

Water Quality Management Plan

Cross River Rail Project – Tunnel, Stations and Development Package (TSD)

REV	DATE	PREPARED BY NAME & SIGNATURE	REVIEWED BY NAME & SIGNATURE	APPROVED BY NAME & SIGNATURE	REMARKS

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Compliance Matrix

Table 1 Compliance matrix

CRRDA REFERENCE	REQUIREMENT	ADDRESSED IN SECTION
Coordinator-General's change report Appendix 1 – Part C. – Condition 15, 16, and 17		
Condition 15 Water Quality	A. Discharge of groundwater from Project Works must comply with: <ul style="list-style-type: none"> i. the Brisbane River Estuary environmental values and water quality objectives (Basin no. 143 - mid-estuary) in the Environmental Protection (Water and Biodiversity) Policy 2019. Note that surface water runoff and dewatering activities from sediment basins and surface exactions associated with surface construction works is managed in accordance with Imposed condition 18.	Section 5.2
	B. During construction monitor and report on water quality in accordance with the Water Quality Management Plan, a sub-plan of the Construction Environmental Management Plan	This Plan
Condition 16 Water Resources	A. Prior to the commencement of Project Works involving excavation, the Proponent must undertake predictive modelling of the potential for groundwater drawdown. The predictive modelling must be based on validated monitoring data and must address the likely extent of any drawdown over time, up to the time when such movement reaches equilibrium.	This Plan
	B. Project Works must be designed, planned and implemented to avoid where practicable and otherwise minimise the inflow of groundwater to the Project Works, including excavations, the underground stations and tunnels, having regard for the predictive modelling.	
	C. The Proponent must monitor the inflow of groundwater to the Project Works and compare monitoring data with the predictive modelling. If the rate of groundwater inflow rate exceeds 1L/sec in any worksite, the proponent must revise work methods and devise and implement mitigation measures as soon as practicable.	
Condition 17 Surface Water	A. Project Works, and worksites, must be designed and implemented to avoid inundation from stormwater due to a 2 year (6hr) ARI rainfall event and flood waters due to a 5 year ARI rainfall event.	This Plan
	B. Project works must be designed and implemented to avoid afflux or cause the redirection of uncontrolled surface water flows, including stormwater flows, outside of worksites.	
Condition 18 Erosion and Sediment control	A. An erosion and sediment control sub-plan that is consistent with the Guidelines for Best Practice Erosion and Sediment Control (International Erosion Control Association, 2008) and the Department of Transport and Main Roads' Technical Standard MRTS52 – Erosion and Sediment Control must be submitted as part of the Construction Environmental Management Plan.	This Plan

Details of Revision Amendments

Document Control

The CBGU Project Director is responsible for ensuring that this Plan is reviewed and approved. The Project Environment & Sustainability Manager is responsible for updating this Plan to reflect changes to the Project, legal and other requirements, as required.

Amendments

Any revisions or amendments must be approved by the CBGU Project Director before being distributed / implemented.

Distribution and Authorisation

The CBGU Project Director is responsible for the distribution of this Plan. The controlled master version of this document is available for distribution as appropriate and maintained on TeamBinder. All circulated hard copies of this document are deemed to be uncontrolled.

All personnel employed on the Project will perform their duties in accordance with the requirements of this Plan, supporting management plans, and related procedures.

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Referenced Documents

The following provides a list of referenced documents either as a sub-plan to this plan or referenced from.

Table 2 *Referenced Documents*

Document Number	Document Name	Location of Controlled Version
Referenced Project Plans include:		
CRRTSD-EN-MPL-CBGU-000019	Construction Environment Management Plan	TeamBinder
CRRTSD-EN-ENMP-CBGU-000027	Hazardous Goods Management Plan	TeamBinder
	Dewatering and Discharge Procedure	PMS
CRRTSD-CU-MPL-CBGU-000018	Communications and Stakeholder Engagement Management Plan	TeamBinder
CRRTSD-EN-ENMP-CBGU-000020	Water Quality Monitoring Plan	TeamBinder
CRRTSD-CS-MPL-CBGU-000036	Construction Worksite Management Plan	TeamBinder
	Spills Procedure	PMS

Note: this Management Plan may not contain the current version of the documents listed above. Refer to the 'location of controlled version' for the most current version.

