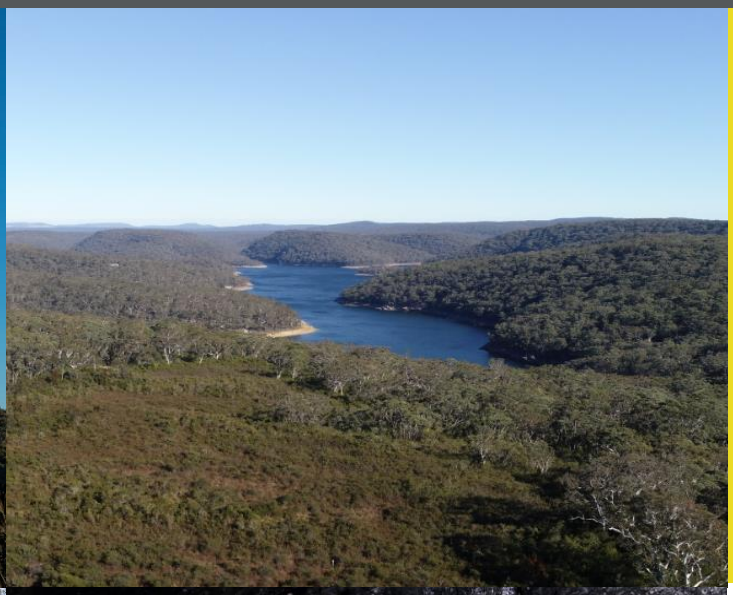
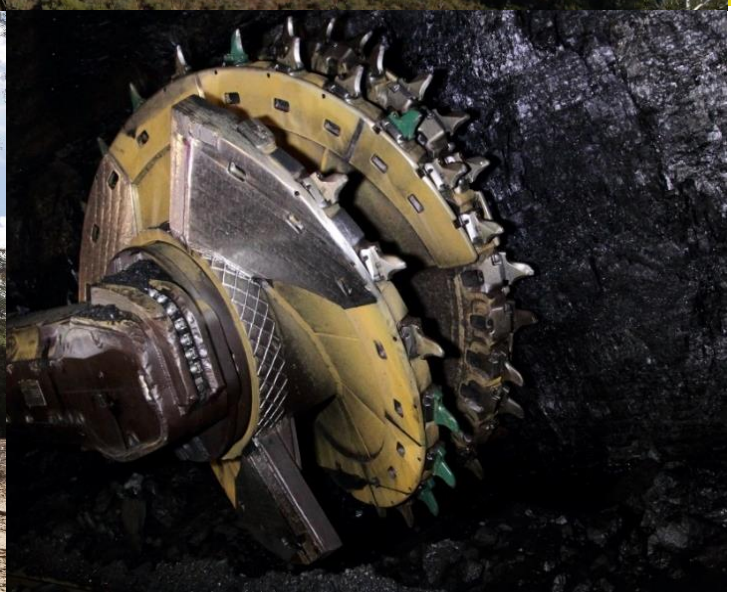
SOUTH32 Illawarra Metallurgical Coal





GEORGES RIVER AQUATIC HEALTH MONITORING PROGRAM

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DOCUMENT REVISION LOG

Persons authorising this Plan

NAME	TITLE	DATE
Chris Schultz	Superintendent Environment	8/01/2024

Document Revisions

REVISION	DESCRIPTION OF CHANGES	DATE
2.0	Version 1 updated to reflect comments from the EPA	6/08/2013
3.0	Version 2 updated to reflect comments from the EPA	10/09/2013
4.0	Changes made to Version 3 following a review of the findings from the Year 1 (2013) campaign. These include: removal of Cascade Creek reference sites as approved by the EPA; removed downstream site GR_OH from the program due to safety concerns with accessing this site Added 3 Georges River sites downstream of the Brennans Ck confluence i.e. Pool 16, Pool 32 and GRQ19. Removed fish monitoring from the program as approved by the EPA. Removed the need to take duplicate water quality samples following a review of the water quality results from the Year 1 (2013) campaign.	8/10/2014
5.0	EIP developed to replace PRP19 & 20. Modifications include: updated section on background information; increased frequency of macroinvertebrate monitoring to every 6 months; added monitoring trigger (TARP) for macroinvertebrate monitoring; addition of EPT biotic index to analysis; and higher level of consultation including establishment of technical working group.	7/10/2016
6.0	Extend the date for implementation of water improvement projects to June 2018. Extend the date for interim water quality limits at Point 10 till June 2019. Add additional dates to Table 6.	30/11/2017
6.1	Incorporated comments from EPA review. Some further changes to dates in Table 6 following feedback from EPA.	19/01/2018
6.2	EPA granted extension of due date for 2018 CSIRO report to 26th April (originally 31 March) – See Table 6.	29/03/2018
6.3	Extension of date to complete water improvement projects to February 2019 (was June 2018) due to delays in the commissioning of the Water Filtration Plant upgrade. Additional detail added to Table 2 (i.e. project status).	21/06/2018
7.0	Updated monitoring program sites and sample replication. Other minor text updates:	24/09/2018

