, 2016)

APPENDIX 1

Martins Creek Quarry Dewatering Procedure

APPENDIX 5 Site Dewatering Management Sub-Plan

Martins Creek Quarry Dewatering and Water Treatment Plan

Document No. 1
Holder: Daracon Martins Creek Quarry

Revision	Date	Prepared By	Reviewed By Quarry Manager		Authorised By Systems Manager	
			Name	Sign	Name	Sign
4	31/03/20	L.Robinson	Paul Walker		Luke Robinson	

TABLE OF CONTENTS Page No.

1. INTRODUCTION

1.1 Project Title

This document establishes the procedure for the treatment of water collected in Sediment dams 1, 2 and 3 within the quarry (Refer to Appendix A). These dams are water quality monitoring/discharge points provided for by Environmental Protection Licence 1378:

- Dam 1 – EPA identification Number Point 6
- Dam 2 – EPA Identification Number Point 7
- Dam 3 – EPA Identification Number Point 8

1.2 Scope of Works

Martins Creek quarry is required to collect site water in dams, transfer water between dams, treat water through flocculation/coagulation, perform water testing and discharge water.

1.3 Work Activities

The work includes:

- Full safety and environmental compliance
- Water sampling
- Water testing by NATA laboratories
- Addition of flocculent and coagulant using electric dosing pumps
- Mixing of flocculent and coagulant through purpose built pipeline
- Pumps for both treatment and discharge to natural watercourse
- Manually operated valves to change from water recirculation to water discharge

1.4 Hours of Work

Unless otherwise restricted the hours of work, including the pumping of water on the site shall be Monday to Saturday between 0600 hours to 1800 hours in Lot 1 DP 204377/Lot 1 DP 1006375 and Monday to Saturday between 0700 hours to 1700 hours in Lot 5 DP 242210 and Lot 6 242210. Work may be done outside these hours where specific approval is obtained from the Quarry Manager.

In general no work shall be done on Sundays or public holidays. If required, approvals will be sought from the Quarry Manager prior to undertaking Sunday work.

1.5 Specifications

Conduct of the water treatment and discharge requires adherence to the requirements of:

- Environmental Protection License 1378
- Daracon Group's Environmental Management System
- Relevant State Laws including the Protection of the Environment Operations Act 1997

EPL 1378 sets the following concentration limits for the discharge for the discharge from these dams

Pollutant	Unit of Measure	Concentration Limit
Oil and Grease	Visual	None visible
pH	pH	6.5-8.5
Total Suspended Solids	Milligrams per litre	50

Table 1

1.6 Environmental Protection Licence (EPL) 1378 Conditions

This procedure has been prepared to ensure that Martins Creek Quarry meet the requirements for surface water management as per EPL 1378. These are as follows:

- For each monitoring point the concentration of a pollutant discharged at that point must not exceed the concentration limits specified for that pollutant.(refer to Table 1)
- Discharges from the stormwater treatment dams must be managed to prevent downstream scouring and erosion
- Any flocculent or coagulent added to stormwater treatment dams must not exceed concentrations that will cause an ecotoxic effect in the downstream receiving environment
- The stormwater treatment dams must be dewatered as is necessary to maintain adequate sediment and water storage volumes

1.6.1 Requirements to Monitor Concentration of Pollutants Discharged

For each monitoring point the following must be monitored and at the frequency as specified:

Pollutant	Units of Measure	Frequency	Sampling Method
Oil and Grease	Visible	Daily During Discharge	Visual Inspection
pH	pH	Daily During Discharge	Probe
Total Suspended Solids	Milligrams per litre	Daily During Discharge	Grab Sample

Table 2

Monitoring of pollutants discharged must be done in accordance with the approved methods publication and must be undertaken by a NATA accredited laboratory in the relevant test method (with the exception of the visual inspection for oils and grease).

1.7 Operation of the Dams

1.7.1 Dam 1

Water in the dam shall be stored at a level that is below the water level indicator in the dam. Following rainfall if the water level raises above the indicator the following measures shall be undertaken until such time that the water falls below the level indicator.
A manually operated Gould electric pump draws water from the dam and pumps water through a poly pipeline fitted with a series of manually operated valves and offshoot pipelines. Water can either be re-circulated within the dam, pumped to Dam #3 or discharged via the dam spillway to the downstream creek.

1.7.1.1 Water Treatment/Clarification

To get the water to within the limits specified in Table 1, the following may be required:

1. Ensure the valves for recirculation within the dam are opened.
2. Ensure the valve to discharge to spillway is closed.
3. Check that there is sufficient flocculent and coagulant.
    a. Flocculent – Hifloc 20
    b. Coagulant – Nalkat 7607
4. Ensure valves are open at suction and discharge of dosing lines
5. Check hoses and fittings for signs of leaks, deterioration or wear.
6. Turn on general purpose outlet for coagulant and flocculent only.
7. Ensure sulphuric acid general purpose outlet is in the off position.
8. Start pump.

9. Dosing pump settings as determined in consultation with water process engineer (currently Victory Engineering)
10. Visually inspect that water flows form discharge lines and there are no noticeable leaks at the pump.
11. Check dosing pump suction and discharge lines are flowing.
12. At end of shift turn off pump. The general purpose outlets have a relay connected to the main electric pumps so they will not operate if the main pump is not operating.
13. Prior to repeating the procedure the following day a visual inspection of the water is required to determine if the water requires treatment again. If it does follow steps 1-11 again if not follow discharge procedure.