Glossary of Terms

Table 3 Terms

Acronym	Definition
All Staff	Means all employees, Proponents and sub-contractors involved in the Project Works
BCC	Brisbane City Council
CBD	Central Business District
CBGU	D&C Contractor comprising a joint venture with CPB Contractors Pty Ltd, BAM International Australia Pty Ltd, Ghella Pty Ltd and UGL Engineering Pty Ltd
CEMP	The Project's Construction Environmental Management Plan
CG	Coordinator-General
CGCR	Coordinator-General's Change Report
CGER	Coordinator-General's Evaluation Report
CMS	CPB Management System
COEMP	The Project's Commissioning Environmental Management Plan
Contractor	The Contractors appointed to design, construct and commission the Project
Coordinator-General	The corporation sole preserved, continued and constituted under section 8 of the SDPWO Act
CRR	Cross River Rail
CRRDA	Cross River Rail Delivery Authority acting on behalf of the State
CRR TSD (the Project)	Cross River Rail - Tunnels, Stations and Development (TSD) Project
CSEP	Community and Stakeholder Engagement Plan
DES	Department of Environment and Science
Directly Affected Persons	An entity being either the owner or occupant of premises for which predictive modelling or monitoring indicates the Project impacts would be above the performance criteria in the Imposed Conditions
DTMR	Department of Transport and Main Roads (QLD)
EIS	Environmental Impact Statement
EMP	Environmental Management Plan (refers to the OEMP, CEMP, COEMP including any Project sub-plans)
EMS	Environmental Management System
Environmental Monitor	The Environmental Monitor engaged in accordance with Imposed Condition 7
FM	Facilities Manager
GHG	Greenhouse gas
GIS	Geographic Information System

Acronym	Definition
HGMP	Hazardous Good Management Plan
ISA	Independent Safety Assessor
O&M	Operations and maintenance
OEMP	Outline Environment Management Plan
PIC	Project Independent Certifier
PSTR	Project Scope and Technical Requirements
QR	Queensland Rail
RIS (or RIS Alliance)	Cross River Rail – Rail Integration and Systems Project Alliance
Risk matrix	A table used in the evaluation of risk severity that has likelihood and consequence as its axes with numbers and ratings applicable to each likelihood/consequence combination. For use in risk evaluation and Safety in Design reviews.
Risk register	A database containing Project risks, assessments, treatments and responsibilities
RfPC	EIS Request for Project Change
Subcontractor	Any company, body or person who is contracted to CBGU for the purpose of supplying plant and/or services
TeamBinder	Proprietary software used as part of the Project wide Electronic Document Management System
the Project (or CRR TSD)	Cross River Rail - Tunnels, Stations and Development (TSD) Project
WBS	Work Breakdown Structure - the hierarchical breakdown of a project into manageable portions of work, used to drive program, cost, work documentation and organisational structure
WQMP	Water Quality Management Plan

1 Introduction

1.1 Background

The Design and Construction Joint Venture comprising of CPB Contractors Pty Ltd, BAM International Australia Pty Ltd, Ghella Pty Ltd and UGL Engineering Pty Ltd (CBGU D&C JV or CBGU) is responsible for delivering the Cross River Rail (CRR) Project (the Project) on behalf of the Cross River Rail Delivery Authority (the Delivery Authority).

This Water Quality Management Plan should be read in conjunction with the Project's overarching Construction Environment Management Plan (CEMP). The CEMP provides specific details regarding the background of the Project, the scope of the Project and the staging and timing of key milestones associated with the construction of the Project.

1.2 Context

This Construction Water Quality Management Plan (WQMP) forms part of the Construction Environmental Management Plan (CEMP) developed for the construction of the Project. The WQMP describes how CPGU will manage water quality and minimise impacts during construction of the Project.