	Remove 6 monthly reporting to EPA (already done in conjunction with the 6 monthly stakeholder meetings) Table 5 TARP to come into effect once all water quality improvements /final flow regime is in place and rehabilitation of longwall subsidence impacts are complete.	

1.0	Variation to EPL2504 issued March 2020:
	• Drought condition added
	• Removal of Environment Improvement Program (EIP2) (EIP2 revoked)
	• Inclusion of special conditions:
	  ○ Program of works for water treatment
	  ○ Toxicity monitoring
	  ○ Requirement to submit an aquatic health monitoring program.
	New Program to comply with the revised EPL conditions and renamed 'Georges River Aquatic Health Monitoring Program' (Formerly known as the Georges River EIP (EIP2)).
		June 2020

1.1	Clarification of quarterly Ecotox monitoring frequency requirement. Include reference to Notice of Variation dated March 2021, including LDP 40.	May 2021
2.0	General update.	January 2024

Persons involved in the review of this Plan

NAME	TITLE	COMPANY	EXP (YRS)	DATE
David Gregory	Specialist Environment	S32 IMC	12	June 2020
Polly Barlow	Specialist Environment	S32 IMC	4	September 2023
Josh Carlon	Coordinator Environment	S32 IMC	12	June 2020
Chris Schultz	Superintendent Environment	S32 IMC	24	January 2024
Monique Binet	Ecotoxicologist	CSIRO		April 2021
Sarah Stephenson	Molecular Ecologist - Coastal Vegetation and Sediment - CSIRO Oceans and Atmosphere	CSIRO	10	June 2020
Dr Anthony Chariton	Senior Lecturer - Environmental Genomics, Ecology and Ecotoxicology Lab (EGEEL)	Macquarie University	15	June 2020

1. INTRODUCTION

The community has identified the Georges River as being of high environmental, cultural and recreational value, and has expressed concerns about the impacts on the Georges River due to discharges from Brennans Creek Dam (BCD) (GREA 2012, Georges River Stakeholder Group).

Several field and laboratory studies have been carried out to investigate the ecological health of Brennans Creek and the Upper Georges River. These have included various Pollution Reduction Programs (PRP 6, PRP 9, PRP 10, PRP 11, PRP 20 and Environmental Improvement Program (EIP) 2), as well as studies undertaken by the Georges River Combined Councils Committee (GRCCC), the Australian Coal Association Research Program (ACARP 2010) and research by Dr Ian Wright and students from the University of Western Sydney. These studies indicated the impaired health of the Georges River downstream of the Brennans Creek confluence relative to reference sites.

1.1 Background Information

In 2013, the Environment Protection Authority (EPA) issued a notice of variation of Environment Protection Licence (EPL) 2504 and imposed two Pollution Reduction Programs (PRP 19 and PRP 20) to meet very stringent water quality limits for discharges into the Georges River. The limits were recommended by the (then) community groups and former Office of Environment and Heritage (OEH)[1]. PRP 19 included a requirement to carry out a program of works to reduce the concentrations of contaminants being released to the Georges River via Licence Discharge Point (LDP) 10. PRP 20 was aimed at assessing the aquatic health of Brennans Creek and the Upper Georges River as projects required under PRP 19 were commissioned.

In 2013, South32 Illawarra Metallurgical Coal (IMC) committed to several water projects and monitoring to satisfy PRPs 19 and 20. In 2016, both PRPs were replaced by an Environmental Improvement Program (EIP2).The commitments under EIP2 remained the same as the PRPs.

The Georges River Stakeholder Group (GRSG) was established in 2015 to corroborate research (and monitoring results) undertaken by IMC and to develop (and have endorsement for) more appropriate licence limits. The GRSG included members from the EPA, BCS, University of Western Sydney (UWS) academics, local environment groups, Georges Riverkeeper[2] and local government representatives.