1.7.1.2 Discharge Procedure

When planning to discharge water to downstream creek, the following is required:

1. Determine the ph of the water using probe.
2. Ensure the valve that discharges to the spillway is closed.
3. Check that there is sufficient sulphuric acid.
4. Ensure that the valves at the suction and discharge of Sulphuric Acid dosing lines are open.
5. Check hoses and fittings for signs of leaks, deterioration or wear.
6. Turn on general purpose outlet for Sulphuric Acid.
7. Ensure general purpose outlets for Flocculent and Coagulant are off.
8. Start pump.
9. Visual inspect that acid is moving through suction and discharge lines.
10. Open valve at sampling point and allow to run until it is evident that built up sediment has been purged from the pipe line.
11. Use sampling bottle to sample water.
12. If water appears clear enough to meet the requirements check for pH using probe. If water appears to still require treatment turn off the pump and follow procedure for “water treatment/clarification”.
13. If pH test shows that sample is within the allowable limits take sample to NATA accredited laboratory for testing.
14. If report from the NATA accredited laboratory shows that the water is within the allowable limits water can be discharged to downstream creek.
15. Prior to discharge complete “**Dewatering Permit.”** (Refer to Appendix B)
16. To do this open valve to spillway discharge and close valves for recirculation.
17. During discharge visually inspect downstream creek for signs of erosion.

1.7.1.3 Pumping to Dam #3 Procedure

When planning to pump water over the hill to Dam #3, the following is required:

1. If the water entering Dam #1 appears to be faster than can be appropriately treated, tested and discharged, then water may be pumped over the hill to Dam #3 for temporary storage;
2. Ensure all pumps necessary to pump to Dam #3 are available and operating appropriately;
3. Ensure the valve that discharges to the spillway is closed.
4. Start all pumps and progressively close the recirculation valves so as to direct water to Dam #3;
5. Inspect all inlet and outlet hoses for leaks and repair as necessary;
6. Inspect the outlet hose down ramp into the pit (Dam #3) regularly to ensure no significant scouring occurs;
7. Water transfer from Dam #1 to Dam #3 should continue to ensure sufficient water storage in Dam #1 exists or when the correct water quality for discharge is achieved;

1.7.2 Dam 2

Water in the dam shall be stored at a level that is below the water level indicator in the dam. Following rainfall if the water level raises above the indicator the following measures shall be undertaken until such time that the water falls below the level indicator.

Water is not to be pumped from stormwater treatment Dam 2 via the spillway. The dewatering of Dam 2 is to be done by either of the following methods. :

1. Using the fixed electric pump at Dam 2 pump water to Dam 1 through the 75mm poly pipe line. Chemical coagulant Nalkat 7607 can be added by the use of a dosing pump.
2. Using the fixed electric pump at Dam 2 treat the water in Dam 2 through recirculation by adding coagulant Nalkat 7607 using the fixed dosing pump. Ensure that the valve is open to re-circulate the water and the valve is closed to transfer to Dam 1.

1.7.3 Dam 3

Water treatment for dam 3 is undertaken as follows (refer to plan Appendix C):

1. Establish portable diesel pump, chemical dosing pump and chemical coagulant in Dam 3.
2. Chemical dosing line to be connected to the suction side of the pump.
3. Chemical dosing rate as determined in consultation with water processing engineer (currently Victory Engineering).
4. Discharge line on diesel pump to Northern end of “transfer dam”.
5. Install AN2 Floc blocs at discharge into transfer dam if deemed necessary.
6. Establish Portable diesel pump at Southern End of “transfer dam”. Discharge hose installed to license discharge point 8.
7. Install dosing line to suction side of portable diesel pump to dosing pump for PH correction (as required only).
8. Sample water.
9. If test result is within allowable limits complete “**Dewatering Permit”** and discharge water.
10. Test daily during discharge.

2. ROLES AND RESPONSIBILITIES

TASK	APPROVED PERSONS
Water Sampling	Trained water sampler
Dewatering Permit Sign off	• Quarry Manger or delegate
Environmental Inspections	• Quarry Manager • Quarry Supervisor • Quarry Coordinator • Martins Creek Systems Coordinator • Environmental Coordinator
Modifications to Coagulant and Flocculent Dose Rates	• Delegate as approved by Quarry Manager and only under direction from appropriately trained water process consultant (Currently Victory Engineering)
Adjustments to Sulphuric Acid dose rate	• Quarry Manager • Quarry Supervisor • Quarry Coordinator • Martins Creek Maintenance and Systems Coordinator • Environmental Coordinator
Operation of pump and	• Quarry Manager

dosing system	• Quarry Supervisor • Quarry Coordinator • Martins Creek Maintenance and Systems Coordinator • Environmental Coordinator • Martins Creek Diesel Service
Repairs and Maintenance to Hoses and Fittings	• Quarry Supervisor • Martins Creek Maintenance and Systems Coordinator • Environmental Coordinator • Martins Creek Diesel Service

3. SAFETY

Refer to the onsite SDS Register for Safety Data sheets for the Hifloc 20, Nalkat 7607 and Sulphuric Acid. All works involving the use of these chemicals are to be done so in accordance with the relevant SDS.

Any person involved in works associated with the stormwater treatment dams must refer to the Safe Work Method Statement “Operation of Water Treatment for Dams 1, 2 and 3” which is located at Martins Creek Quarry.

4. INCIDENT AND EMERGENCY PROCEDURES

4.1 General

Incidents and emergencies are to be dealt with in accordance with the Project Safety Management Plan and the Pollution Incident Response Management Plan (PIRMP).