1.3 Objectives

The objectives of this WQMP are to achieve the environmental outcomes stated in the CEMP through the implementation of site-specific mitigation measures. This WQMP will also:

- nominate the Project's monitoring and reporting requirements in relation to water quality
- manage the quality of waters released from construction worksites
- monitor the effects of water discharges from construction worksites on receiving waters
- monitor the effects of management and mitigation measures.

It is intended that a water quality monitoring programme be developed and implemented at each worksite so that Project-related impacts on receiving waters in the Brisbane River (mid-estuary) sub catchment can be avoided, or minimised and managed.

1.4 Legislative Framework

Delivery and implementation of the Project must comply with the environmental legislation, guidelines and standards specified in the CEMP (as updated to reflect any changes current at commencement of each Project phase) and any additional requirements specified in the conditions of approval.

Specific legislation relevant to this WQMP is detailed below.

1.4.1 Commonwealth Legislation

Commonwealth legislation that is likely to be relevant to the Project and this WQMP includes:

- *Environment Protection and Biodiversity Conservation Act 1999.*

1.4.2 State Legislation

State legislation that is likely to be relevant to the Project and this WQMP includes:

- *Cross River Rail Delivery Authority Act 2016*
- *Environmental Protection Act 1994*
- *Environmental Protection (Water and Biodiversity) Policy 2019*
- *Biosecurity Act 2014*
- *City of Brisbane Act 2010*
- *Coastal Protection and Management Act 1995*
- *Forestry Act 1959*
- *Land Act 1994*
- *Land Title Act 1994*
- *South East Queensland Water (Distribution and Retail Restructuring) Act 2009*
- *Local Government Act 2009*
- *Nature Conservation Act 1992*
- *Planning Act 2016*
- *Plumbing and Drainage Act 2002*
- *Vegetation Management Act 1999*
- *Fisheries Act 1994*
- *Waste Reduction and Recycling Act 2011*
- *Water Act 2000*
- *Water Supply (Safety and Reliability) Act 2008*
- *State Development and Public Works Organisation Act 1971*

1.4.3 Approvals, Permits and Licences

CBGU will obtain licences, permits and approvals as required by law and maintain them as required throughout the delivery phase of the project. No condition of the Infrastructure Approval removes the obligation for CBGU to obtain, renew or comply with such necessary licences, permits or approvals.

Approvals expected to be required for the Project, that relate to water quality impacts and management are identified in Table 4 below.

Table 4 Environmental approvals, permits and licences

Approval / Permit / Licence	Regulatory Authority	Responsibility / Timeframe	Items approved
Network Access Permit	Queensland Urban Utilities (QUU)	CBGU <u>Approval Timeframes:</u> 4 weeks	If discharge to sewer required
Water Discharge Approval	Queensland Urban Utilities (QUU)	CBGU <u>Approval Timeframes:</u> 4 weeks	If discharge to sewer required

1.4.4 Guidelines and Standards

The following guidelines and standards are relevant to the management of water quality for the Project:

- Brisbane River Estuary environmental values and water quality objectives (Basin no. 143 - mid- estuary) in the EPP (Water)
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000 (ANZECC, 2000)
- Queensland Water Quality Guidelines 2009 (DEHP, 2009)
- Monitoring and Sampling Manual: Environmental Protection (Water) Policy 2009 (DES, 2018)
- Heads of EPAs Australia and New Zealand (HEPA) (2018). PFAS National Environmental Management Plan (NEMP). January 2020
- National Environment Protection Council (NEPC) (2013). National Environment Protection (Assessment of Site Contamination) Amendment Measure (NEPM).

2 Required Outcomes

The following Imposed Conditions and environmental outcomes must be achieved throughout construction of the Project. The environmental outcomes may be achieved by meeting the performance criteria in this WQMP.

2.1 Coordinator-General Conditions

The Imposed Conditions relating to water quality and water resources for the Project can be found on the Coordinator-General's website (<http://www.dsdmip.qld.gov.au/coordinator-general/assessments-and-approvals/coordinated-projects/completed-projects/cross-river-rail-project.html>).

2.2 Environmental Outcomes

The following environmental outcomes in relation to water quality are to be achieved for the Project.