The GRSG had been meeting for six years and the members were nominally provided with six-monthly progress updates.[3] The GRSG accepted IMC's and CSIRO's research

[1] Now Biodiversity and Conservation Science Directorate (BCS)
[2] Previously Georges River Combined Councils Committee (GRCCC)
[3] The GRSG was wound up in April 2023 in consultation with the EPA. This was due to the resignation of a number of key members of the group and the completion of the commissioning of the Appin North Water Treatment Plant.

findings, recommended water quality limits and has undertaken their own monitoring which supports IMC's findings and recommendations.

In April 2019, the EPA issued IMC with a Notification of Intention (NoI) to make licence changes to provide greater certainty in the achievement of water quality outcomes, address the ongoing delays in environmental improvements and to provide for greater public involvement in the regulatory decision-making process. IMC reviewed measures that could be undertaken to meet the proposed water quality concentration limits in the NoI and made a commitment to the EPA to progress the proposed improvements.

To formalise this commitment, the EPA issued a Notice of Variation to EPL 2504 in March 2020. The EPA revoked EIP2 and attached Special Condition E1.1 to the EPL requiring the installation and operation of a Water Treatment Plant (WTP) at Appin North by 31 March 2021 and amplification of the Appin West WTP by 31 July 2021 to meet revised water quality concentration limits (detailed in Condition E1.1).

A temporary WTP was constructed at Appin North that was commissioned in May 2021. The temporary WTP operated until December 2022 and produced over 290 ML of permeate that was discharged to Brennans Creek.

EPL 2504 variations were sought and approved for the operation of the Appin North WTP. There were significant delays to construction and commissioning due to COVID restrictions, labour shortages, equipment availability, supply chain issues and significant wet weather in FY21/FY22/FY23.

Feed water to the temporary WTP was redirected to the Appin North WTP during January 2023 during the production proving stage. The Appin North WTP began operating and discharging permeate to Brennans Creek in February 2023.

The EPA specified concentration values that the WTPs must be designed to meet and the requirement to develop an aquatic health monitoring program (this document) to verify improvements to the aquatic health of the Georges River.

The Notice of Variation issued in March 2021 included Point 40, used to monitor compliance with the water quality concentration limits associated with the discharge from the Appin North WTP. Monitoring at Point 10 (discharge from BCD) is supplemented with monitoring from Point 40 (discharge from Appin North WTP).

1.2 EPL Requirements

The Georges River Aquatic Health Monitoring Program (GRAHMP) (this document) was a requirement of EPL 2504[4], Special Condition E3 which stated:

E3.1 The licensee must prepare an aquatic health monitoring program to verify improvements to the aquatic health of the Georges River following commissioning of the reverse osmosis water treatment plant required by condition E1.1. The monitoring must include:

- *quantitative sampling of macroinvertebrates;*

[4] Special Condition E3.1 was removed from EPL 2504 in the November 2021 variation.

- *ecological assessment processed using DNA extracted from sediment (as appropriate);*
- *in-stream water quality; and*
- *laboratory water testing.*

A copy of the monitoring program must be submitted to the EPA by 30 June 2020.

Version 1.0 of the monitoring program was finalised by 30 June 2020.

A copy of the current GRAHMP is available on the IMC website at https://www.south32.net/what-we-do/our-locations/australia/illawarra-metallurgical-coal.

Special Condition E2 of EPL 2504 requires monitoring of the toxicity of water discharged through Point 10/Point 40 and Point 24[5] on a quarterly basis. The results of ecotoxicity monitoring required under this condition will be incorporated into reporting required under the GRAHMP.

2. SCOPE

The GRAHMP is predominantly a continuation of the former EIP2 program with some additions as laid out in the subsequent sections.

The monitoring program incorporates:

- quantitative sampling of macroinvertebrates;
- ecological assessment processes using DNA extracted from sediment;
- ecotoxicity testing;
- in-stream water quality;
- laboratory water quality testing; and
- pool level and flow monitoring.