5. APPENDICES

5.1 Appendix A Water Monitoring Locations

5.2 Appendix B - Dewatering Permit

Facility : **EPL Number:** **Discharge Location (**as per EPL**):**

A Dewatering permit authorizing water to be released is required where the following occurs: • When releasing water from a Water Quality Monitoring Point • Water quality must be tested daily during discharge

(Completed by Person in charge of the work)

PART A Notification

Requested By:	Position:	Request Date:
Start Date:	Finish Date	

PART B Conditions for Release

All water released from a sediment basin must meet specific quality levels as set out in the Environmental Protection Licence - The pH must be within 6.5 to 8.5 - Total Suspended Solids (Tss) must be less than 50mg/L - Free from oil, grease and other Chemicals - Any other conditions outlined within the licence.

PART C Water Quality Record

Prior to the release of any water off site, water must be tested by a NATA accredited laboratory.		
Water Sampled by:		
Water tested by:		Report Number:
Has the water been treated with any Flocculants?	Y/N	If yes, Type: Amount (kg/L): Date treated:
Total Suspended Solids (mg/L)		Condition: Less than 50mg/l
pH		Condition: Between 6.5 and 8.5
Is the water free of oil and grease	Y/N	Condition: Y (Visual Inspection)
If the water meets **all** the above conditions then release is permitted, If any one of the conditions fails, the water must be treated before release.		

PART D – Water Discharge Details

Method of Discharge	
Description of receiving waters/ land	
Time and Date of Discharge	Time: til Date:
Estimated Quantity Discharged	L , m^3 or ML (circle)

Reason for Release:

Comments:

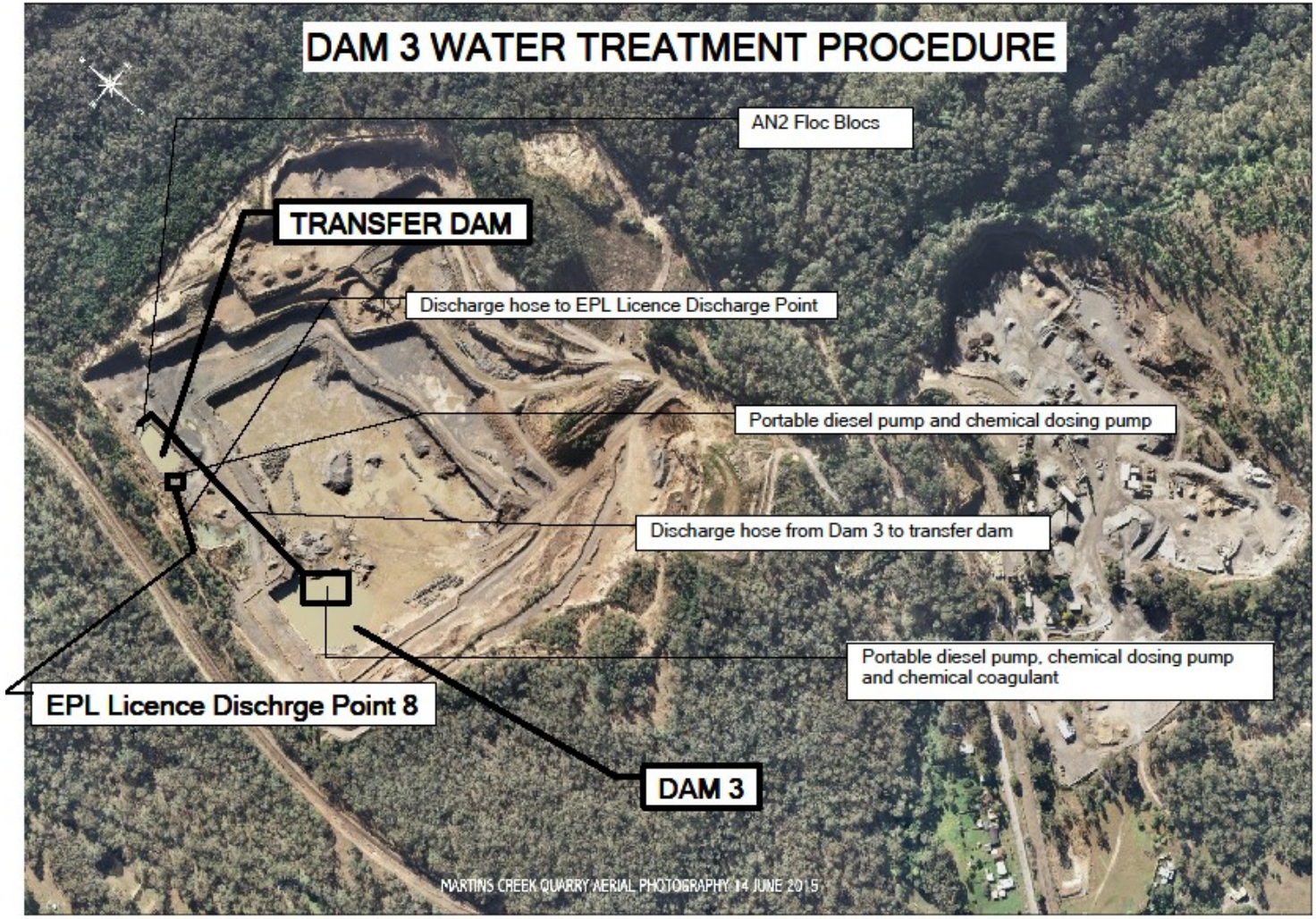
PART E PERMIT APPROVAL

Approval is hereby given to undertake Dewatering, I am satisfied that all the above conditions have been met.