2.2.1 Groundwater

- Groundwater inflow to construction worksites, including tunnels, cross-passages, underground stations is minimised.
- Groundwater quality is maintained generally at pre-disturbance levels during and after construction.

2.2.2 Surface water

- Discharge of groundwater inflow from construction worksites does not adversely affect the environmental values of receiving water.
- Environmental values of surface water immediately downstream of construction worksites are not adversely affected by the Project, during and post-construction.
- Construction activities are managed to avoid the transportation of contaminants that might be released to waters.

2.2.3 Flood Management – Construction

- Construction activities do not significantly alter existing flood patterns and do not increase existing flood levels on private property.
- Construction worksites are designed to provide for safe evacuation of worksites and to avoid disruption of evacuation routes for adjacent properties in the event of flooding.

2.3 Performance Criteria

2.3.1 Groundwater

- Contamination of groundwater by construction materials is avoided.
- Discharge of groundwater from Project Works must comply with the Brisbane River Estuary environmental values and water quality objectives (Basin no. 143 - mid-estuary) in the Environmental Protection (Water) Policy 2009.

2.3.2 Surface water

- Surface water runoff and dewatering activities from sediment basins and surface exactions associated with surface construction works is managed in accordance with the Guidelines for Best Practice Erosion and Sediment Control (International Erosion Control Association, 2008) and the Department of Transport and Main Roads' Technical Standard MRTS52 – Erosion and Sediment Control.
- Stormwater drainage is intercepted and diverted around exposed works within worksites.
- Contaminants, chemicals, toxicants and litter from Project worksites are prevented from entering receiving surface waters, including stormwater drains, roadside gutters and waterways.
- Acid Sulfate Soils (ASS) is avoided, or if intercepted, is managed to ensure no adverse impact on surface waters.

2.3.3 Flood Management – Construction

- Construction flood protection measures are designed and implemented so as not to impact on third parties for a 1 in 5-year AEP flood event or greater. For underground tunnels and stations - Project Works, and worksites, must be designed and implemented to avoid inundation from stormwater due to a 2 year (6hr) ARI rainfall event and flood waters due to a 5 year ARI rainfall event.
- Construction activities, including any temporary works and spoil placement, do not cause flood water to be re-directed over other private property.
- Construction worksites and spoil placement sites and protected from inundation by flood waters, including overland flows, from a 1 in 20 AEP flood event.
- Bulk storage facilities for hazardous substances used in construction are protected from inundation by flood waters from a 1 in 50 AEP flood event in accordance with the Hazardous Good Management Plan (HGMP).

3 Impacts and Mitigation Measures

The Project has the potential to impact the surrounding surface and groundwater and to harm receiving water environments if not managed appropriately. Surface waters have the potential to enter tributaries and creek systems which flow into the Brisbane River and subsequently enter Moreton Bay, which contains marine protected zones and the internationally-recognised Ramsar Wetlands. Risks to the Brisbane River from the Project are anticipated to be primarily from surface and sediment runoff.

A range of environmental mitigation measures and requirements to address potential impacts to waterways and water quality are outlined below, in Section 3.2.

3.1 Impacts

3.1.1 Groundwater

3.1.1.1 Groundwater Flow

- Locally in drained tunnel areas, steep vertical downward hydraulic gradients are predicted to develop between the alluvial aquifer and the fractured rock aquifer in proximity to the tunnel sections of the Project. Leakage of groundwater from the alluvial aquifer to the fractured rock aquifer and ultimately to the tunnel itself may result.
- Tunnelling beneath the Brisbane River may cause groundwater to seep into the excavation.
- Drawdown associated with nearby drained sections (underground stations) of the tunnel may have an influence of the hydraulic gradient and flow regime of groundwater resulting in potential inflow of saline water into sections of the tunnel. However, based on the modelling, changes in baseflow and/or increases in leakage from the Brisbane River are expected to be minimal and below detection levels.