3. AIMS

The mandate for the Appin North WTP is to improve discharge water quality into Brennans Creek, and reduce its toxicity. The aim of this GRAHMP is to verify these changes by:

a) comparing water quality in the Georges River before and after commencement of the Appin North WTP;

b) assessing the ecotoxicity of discharge waters from the Appin North WTP;

c) comparing the in-stream and sediment biota of pools downstream of the discharge with reference sites (located upstream of the Brennans Creek confluence);

[5] Point 24 is associated with the Appin West WTP and discharges to the Nepean River. Reporting of ecotoxicity results for Point 24 will be separate to reporting under the GRAHMP.

d) calculating changes over time in the composition of in-stream and sediment biota, particularly downstream of the discharge; and

e) assessing the downstream gradient changes in composition of the in-stream and sediment biota.

3.1 Hypothesis

There will be an improvement to water quality and ecotoxicity in pools downstream of the discharge into Brennans Creek, following the commencement of operation of the Appin North WTP.

There will be a gradual increase in the abundance of contaminant-sensitive taxa within pools downstream of the discharge into Brennans Creek.

4. MONITORING PROGRAM DESIGN

4.1 Study Area and Sites

The study area is located within the Upper Georges River Catchment (Figure 1), commencing at GRQ1 and runs for 9 kilometres to Site GRQ18. Site GRQ18 is located approximately 8 kilometres downstream of Points 10 and 40. For full site descriptions see Table 1.

The sampling design consists of two treatments:

- Discharge Monitoring (6 sites), which captures the gradient from the discharge water – Point 10/Point 40[6], Point 12, Jutts Crossing, Pool 16, Pool 32 and GRQ18; and
- Reference (3 sites) – GRQ1, GR_UFS and Point 11.

[6] Both discharges from Point 10 and Point 40 enter Brennans Creek via the receiving pool historically referred to as discharge monitoring site Point 10. Aquatic health metrics identified in special condition E3.1 are sampled from the receiving pool identified as Point 10. Ecotoxicity monitoring is sampled from the two discharge streams - Point 10 and Point 40.

Table 1: Site descriptions and locations

Treatment	Watercourse	Site Name	Easting	Northing	Estimated Pool Depth and Width	Distance D/S from Points 10 / 40	Gradient	Substrate
Discharge Monitoring	Brennans Creek	Point 10 / Point 40	296844	6213232	Up to 0.5 m dept; up to 5 m width	0 km	18 m/km	Predominantly bedrock, boulder and deposits of sand in areas of low flow
	Georges River	Point 12	297157	6213016	Up to 2.5 m depth; up to 5 m width	0.5 km	18 m/km	Predominantly bedrock, boulder and deposits of sand in areas of low flow
	Georges River	Jutts Crossing (Pool 10)	296844	6213232	Up to 2 m depth; up to 20 m width	1 km	18 m/km	Predominantly bedrock with deposits of sand
	Georges River	Pool 16 (D/S of Marhnyes Hole	296890	6213908	Up to 0.5 m depth; up to 5 m width	2 km	18 m/km	Predominantly bedrock with deposits of sand
	Georges River	Pool 32 (D/S of Sawpit Gully)	297192	6215029	Up to 2 m; up to 5 m width	4 km	18 m/km	Predominantly bedrock with deposits of sand
	Georges River	GRQ18	296748	6217637	Up to 1 m depth; up to 2 m width	8 km	18 m/km	Predominantly bedrock, boulder and deposits of sand in areas of low flow. Large amount of macrophytes around edges
Reference	Georges River	GRQ1	297225	6211446	2 m depth; up to 2-3 m width	N/A	18 m/km	Predominantly bedrock with deposits of sand. Lots of

								detritus and submerged logs
	Georges River	GR_UFS	297082	6211771	0.5 m depth; up to 2-3 m width	N/A	18 m/km	Predominantly bedrock with deposits of sand
	Georges River	Point 11	297207	6212940	up to 5 m width	N/A	18 m/km	Predominantly bedrock, boulder and deposits of sand in areas of low flow, lots of detritus