		/ /
Name:	Signature	Approval Date:

(Manager or Delegate)

5.3 Appendix C Dam 3 Dewatering Procedure



APPENDIX 2

Water Treatment Chemical Safety Data Sheets

Nalco Nalkat 7607

Not Available

Chemwatch Hazard Alert Code: **1**

Chemwatch: **34-8999**
Version No: **4.1.1.1**
Safety Data Sheet according to WHS and ADG requirements

Issue Date: **04/12/2017**
Print Date: **20/12/2018**
S.GHS.AUS.EN

SECTION 1 IDENTIFICATION OF THE SUBSTANCE / MIXTURE AND OF THE COMPANY / UNDERTAKING

Product Identifier

Product name	Nalco Nalkat 7607
Synonyms	Not Available
Other means of identification	Not Available

Relevant identified uses of the substance or mixture and uses advised against

Relevant identified uses	Cationic polyelectrolyte.

Details of the supplier of the safety data sheet

Registered company name	**Not Available**
Address	Not Available
Telephone	Not Available
Fax	Not Available
Website	Not Available
Email	Not Available

Emergency telephone number

Association / Organisation	**Not Available**
Emergency telephone numbers	Not Available
Other emergency telephone numbers	Not Available

SECTION 2 HAZARDS IDENTIFICATION

Classification of the substance or mixture

NON-HAZARDOUS CHEMICAL. NON-DANGEROUS GOODS. According to the WHS Regulations and the ADG Code.

CHEMWATCH HAZARD RATINGS

		Min	Max
Flammability	1		
Toxicity	0		
Body Contact	0		
Reactivity	1		
Chronic	0		

0 = Minimum
1 = Low
2 = Moderate
3 = High
4 = Extreme

Poisons Schedule	Not Applicable
Classification [1]	Chronic Aquatic Hazard Category 3
Legend:	*1. Classified by Chemwatch; 2. Classification drawn from HSIS; 3. Classification drawn from Regulation (EU) No 1272/2008 - Annex VI*

Continued...

Label elements

Hazard pictogram(s)	Not Applicable
SIGNAL WORD	**NOT APPLICABLE**

Hazard statement(s)

H412	Harmful to aquatic life with long lasting effects.

Precautionary statement(s) Prevention

P273	Avoid release to the environment.

Precautionary statement(s) Response

Not Applicable

Precautionary statement(s) Storage

Not Applicable

Precautionary statement(s) Disposal

P501	Dispose of contents/container in accordance with local regulations.

SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

Substances

See section below for composition of Mixtures

Mixtures

CAS No	%[weight]	Name
Not Available	100	non-hazardous ingredients

SECTION 4 FIRST AID MEASURES

Description of first aid measures

Eye Contact	If this product comes in contact with eyes: ▸ Wash out immediately with water. ▸ If irritation continues, seek medical attention. ▸ Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.
Skin Contact	If skin or hair contact occurs: ▸ Flush skin and hair with running water (and soap if available). ▸ Seek medical attention in event of irritation.
Inhalation	▸ If fumes, aerosols or combustion products are inhaled remove from contaminated area. ▸ Other measures are usually unnecessary.
Ingestion	▸ Immediately give a glass of water. ▸ First aid is not generally required. If in doubt, contact a Poisons Information Centre or a doctor.

Indication of any immediate medical attention and special treatment needed

Treat symptomatically.

SECTION 5 FIREFIGHTING MEASURES

Extinguishing media

- Water spray or fog.
- Foam.
- Dry chemical powder.
- BCF (where regulations permit).

Special hazards arising from the substrate or mixture

Fire Incompatibility	▸ Avoid contamination with oxidising agents i.e. nitrates, oxidising acids, chlorine bleaches, pool chlorine etc. as ignition may result

Advice for firefighters

Continued...

Fire Fighting	▸ Alert Fire Brigade and tell them location and nature of hazard. ▸ Wear full body protective clothing with breathing apparatus. ▸ Prevent, by any means available, spillage from entering drains or water course. ▸ Use water delivered as a fine spray to control fire and cool adjacent area.
Fire/Explosion Hazard	▸ Combustible. ▸ Slight fire hazard when exposed to heat or flame. ▸ Heating may cause expansion or decomposition leading to violent rupture of containers. ▸ On combustion, may emit toxic fumes of carbon monoxide (CO). Combustion products include: carbon dioxide (CO_2) nitrogen oxides (NOx) other pyrolysis products typical of burning organic material.
HAZCHEM	Not Applicable

SECTION 6 ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

See section 8

Environmental precautions

See section 12

Methods and material for containment and cleaning up

Minor Spills	▸ Remove all ignition sources. ▸ Clean up all spills immediately. ▸ Avoid breathing vapours and contact with skin and eyes. ▸ Control personal contact with the substance, by using protective equipment.
Major Spills	Moderate hazard. ▸ Clear area of personnel and move upwind. ▸ Alert Fire Brigade and tell them location and nature of hazard. ▸ Wear breathing apparatus plus protective gloves.

Personal Protective Equipment advice is contained in Section 8 of the SDS.

SECTION 7 HANDLING AND STORAGE

Precautions for safe handling

Safe handling	▸ **DO NOT** allow clothing wet with material to stay in contact with skin ▸ Avoid all personal contact, including inhalation. ▸ Wear protective clothing when risk of exposure occurs. ▸ Use in a well-ventilated area. ▸ Prevent concentration in hollows and sumps.
Other information	▸ Store in original containers. ▸ Keep containers securely sealed. ▸ No smoking, naked lights or ignition sources. ▸ Store in a cool, dry, well-ventilated area.