3.1.1.2 Groundwater Drawdown

General impacts that may occur as a result of groundwater drawdown include:

- Groundwater drawdown in the underlying rock to drained portions of a tunnel may impact upon groundwater in the shallow alluvial systems (if they are hydraulically connected).
- Settlement resulting from tunnel excavation/construction activities may arise due to:
 - elastic ground settlements caused by the excavation of the tunnel
 - consolidation settlements caused by dewatering of porous rock formations or compressible soil layers that are hydraulically connected to groundwater drawn down into the tunnel excavations.

Specific impacts that may occur as a result of groundwater drawdown are detailed below. Information regarding groundwater drawdown can also be found in the Hydrogeological Interpretive Report (HIR).

3.1.1.2.1 Northern Portal

- Limited drawdown is expected at the Northern Portal. The construction is predominately above the measured water table.

3.1.1.2.2 Roma Street Station

- Construction at Roma Street Station will induce local drawdown of about 30 m. The drawdown will be centred on the station, typically propagating radially over time up to 200 to 250 m from the station invert. For example, at the end of construction the drawdown is typically constrained to within about 50 m of the station, with the drawdown footprint increasing to about 100m after 20 years and subsequently to 200 to 250 m after 100 years. North of the station, drawdown greater than 5 m propagates only about 50 m in low-transmissivity NFG bedrocks associated with Spring Hill Ridgeline. To the south, drawdown greater than 5 m extends about 200 m from the station, as enabled by alluvium and residual soil profiles.
- No Regional Ecosystems, GDEs, remnant vegetation or regulated vegetation has been recorded in the vicinity of Roma Street Station (EIS 2019). At the Roma Street Parklands, the drawdown will range up to 4 m. In the parklands, the wetlands are artificial, constructed above the water table, and water supplies are sustained by supplementation.
- The Emma Miller Place park at the junction between Albert Street and Roma Street will incur up to 2 m drawdown.
- Registered groundwater bores in the vicinity of Roma Street Station (tabulated below) have monitoring objectives. The drawdown that propagates onto the register bores will not adversely impact this objective.

Table 5 Registered Groundwater Bores adjacent Roma Street.

Registration Number	Role ¹	Drawdown Range (m)
152560	monitoring	8.3 - 20.0
152708	monitoring	1.7 – 6.0
152709	monitoring	1.1 – 4.7
169980	monitoring	12.7 - 17.9

Notes: ¹ Facility status or role as provided in DERM (2010) database.

- Groundwater drawdown has the potential to cause migration of potential contamination plumes.

3.1.1.2.3 Albert Street Station

- There is already significant drawdown of the water table at Albert Street. Ingress of groundwater into basement within the CBD during the past 40 years has progressively lowered the water table by up to about 10 m. Albert Street Station will impose a further cumulative drawdown impact.
- Construction at Albert Street Station will induce local drawdown to about -36 m AHD, with additional local drawdown of about 25 m. In the east, the drawdown extends to the Brisbane River. Outside of the incised alluvium the drawdown typically extends up to about 200 m. At the end of construction, the drawdown is typically constrained to within about 50 m of the station, with the drawdown footprint increasing to about 200 to 300 m after 20 years and subsequently to 200 to 400 m after 100 years. Drawdown amplitudes greater than 5 m propagate from about 50 to 100 m from the station invert.
- No regional ecosystems, GDEs, remnant vegetation or regulated vegetation has been recorded in the vicinity of Albert Street Station (EIS 2019). The greatest potential for groundwater dependency near Albert Street Station, albeit at subordinate levels, may be selected settings of the Brisbane City Botanic

Gardens characterised by a shallow water table in alluvial beds. Up to approximately 2.0 m drawdown occurs beneath the northern part of Brisbane City Botanic Gardens. In this setting, wetlands are constructed and brackish to saline groundwater may further limit groundwater dependency.

- Registered groundwater bores in the vicinity of Albert Street Station (tabulated below) have monitoring objectives. The drawdown that propagates onto the register bores will not adversely impact this objective.

Table 6 Registered Groundwater Bores adjacent Albert Street.