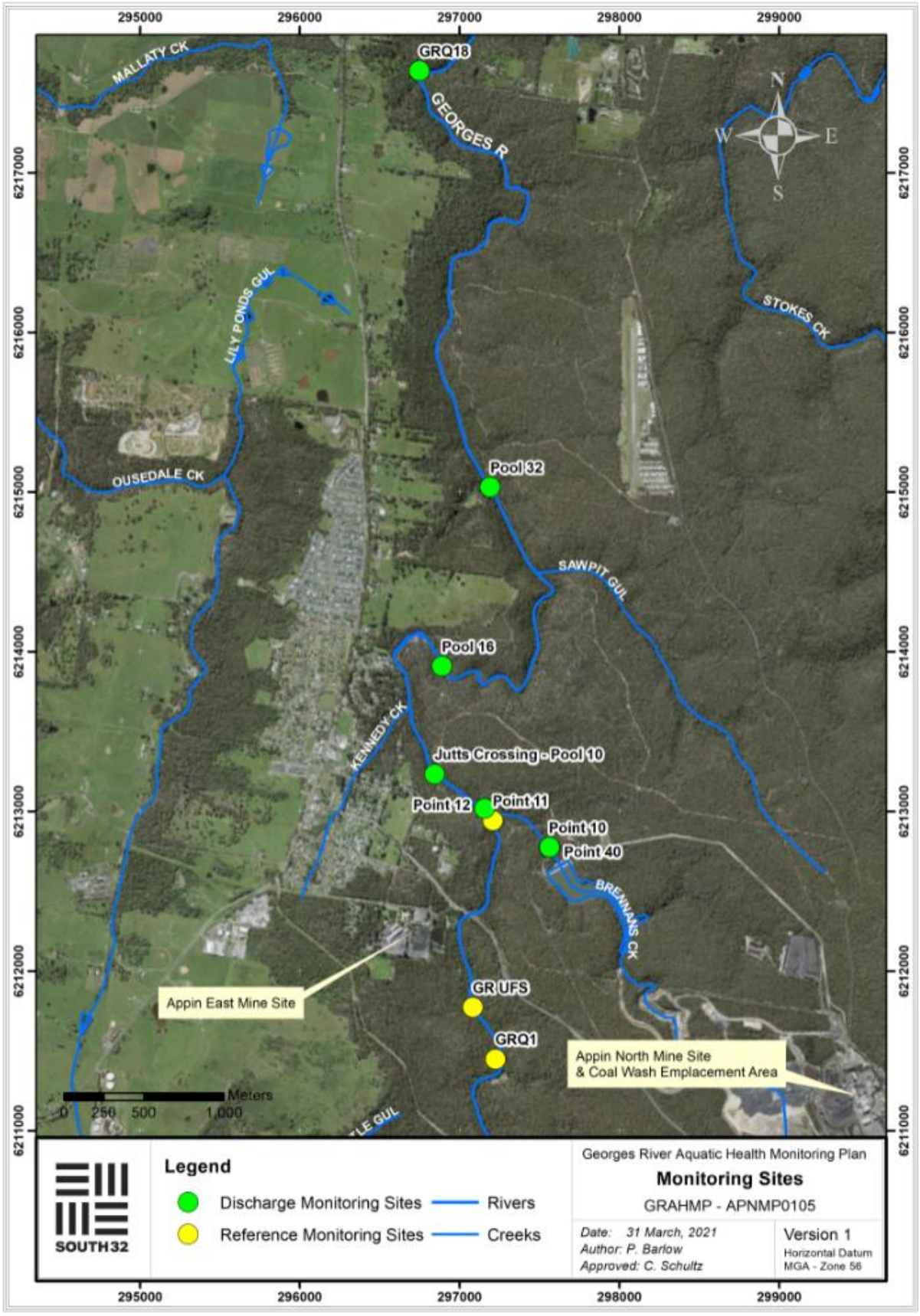

Figure 1: Monitoring locations

4.2 Design Limitations

There are other anthropogenic influences that could potentially confound the effects of mine water discharge from BCD including runoff from local farms and Appin township, and effects of mining subsidence (The Ecology Lab Pty Ltd, 2004, 2006). The very upper reaches of the Georges River (upstream of the Brennans Creek confluence) contains only a small number of permanent pools, limiting the number of suitable reference sites. The area is a popular spot for (illegal) recreational activities like four-wheel driving which has caused significant bank and trail erosion and sediment runoff to the river (D. Gregory pers. obs).

This GRAHMP has been designed to reduce the influence of confounding effects by taking samples at several places at distances from the mine discharge points (Point 10 and Pont 40), sampling at a distance from localised influences (Appin village runoff and EPA-licenced waste disposal sites) and assessing the amount of variation between the sites in the Georges River, in accordance with recommendations from Quinn and Keough (2002), and Chariton et al. (2016).