Conditions for safe storage, including any incompatibilities

Suitable container	▸ Metal can or drum ▸ Packaging as recommended by manufacturer. ▸ Check all containers are clearly labelled and free from leaks.
Storage incompatibility	▸ Avoid reaction with oxidising agents

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

Control parameters

OCCUPATIONAL EXPOSURE LIMITS (OEL)

INGREDIENT DATA

Not Available

EMERGENCY LIMITS

Ingredient	Material name	TEEL-1	TEEL-2	TEEL-3

Continued...

Nalco Nalkat 7607	Not Available	Not Available	Not Available	Not Available

Ingredient	Original IDLH	Revised IDLH
Nalco Nalkat 7607	Not Available	Not Available

Exposure controls

Appropriate engineering controls	Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions to provide this high level of protection. The basic types of engineering controls are: Process controls which involve changing the way a job activity or process is done to reduce the risk. Enclosure and/or isolation of emission source which keeps a selected hazard "physically" away from the worker and ventilation that strategically "adds" and "removes" air in the work environment.
Personal protection	
Eye and face protection	▸ Safety glasses with side shields ▸ Chemical goggles. ▸ Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lenses or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience.
Skin protection	See Hand protection below
Hands/feet protection	Wear general protective gloves, eg. light weight rubber gloves. The selection of suitable gloves does not only depend on the material, but also on further marks of quality which vary from manufacturer to manufacturer. Where the chemical is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application. The exact break through time for substances has to be obtained from the manufacturer of the protective gloves and.has to be observed when making a final choice. Personal hygiene is a key element of effective hand care.
Body protection	See Other protection below
Other protection	No special equipment needed when handling small quantities. **OTHERWISE:** ▸ Overalls. ▸ Barrier cream. ▸ Eyewash unit.

Respiratory protection

Type A Filter of sufficient capacity. (AS/NZS 1716 & 1715, EN 143:2000 & 149:2001, ANSI Z88 or national equivalent)

Selection of the Class and Type of respirator will depend upon the level of breathing zone contaminant and the chemical nature of the contaminant. Protection Factors (defined as the ratio of contaminant outside and inside the mask) may also be important.

Required minimum protection factor	Maximum gas/vapour concentration present in air p.p.m. (by volume)	Half-face Respirator	Full-Face Respirator
up to 10	1000	A-AUS / Class1	-
up to 50	1000	-	A-AUS / Class 1
up to 50	5000	Airline *	-
up to 100	5000	-	A-2
up to 100	10000	-	A-3
100+			Airline**

* - Continuous Flow ** - Continuous-flow or positive pressure demand
A(All classes) = Organic vapours, B AUS or B1 = Acid gasses, B2 = Acid gas or hydrogen cyanide(HCN), B3 = Acid gas or hydrogen cyanide(HCN), E = Sulfur dioxide(SO2), G = Agricultural chemicals, K = Ammonia(NH3), Hg = Mercury, NO = Oxides of nitrogen, MB = Methyl bromide, AX = Low boiling point organic compounds(below 65 degC)

- Cartridge respirators should never be used for emergency ingress or in areas of unknown vapour concentrations or oxygen content.
- The wearer must be warned to leave the contaminated area immediately on detecting any odours through the respirator. The odour may indicate that the mask is not functioning properly, that the vapour concentration is too high, or that the mask is not properly fitted. Because of these limitations, only restricted use of cartridge respirators is considered appropriate.
- Cartridge performance is affected by humidity. Cartridges should be changed after 2 hr of continuous use unless it is determined that the humidity is less than 75%, in which case, cartridges can be used for 4 hr. Used cartridges should be discarded daily, regardless of the length of time used

Continued...

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Appearance	Clear light yellow liquid with ammoniacal odour; mixes with water.

Physical state	Liquid	**Relative density (Water = 1)**	1.16
Odour	Not Available	**Partition coefficient n-octanol / water**	Not Available
Odour threshold	Not Available	**Auto-ignition temperature (°C)**	Not Available
pH (as supplied)	3.3	**Decomposition temperature**	Not Available
Melting point / freezing point (°C)	-1	**Viscosity (cSt)**	560 @21C
Initial boiling point and boiling range (°C)	Not Available	**Molecular weight (g/mol)**	Not Applicable
Flash point (°C)	Not Available	**Taste**	Not Available
Evaporation rate	Not Available	**Explosive properties**	Not Available
Flammability	Not Available	**Oxidising properties**	Not Available
Upper Explosive Limit (%)	Not Available	**Surface Tension (dyn/cm or mN/m)**	Not Available
Lower Explosive Limit (%)	Not Available	**Volatile Component (%vol)**	Not Available
Vapour pressure (kPa)	3.19 @20C	**Gas group**	Not Available
Solubility in water	Miscible	**pH as a solution (1%)**	Not Available
Vapour density (Air = 1)	1	**VOC g/L**	Not Available

SECTION 10 STABILITY AND REACTIVITY

Reactivity	See section 7
Chemical stability	Product is considered stable and hazardous polymerisation will not occur.
Possibility of hazardous reactions	See section 7
Conditions to avoid	See section 7
Incompatible materials	See section 7
Hazardous decomposition products	See section 5