Registration Number ¹	Role ²	Drawdown (m)
142666 (CRR202)	monitoring	4.3 - 20.0
142667 (CRR203)	monitoring	<1.0 – 5.2
142669 (CRR205)	monitoring	<1.0 – 1.3
152681	monitoring	3.1 - 3.7
152682	monitoring	3.1 - 5.6
152712	monitoring	4.9 - 9.1

Notes:

¹ CRR bore name listed in parenthesis if it is a CRR bore.

² Facility status or role as provided in DERM (2010) database.

- Groundwater drawdown has the potential to oxidise Potential Acid Sulfate Soils and cause migration of potential contamination plumes.

3.1.1.2.4 Woolloongabba Station

- Construction at Woolloongabba Station will induce local drawdown of about 20 to 25 m. The drawdown will be centred on the station, typically propagating radially over time up to about 300 to 400 m north, west, and east of the station invert. In the south, the extent of drawdown is similar, but flow lines are perpendicular to the station and mined tunnels, which extend further south. At the end of construction, the drawdown is typically constrained to within about 80 m of the station, with the drawdown footprint progressively increasing to about 200 to 300 m after 20 years and subsequently to 300 to 400 m after 100 years. Drawdowns with amplitudes greater than 5 m occur within 150 to 250 m of the station invert.
- The EIS (2019) does not describe GDEs in the vicinity of Woolloongabba Station. The simulated 100-year flow lines do not propagate onto vegetation along the Brisbane River.
- The single registered groundwater bore in the vicinity of Woolloongabba Station (tabulated below) has a monitoring objective. The drawdown that propagates onto the register bore will not adversely impact this objective.

Table 7 Registered Groundwater Bore adjacent Woolloongabba.

Registration Number	Role	Drawdown Range (m)
152711	monitoring	7.9 – 11.2

Note: ¹ Facility status or role as provided in DERM (2010) database.

- Drawdown has the potential to cause settlement at the Woolloongabba Station which has been identified as a higher risk location. Settlement may impact on surrounding buildings.
- Drawdown has the potential to cause groundwater acidification within the vicinity of the Brisbane River (if ASS materials exist) and cause migration of potential contamination plumes.

3.1.1.2.5 Woolloongabba Station to Boggo Road Station

- Before tunnelling, the groundwater levels along the mined running tunnels alignment range from approximately 10 m AHD at Woolloongabba to 20 m AHD at Boggo Road. After tunnelling, the groundwater heads are drawn down to the invert level of the tunnels, in the range from -12 m AHD to 8 m AHD. The mined tunnels extend further beneath the water table on transect from south to north. Construction of the mined tunnels will induce local drawdown of 15 to 25 m in the south and north, respectively. The predicted extent of drawdown is 300 to 400 m.
- The EIS (2019) does not describe GDEs in the vicinity of the mined tunnels.
- The two registered groundwater bores in the vicinity on the mined tunnel alignment (tabulated below) have water supply objectives. The excavation of the mined running tunnels is expected to locally draw down the groundwater heads.

Table 8 Registered Groundwater Bores between Woolloongabba to Boggo Road.

Registration Number	Role ¹	Drawdown (m)
138657	Water supply	5.7 – 9.8
145002	Water supply	5.9 – 10.1

Note: ¹ Facility status or role as provided in DERM (2010) database.

3.1.1.2.6 Boggo Road Station

- Drawdown has the potential to cause settlement at the Boggo Road Station which has been identified as a higher risk location. Settlement may impact on surrounding buildings.
- Construction at Boggo Road Station will induce local drawdown of about 15 to 20 m. The drawdown will be centred on the station, typically propagating radially over time up to about 250 m in the west and 100 m in the east after 100 years. At the end of construction, the drawdown is typically constrained to within about 50 m of the station. Subsequently, the drawdown footprint progressively propagates 50 to 100 m after 20 years, and 80 to 200 m after 50 years. Drawdowns with amplitudes greater than 5 m occur within about 150 m of the station inverts.
- The EIS (2019) does not describe GDEs in the vicinity of Boggo Road Station. The simulated 100-year flow lines do not propagate onto vegetation along the Brisbane River. Drawdown of 1.0 to 2.0 m propagates beneath Dutton Park but is not considered to pose a risk to vegetation.
- Registered groundwater bores in the vicinity of Boggo Road Station (tabulated below) have a monitoring objective. The drawdown that propagates onto the register bore will not adversely impact this objective.