Point 11 is also be sampled in line with the other sites. This site may be confounded by licenced mine discharge from Appin East (Point 19) (as it is located between the Appin East discharge point and the confluence of Brennans Creek with the Georges River). However, the results from previous campaigns indicated that Point 11 is more similar in composition to the other reference sites and for this reason is included as a reference site.

The long term data is complexed due to changes in design that have occurred since the program inception (2013) including changes to sites/locations and number of replicates.

It should not be assumed that the system downstream of the discharge will show a similar response to the reference sites; for instance, there has been a differential response between the reference sites and discharge sites due to the drought experienced in 2018/2019. The drought has had a more pronounced effect in the reference sites compared to discharge sites, likely due to supplementary flows from BCD masking the impact of the drought downstream of BCD.

Structural differences such as habitat availability also play an important role in the biotic composition of pools The discharge sites are far more homogenous and simplified whereas the reference sites are more complex in terms of habitat. Therefore water quality is not the only relevant factor that needs to be considered.

4.3 Methods

4.3.1 Quantitative sampling of macroinvertebrates

Five samples will be collected biannually from each pool to represent the different substrates. A suction sampler described by Brooks (1994) will be placed over the substrate and operated for one minute at each sampling location. The sample will be washed thoroughly over a 500-µm mesh sieve. All material retained on the 500-µm mesh sieve will be preserved in 70% ethanol for laboratory sorting and identification to at least Family level.

4.3.2 Ecological assessment processes using DNA extracted from sediment

At each site, five sediment samples will be collected for eDNA metabarcoding following the protocol of Chariton et al. (2015). DNA samples will be amplified, targeting at least two taxonomically informative genes: 18S rDNA for eukaryotes and 16S rDNA for bacteria. Additional loci will be included in the metabarcoding work targeting the V4 region of 18S rDNA for diatoms (Zimmerman et al., 2011).

All products will be amplified three times to capture the stochasticity associated with polymerase chain reaction. Sequencing will be performed on an Illumina genome sequencer (platform may vary), with >50,000 reads allocated per sample. Appropriate replicated positive and negative controls will be used in each run. Bioinformatics will be performed using in-house custom software.

4.3.3 Ecotoxicity testing

Ecotoxicity tests will be undertaken as specified in the table below at Point 24[7] and Points 10 and 40. Monitoring commenced in the quarter before the commencement of operation of the respective WTPs, as prescribed in Condition E2 of EPL 2504.

Table 2: Ecotoxicity testing requirements and assessment criteria (from EPL 2504)

Species	Sampling Frequency	Sampling Method	Assessment Criteria
Ceriodaphnia dubia	Quarterly (minimum of 80-day intervals)	Chronic toxicity US EPA Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, 4th Edition (2002), EPA-821-R-02-013.	EC10[8] reproduction > 100% sample
Melenotaenia duboulayi or Melenotaenia splendida	Quarterly (minimum of 80-day intervals)	96-hour larval imbalance test with or without water renewal (if with renewal – daily or once at 48 hours). US EPA (2002). Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms. 5 ed. EPA-821-R-02-012. Washington DC, USA.	EC10 reproduction > 100% sample

[7] Point 24 is associated with the AWWTP and discharges to the Nepean River. The assessment criteria also apply to this monitoring location.
[8] Warne and van Dam (2008) - NOEC and LOEC data should no longer be generated or used.

4.3.4 *In-stream water quality*

Measures of water quality indicators will be taken at a surface depth at each site. Field parameters will include water temperature, electrical conductivity, pH, dissolved oxygen and turbidity.

4.3.5 *Laboratory water quality testing*

The following chemical parameters have been selected to align with the EPL requirements. This analysis will be undertaken in conjunction with biannual biota sampling and field water quality measurements. Grab samples will also be collected at the same time as the quarterly ecotox samples are collected and analysed in the lab.

Table 3: Analytes to be measured

Pollutant/Analyte	Unit of Measure
pH	pH units
Electrical Conductivity	µS/cm
Bicarbonate Alkalinity (as $CaCO_3$)	mg/L
Dissolved Aluminium	µg/L
Dissolved Cobalt	µg/L
Dissolved Copper	µg/L
Dissolved Nickel	µg/L
Dissolved Zinc	µg/L
Total Nitrogen	µg/L

4.3.6 *Pool level monitoring*

Pool water levels will be monitored using installed pressure sensors and loggers at each of the pool monitoring sites (refer to Figure 1). Water level data will be calibrated to an installed benchmark, typically a single bolt inserted to the rockbar or bedrock step. Loggers will be housed in PVC pipes bolted to the pool's rockbar or step. Logging will be set to 1-hour intervals to adequately capture fluctuating water levels across the duration of the monitoring program. Data will be collected on a biannual basis.