SECTION 11 TOXICOLOGICAL INFORMATION

Information on toxicological effects

Inhaled	The material is not thought to produce adverse health effects or irritation of the respiratory tract (as classified by EC Directives using animal models). Nevertheless, good hygiene practice requires that exposure be kept to a minimum and that suitable control measures be used in an occupational setting.
Ingestion	The material has **NOT** been classified by EC Directives or other classification systems as "harmful by ingestion". This is because of the lack of corroborating animal or human evidence.
Skin Contact	The material is not thought to produce adverse health effects or skin irritation following contact (as classified by EC Directives using animal models). Nevertheless, good hygiene practice requires that exposure be kept to a minimum and that suitable gloves be used in an occupational setting. Open cuts, abraded or irritated skin should not be exposed to this material Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected.
Eye	Although the liquid is not thought to be an irritant (as classified by EC Directives), direct contact with the eye may produce transient discomfort characterised by tearing or conjunctival redness (as with windburn).
Chronic	Long-term exposure to the product is not thought to produce chronic effects adverse to the health (as classified by EC Directives using animal models); nevertheless exposure by all routes should be minimised as a matter of course.

Continued...

	TOXICITY	IRRITATION
Nalco Nalkat 7607	Not Available	Not Available
Legend:	*1. Value obtained from Europe ECHA Registered Substances - Acute toxicity 2.* Value obtained from manufacturer's SDS. Unless otherwise specified data extracted from RTECS - Register of Toxic Effect of chemical Substances*	

Nalco Nalkat 7607	Asthma-like symptoms may continue for months or even years after exposure to the material ends. This may be due to a non-allergic condition known as reactive airways dysfunction syndrome (RADS) which can occur after exposure to high levels of highly irritating compound. Main criteria for diagnosing RADS include the absence of previous airways disease in a non-atopic individual, with sudden onset of persistent asthma-like symptoms within minutes to hours of a documented exposure to the irritant. Other criteria for diagnosis of RADS include a reversible airflow pattern on lung function tests, moderate to severe bronchial hyperreactivity on methacholine challenge testing, and the lack of minimal lymphocytic inflammation, without eosinophilia.

Acute Toxicity	✗	**Carcinogenicity**	✗
Skin Irritation/Corrosion	✗	**Reproductivity**	✗
Serious Eye Damage/Irritation	✗	**STOT - Single Exposure**	✗
Respiratory or Skin sensitisation	✗	**STOT - Repeated Exposure**	✗
Mutagenicity	✗	**Aspiration Hazard**	✗

Legend: ✗ *– Data either not available or does not fill the criteria for classification*
✔ *– Data available to make classification*

SECTION 12 ECOLOGICAL INFORMATION

Toxicity

	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
Nalco Nalkat 7607	Not Available	Not Available	Not Available	Not Available	Not Available
Legend:	*Extracted from 1. IUCLID Toxicity Data 2. Europe ECHA Registered Substances - Ecotoxicological Information - Aquatic Toxicity 3. EPIWIN Suite V3.12 (QSAR) - Aquatic Toxicity Data (Estimated) 4. US EPA, Ecotox database - Aquatic Toxicity Data 5. ECETOC Aquatic Hazard Assessment Data 6. NITE (Japan) - Bioconcentration Data 7. METI (Japan) - Bioconcentration Data 8. Vendor Data*				

Harmful to aquatic organisms.
May cause long-term adverse effects in the aquatic environment.
Do NOT allow product to come in contact with surface waters or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning equipment or disposing of equipment wash-waters.
Wastes resulting from use of the product must be disposed of on site or at approved waste sites.

Persistence and degradability

Ingredient	Persistence: Water/Soil	Persistence: Air
	No Data available for all ingredients	No Data available for all ingredients

Bioaccumulative potential

Ingredient	Bioaccumulation
	No Data available for all ingredients

Mobility in soil

Ingredient	Mobility
	No Data available for all ingredients

SECTION 13 DISPOSAL CONSIDERATIONS

Waste treatment methods

Continued...

Product / Packaging disposal	Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. In some areas, certain wastes must be tracked. A Hierarchy of Controls seems to be common - the user should investigate: ▸ Reduction ▸ Reuse ▸ Recycling ▸ Disposal (if all else fails) This material may be recycled if unused, or if it has not been contaminated so as to make it unsuitable for its intended use. ▸ **DO NOT** allow wash water from cleaning or process equipment to enter drains. ▸ It may be necessary to collect all wash water for treatment before disposal. ▸ In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first. ▸ Where in doubt contact the responsible authority. ▸ Recycle wherever possible or consult manufacturer for recycling options. ▸ Consult State Land Waste Authority for disposal. ▸ Bury or incinerate residue at an approved site. ▸ Recycle containers if possible, or dispose of in an authorised landfill.