Table 9 Registered Groundwater Bores adjacent Boggo Road.

Registration Number ¹	Role ²	Drawdown (m)
142673 (CRR210)	Monitoring	9 – 12.1
142679	Abandoned	1.8 – 5.6
152698	Monitoring	18.5 – 19.1
152699	Monitoring	17.9 – 18.9
152710	Monitoring	18.5 – 19.3

Notes:

¹ CRR bore name listed in parenthesis if it is a CRR bore.² Facility status or role as provided in DERM (2010) database.

3.1.1.2.7 Southern portal

- Construction at the Southern Portal will induce local drawdown up to about 15 m, with drawdown increasing from south to north. The drawdown will be centred on the invert of the cut and cover, typically propagating radially over time up to about 200 m in the west and 50 m in the east after 100 years. At the end of construction, the drawdown is typically constrained to within about 10 to 20 m of the excavation. Subsequently, the drawdown footprint progressively propagates 50 to 100 m after 20 years, and 80 to 200 m after 50 years. Drawdowns with amplitudes greater than 5 m only occur in proximity to Boggo Road Station, within about 100 m of the station inverts.
- The EIS (2019) does not describe GDEs in the vicinity of the Southern Portal. The simulated 100-year flow lines do not propagate onto vegetation along the Brisbane River. Drawdown of 1.0 to 2.0 m propagates beneath Dutton Park but is not considered to pose a risk to vegetation.
- The single registered groundwater bore in the vicinity of the Southern Portal (tabulated below) has a monitoring objective. The drawdown that propagates onto this registered bore will not adversely impact its monitoring objective.

Table 10 Registered Groundwater Bore adjacent Southern Portal.

Registration Number	Role ¹	Drawdown (m)
169985	Monitoring	3.8 – 5.4

Note: ¹ Facility status or role as provided in DERM (2010) database.

- Drawdown associated with this area has the potential to cause groundwater acidification within the vicinity of the Brisbane River, should ASS materials exist. Potentially contaminated land parcels may impact on groundwater quality, ultimately reducing the beneficial use of groundwater in this area.

3.1.2 Surface Water

There may be impacts to surface water quality as a result of activities associated with vegetation clearance, excavation and earthworks associated with utility diversions, construction of cut and cover tunnels, embankments, bridges and haul roads, and stockpiling and transferring of spoil from tunnel excavation.

3.1.2.1 General Impacts

A number of general impacts may occur that have the potential to affect aquatic ecosystem health, human health, visual and recreational amenity, cultural and spiritual values of waterways and suitability of use for irrigation and stock watering.

General impacts relating to surface water quality are detailed below.

3.1.2.1.1 Changes to surface water flow

- Increases in water flow velocities or frequencies as a result of increased stormwater runoff from hardened areas can lead to creek erosion and subsequent decline in water quality and aquatic habitats.

3.1.2.1.2 Sedimentation and surface water run-off

- Soil erosion and the transport of loose or excavated material into local stormwater systems and waterways, including:
 - Clearing of vegetation
 - demolition of buildings or structures
 - excavation and earthworks associated with surface track works, stations and shafts, cut and cover tunnels, realignment of roads, construction of embankments and bridges, piling operations and haulage roads.
 - excavation, stockpiling and haulage of spoil from shaft, station and tunnel construction.
- Worksites at Roma Street Station, Albert Street Station and Woolloongabba Station may result in indirect impacts on the Brisbane River via surface run-off, discharge of sediments and other toxicants from worksites, station and/or shaft excavation and spoil removal.
- Increases in water flow velocities or frequencies as a result of increased stormwater runoff from hardened areas can lead to creek erosion and subsequent decline in water quality and aquatic habitats.
- Increases in turbidity levels, which could result in reduced water clarity and light penetration, resulting in a reduction of aquatic plant growth and impacts on aquatic fauna.
- Changes to substrate types and blanketing of bottom substrates, possibly impacting on benthic organisms.
- Increases in the concentration of nutrients such as nitrogen and phosphorus, potentially resulting in increased algal growth.
- Reductions in the levels of dissolved oxygen, potentially impacting on aquatic fauna decreases to in-stream plant growth and/or increases in nuisance plant species changes to environmental values, particularly those relating to visual and recreational amenity (Erosion & Sediment Control Management Plan).