4.3.7 *Spot flow monitoring*

Surface flows will be monitored using spot flow gaugings at GR_UFS (Figure 1). A Pygmy flow meter will be used to calculate the discharge during inspections at the site, on a biannual basis. This discharge is obtained by measuring the velocity of the water at different points across a known cross-sectional area at the site.

4.3.8 Sampling time and frequency

Sampling will be undertaken in accordance with the schedule in Table 4.

Table 4: GRAHMP Monitoring schedule

Monitoring Type	Frequency	Timing[9]	Applicable Site
Ecotoxicity	Quarterly for a period of two years (commencing prior to the operation of the WTPs).	*Feb 21, May 21, Aug 21, Nov 21, Feb 22, May 22, Aug 22, Nov 22, Feb 23, May 23, Aug 23, Nov 23.*	Point 10/Point 40 Point 24[10]
Water quality, macroinvertebrates	Biannually	Spring 2020, Autumn and Spring *2021, 2022 and 2023.*	All sites
DNA metabarcoding ecological Assessment	Annual	Spring *2020, 2021, 2022 and 2023.*	All sites
Pool level	Hourly (where installed)	Commence monitoring by *Feb/March 2021, cease Spring 2023.*	All sites
Flow monitoring	Continuous for the WTP. Biannually for Upper Flow Station (GR_UFS).	Monitoring for WTP to commence upon plant startup. Spot flows at GR_UFS to coincide with water quality and macroinvertebrate monitoring.	WTP and GR_UFS

4.4 Results Analysis

Surveys will be examined by:

- summarising the water quality measurements obtained;
- ecotoxicity monitoring results;
- SIGNAL scores;

[9] Dates in italics are in the past and samples were collected on those dates.
[10] Point 24 is associated with the AWWTP and discharges to the Nepean River. The monitoring frequency also applies to this monitoring location.

- Pool level and flow monitoring;
- exploring compositional patterns in macrobenthic invertebrate communities sampled; and
- exploring compositional patterns in the metabarcoding data for prokaryotes (bacteria and archaea) and eukaryotes communities.

4.4.1 Statistical Analysis

Multivariate analyses will be used to compare water quality and taxa composition between mine discharge and reference sites. The analysis will involve a detailed assessment of assemblage differences, both spatial and temporal. The data will be visualized using nMDS (or similar). Comparisons between the treatments will be performed using PERMANOVA. The relationship between environmental gradients and stream biota will be explored where possible using constrained ordination techniques such as Distance-based Linear Modelling. Where possible, the data will be used to explore both long and short-term trends.

5. REPORTING AND CONSULTATION

IMC will discuss results with the GRSG on a regular basis and formally present progress reports in accordance with the following table.

Table 5: Summary of reporting and consultation commitments for the GRAHMP

Report Type or Consultation	Frequency[11]	Report Due Date[12]
GRSG progress meeting (Stakeholder progress meeting with EPA, BCS, Georges Riverkeeper, Wollondilly and Campbelltown Councils, WSU, other interest groups).	*October 2020, April 2021, September 2021 and April 2022,* and annually thereafter (post commissioning of the ANWTP).	*2021 (once the WTP is commissioned), 2022 (after scientific report is received), 2023 (after scientific report is received)* and 2024 (after final scientific report is received). [13]
Detailed scientific report on macroinvertebrate and DNA monitoring to EPA and uploaded to South32 website.	Annually.	*31 March 2022, 2023* and 2024. [14]

[11] Dates in italics are in the past.
[12] Dates in italics are in the past.
[13] GRSG was wound up in April 2023 and no further meetings will occur.
[14] It is anticipated, following discussions with the EPA, that the March 2024 report will be the final report under the GRAHMP.

Report Type or Consultation	Frequency[11]	Report Due Date[12]
IMC Community Consultative Committee	Regular updates at meetings which are nominally held every two months.	N/A.
Ecotox report	Annually (results to be included within the annual scientific report for Points 10 and 40). Point 24 results to be reported separately.	*31 March 2022, 2023* and 2024.[15]

6. REFERENCES

ACARP C15016 (2010). Effects of Mine Water Salinity on Freshwater Biota Investigations of Coal Mine Water Discharge in NSW. Cardno Ecology Lab Pty Ltd.