SECTION 14 TRANSPORT INFORMATION

Labels Required

Marine Pollutant	NO Not Applicable
HAZCHEM	Not Applicable

Land transport (ADG): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS

Air transport (ICAO-IATA / DGR): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS

Sea transport (IMDG-Code / GGVSee): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS

Transport in bulk according to Annex II of MARPOL and the IBC code

Not Applicable

SECTION 15 REGULATORY INFORMATION

Safety, health and environmental regulations / legislation specific for the substance or mixture

National Inventory Status

National Inventory	Status
Australia - AICS	No (non-hazardous ingredients) Non-disclosed ingredients
Canada - DSL	No (non-hazardous ingredients) Non-disclosed ingredients
Canada - NDSL	No (non-hazardous ingredients) Non-disclosed ingredients
China - IECSC	No (non-hazardous ingredients) Non-disclosed ingredients
Europe - EINEC / ELINCS / NLP	No (non-hazardous ingredients) Non-disclosed ingredients
Japan - ENCS	No (non-hazardous ingredients) Non-disclosed ingredients
Korea - KECI	No (non-hazardous ingredients) Non-disclosed ingredients
New Zealand - NZIoC	No (non-hazardous ingredients) Non-disclosed ingredients
Philippines - PICCS	No (non-hazardous ingredients) Non-disclosed ingredients
USA - TSCA	No (non-hazardous ingredients) Non-disclosed ingredients
Legend:	*Yes = All ingredients are on the inventory* *No = Not determined or one or more ingredients are not on the inventory and are not exempt from listing(see specific ingredients in brackets)*

SECTION 16 OTHER INFORMATION

Revision Date	04/12/2017
Initial Date	Not Available

SDS Version Summary

Continued...

Version	Issue Date	Sections Updated
3.1.1.1	23/04/2013	Acute Health (eye), Acute Health (inhaled), Acute Health (skin), Classification, Engineering Control, Environmental, Fire Fighter (fire/explosion hazard), Handling Procedure, Ingredients, Instability Condition, Personal Protection (other), Personal Protection (eye), Personal Protection (hands/feet), Physical Properties

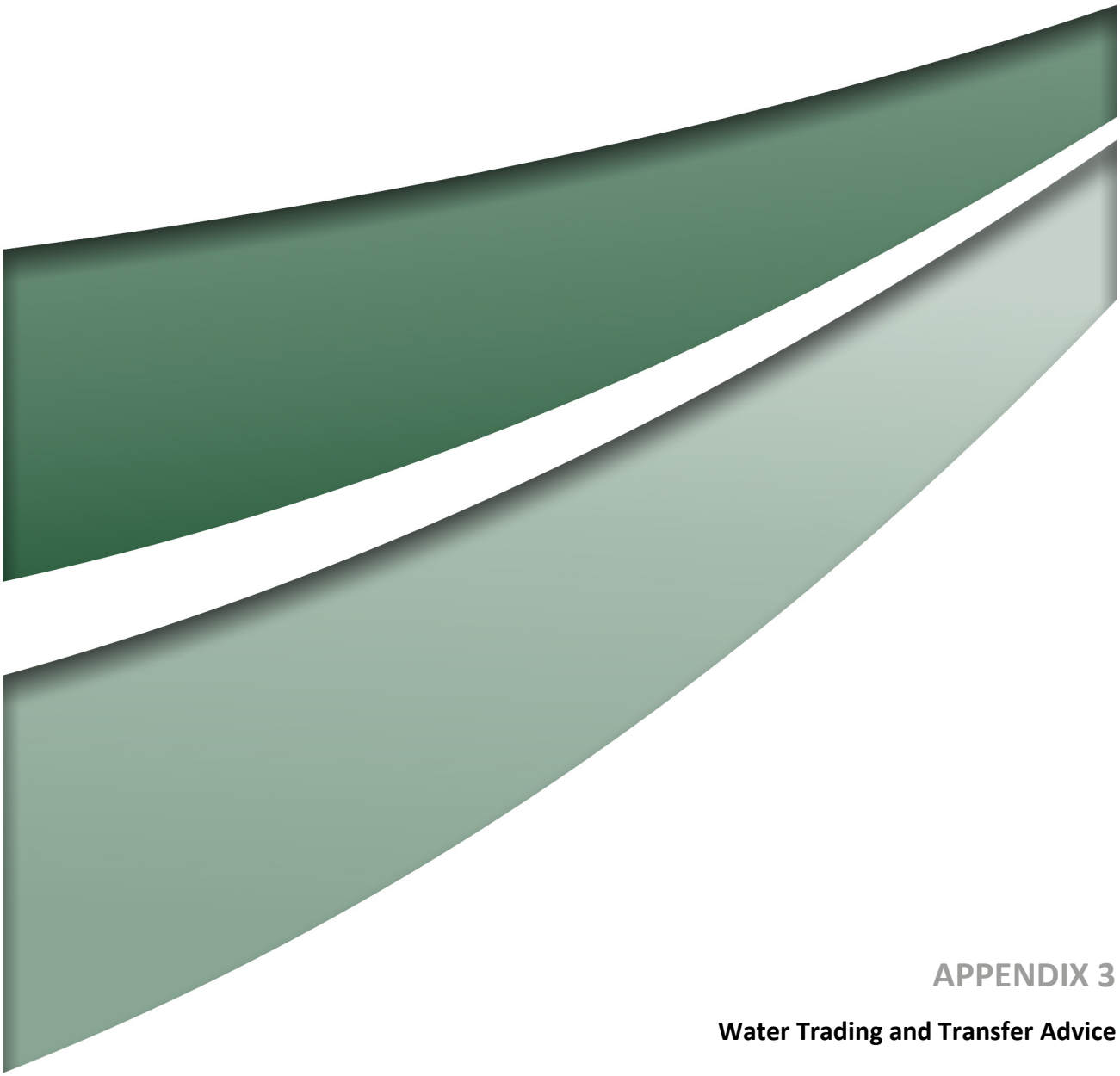
Other information

Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.

The SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios. Scale of use, frequency of use and current or available engineering controls must be considered.

Definitions and abbreviations

PC—TWA: Permissible Concentration-Time Weighted Average
PC—STEL: Permissible Concentration-Short Term Exposure Limit
IARC: International Agency for Research on Cancer
ACGIH: American Conference of Governmental Industrial Hygienists
STEL: Short Term Exposure Limit
TEEL: Temporary Emergency Exposure Limit。
IDLH: Immediately Dangerous to Life or Health Concentrations
OSF: Odour Safety Factor
NOAEL :No Observed Adverse Effect Level
LOAEL: Lowest Observed Adverse Effect Level
TLV: Threshold Limit Value
LOD: Limit Of Detection
OTV: Odour Threshold Value
BCF: BioConcentration Factors
BEI: Biological Exposure Index



APPENDIX 3

Water Trading and Transfer Advice

From: Anthony Bent [mailto:Anthony.Bent@elders.com.au]
Sent: Friday, 15 March 2019 1:43 PM
To: Eugene Moore
Subject: Elders Water - Paterson / Allyn Unregulated River Water Source

Hello Eugene

Re: Paterson / Allyn Rivers Water Source

Please find some information regarding this water source.

Table 1 :

- number of tradeable WAL's & volume of entitlement
- average volume of temporary water made available each season & average volume of temporary water used
- number of temporary and permanent transfers
- average per ML price of the transfers

Note:

1. there has never been a transfer of temporary allocation or transfer of permanent entitlement between water licences (records since 2005/06)
2. the table uses the past six seasons of data for average allocations and average water usage

Table 2:

- identifies the number of Water Licence ownership transfers and the total volume transferred

Note:

1. all of these transfers have been recorded with the transfer price as NIL
    - this is almost certainly because the licence ownership has been transferred as part of the sale of land
    - the water licence is generally seen as an 'after thought'

Table 1

Paterson / Allyn Unregulated Water Source	
Number of WAL's	101.00
Volume	3,823.50
Average Allocation*	100%
Average Annual Volume Used*	-
No. Temporary Transfers	-
Average Price	N/A
No. Permanent Transfers	-
Average Price	N/A

Table 2

Water Year	Volume (ML)	Licence Ownership Transfers
2018/19	77	3
2017/18	325	4
2016/17	134	8
2015/16	205	5
2014/15	206	7
2013/14	207	4

Purchasing water entitlement

I am able to assist you to find the required water and purchase permanent entitlement and guide you through the process from start to finish.
This work will require licence and company searches, obtaining client contact details, making contact with suitable potential vendors and negotiating a trade on your behalf.

These efforts will be exclusively for the purpose of obtaining water for your client and I do not expect that any further business will result from placing resources on this project. As a result, there will be an upfront cost associated with engaging Elders to undertake this work of $8,000 (exc. GST). Below I have provided an estimation of the costs associated with purchasing both the permanent entitlement.

With regards to likelihood of purchasing permanent entitlement; the statistics would indicate that there is a good chance of finding suitable vendors. This water is not being used and vendor may welcome the opportunity to sell.

Two Management Zones

There are two management zones in this water source, i.e. Allyn River and Paterson River. Table 3 indicates the volume of water in each management zone. If your client is required to acquire permanent water in the Paterson River Management Zone only, then this may pose a challenge.

Table 3

Management Zone	Volume (ML)
Allyn River	3677.5
Paterson River	246.5

It is difficult to estimate a price for this permanent entitlement. My recommendation would be to make an opening offer on the permanent entitlement of $500 per ML. However; this price could be far greater as often the need to complete the purchase and "get in and out" could override other considerations. Of course, my objective would be to obtain this water at the lowest possible cost for your client.

I recently completed a project for a client to purchase permanent water in the Upper Talbragar River and Talbragar Groundwater Source approximately 300km west of the Allyn River. This project required the utmost discretion, at no stage was the identity of the purchaser revealed to any licence holders. I am confident that we can work with your clients to ensure the same discretion. If you require further perspective about this then it would be best to have a conversation via phone, give me a call if you need.

I would recommend establishing a new Water Access Licence (WAL) in the Paterson / Allyn Unregulated River Water Source. If Elders is able to locate water that is suitable there would be further costs to purchase this water which is a brokerage of 3.5% of the value of the water and a conveyancing fee of $600.00 per parcel. Elders would complete the transfer of water in-house.

I hope this information is of value. Please contact me if you have any questions.

Yours Sincerely

Anthony Bent
Water Trading Manager
Elders Ltd
m: 0429 332 664
e: anthony.bent@elders.com.au

Chris Bonomini

From: Hemantha DeSilva <Hemantha.DeSilva@waternsw.com.au>
Sent: Tuesday, 26 March 2019 4:05 PM
To: Chris Bonomini
Cc: Water Enquiries
Subject: Water transfers - Paterson-Allyn Rivers Water Source

Hello Chris,

Water Sharing Plan for the Hunter Unregulated and Alluviual Water Sources 2009 allows transfer of unregulated category water from Allyn Water Management Zone to the Paterson Water Management Zone.

Kind Regards
Hemantha

Hemantha De Silva, CEng
Senior Water Regulation Officer (Projects)
Water Regulation Coastal
Customer Approvals & Assessments | Customer & Community

PO Box 2157, Dangar NSW 2309
Suite 2, Level 6 No. 384 Hunter Street, Newcastle NSW 2300
Phone 02 98652880 Mob 0438638987 Email: Hemantha.Desilva@waternsw.com.au
Web page: https://www.waternsw.com.au

umwelt
Environmental & Social Consultants

Newcastle | Perth | Canberra | Brisbane | Sydney | Orange

T| 1300 793 267 E| info@umwelt.com.au www.umwelt.com.au