Brooks, S. (1994). An efficient and quantitative aquatic benthos sampler for use in diverse habitats with variable flow regimes Hydrobiologia 281, 2, 123-128

Chariton, A., Baird, D.J, and Pettigrove, V. (2016). Ecological assessment In: Simpson, S.L. and Batley, G.E, editor/s. Handbook for Sediment Quality Assessment 2nd Edition. CSIRO, ISSN: 9781486303847, pp. 151-189.

Chariton, A.A., Court, L.N., Hartley, D.H., Colloff, M.J. and Hardy, M.H. (2010). Ecological assessment of estuarine sediments by pyrosequencing eukaryotic ribosomal DNA. Frontiers in Ecology and the Environment 8(5), 233-238.

Chariton, A.A., Stephenson, S., Morgan, M.J., Steven, A.D.L., Colloff, M.J., Court, L.N., and Hardy, C.M. (2015). Metabarcoding of benthic eukaryote communities predicts the ecological condition of estuaries. Environmental Pollution 203, 165-174.

Chariton A. and Stephenson S. (2014). Aquatic Monitoring Program for the Upper Georges River: Metabarcoding of the Benthic Eukaryotic Assemblages. CSIRO Oceans and Atmosphere Report prepared for Illawarra Metallurgical Coal, Lucas Heights, NSW. xx pp.

Chariton A. and Stephenson S. (2016). Aquatic Monitoring Program for the Upper Georges River/Brennan's Creek: Metabarcoding of the Benthic Eukaryotic Assemblages. CSIRO Oceans and Atmosphere Report prepared for Illawarra Metallurgical Coal, Lucas Heights, NSW. 33 pp.

Chariton A. and Stephenson S. (2018). Georges River Environmental Improvement Program (EIP2). CSIRO Oceans and Atmosphere Report prepared for Illawarra Metallurgical Coal, Lucas Heights, NSW. xx pp.

[15] A Pollution Study has been included in the latest draft licence variation (December 2023) requiring an investigation of cause and effect of residual toxicity in discharge from LDP 24 and 40.

Chariton A. and Stephenson S. (2020). Georges River Environmental Improvement Program (EIP2). CSIRO Oceans and Atmosphere Report prepared for Illawarra Metallurgical Coal, Lucas Heights, NSW. xx pp.

Georges River Environmental Alliance (2012). Re; Community expectations regarding Discharge from Westcliff Colliery, Appin: Endeavour Coal Application to vary EPL 2504.

Niche (2014). Pollution Reduction Program 20 – Aquatic Health Monitoring Report 2014. Fish and Macroinvertebrates. Report prepared for BHP Billiton, Illawarra Coal.

Niche (2016). Pollution Reduction Program 20 – Aquatic Health Monitoring Report 2015. Report prepared for South32.

Stephenson S., Binet M., Tran-Dinh N., Adams M. (2022). Georges River Aquatic Health Monitoring Program: Report 1 2022.

Stephenson S., Binet M., Tran-Dinh N. (2023). Georges River Aquatic Health Monitoring Program: Report 2 2023.

The Ecology Lab. (2004). Pollution Reduction Program 6. Ecological Effects of Mine Water Discharge from West Cliff Colliery into Brennans Creek. Report prepared for BHP Billiton Illawarra Coal.

The Ecology Lab. (2006). Pollution Reduction Program 9. Ecological Effects of Mine Water Discharge from West Cliff Colliery into Brennans Creek. Report prepared for BHP Billiton Illawarra Coal.

Warne, Michael St J and van Dam, Rick. NOEC and LOEC Data Should No Longer Be Generated or Used [online]. Australasian Journal of Ecotoxicology, Vol. 14, No. 1, Jan 2008: 1-5.
Availability:<https://search.informit.com.au/documentSummary;dn=665706831945866;res=IELHEA> ISSN: 1323-3475. [cited 19 Jun 20].

Wright, I.A. and Ryan, M.M. (2016). Impact of mining and industrial pollution on stream macroinvertebrates: importance of taxonomic resolution, water geochemistry and EPT indices for impact detection. Hydrobiologia 772:103-115.

Zimmermann, J., Jahn, R. and Gemeinholzer, B. (2011). Barcoding diatoms: evaluation of the V4 subregion on the 18S rRNA gene, including new primers and protocols. Organisms Diversity and Evolution.