3.1.2.1.3 Acid Sulfate Soils

- Run-off from worksites containing ASS disturbed by construction activities enters waterways, resulting in reduced pH and potential mobilisation of toxicants resulting in potential impacts on aquatic flora and fauna (Acid Sulfate Soils Management Plan).

3.1.2.1.4 Contaminated Soil

- Entrance of contaminated sediments into waterways via the local stormwater system or surface run-off resulting in impact on aquatic ecosystems (Contaminated Land Management Plan)

3.1.2.1.5 Introduction of litter, toxicants and accidental spillages

- Introduction of contaminated water or materials to surface waters as a result of poor construction waste management protocols (Spills Procedure)
- Reduction of visual and recreational amenity.

3.1.2.1.6 Construction Water Use

- Uncontrolled release of untreated wastewater, potentially affecting the surrounding environment.

3.1.2.2 Site-Specific Impacts

Site-specific impacts relating to impacts to surface water are detailed below.

3.1.2.2.1 Northern Portal to Roma Street Station

- There is potential for indirect impacts associated with surface run-off and discharge of sediments and other toxicants (e.g., hydrocarbons, heavy metals and other chemicals) from worksites, station and/or shaft excavation and spoil removal.
- There is potential for indirect impacts associated with disturbance of contaminated land and groundwater contamination in the vicinity of Roma Street Station.
- There is potential for accidental discharge of dewatering/seepage water from underground components.

3.1.2.2.2 Roma Street Station to Albert Street Station

- Minor indirect impacts on Roma Street Parkland lake, City Botanic Garden ponds and Bundamba Creek may result from construction activities at Roma Street, Albert Street and placement of spoil at Swanbank respectively, from surface run-off, sediment discharge, excavation works and spoil removal.

3.1.2.2.3 Woolloongabba Station

- There is potential for indirect impacts associated with disturbance of contaminated land and groundwater contamination in the vicinity of Woolloongabba Station.

3.1.2.2.4 Southern Portal and Boggo Road Station

- There is potential for direct impacts associated with surface run-off, sediment discharge and release of pollutants (for example solid waste) from worksites, excavation works, spoil removal and bridge construction.
- There is potential for direct impacts associated with disturbance of potentially contaminated land.

3.1.3 Flood Management – Construction

- There are likely to be a negligible reduction of the Brisbane River floodplain storage
- There is likely to be a minor reduction in the flood storage volume of large Brisbane River flood events at Albert Street.

3.2 Mitigation Measures

The following mitigation measures may be implemented to achieve the nominated environmental outcomes and performance criteria. These mitigation measures have been derived from the Outline Water Quality Management Plan (OWQMP) and / or are consistent with achieving the required environmental outcomes and performance criteria having regard for the nature and scale for the impact associated with the works. General mitigation measures are listed below.

- A Water Quality Monitoring Plan for groundwater and surface water has been established in general accordance with the following guidelines:
 - Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2018
 - Queensland Water Quality Guidelines 2009
 - Monitoring and Sampling Manual 2009
 - EPP (Water and Biodiversity) 2019.
- Storage and handling procedures for fuels, chemicals and other hazardous materials as per the HGMP and Spill Procedure to avoid the release of contaminants to groundwater, surface water, and stormwater drains. including procedures to prevent or contain spills and uncontrolled releases and to ensure that accidental spills are cleaned-up and appropriately remediated to avoid contamination of groundwater seepage (OWQMP p9).

3.2.1 Groundwater

- The Water Quality Monitoring Plan incorporates a groundwater monitoring program which specifically deals with monitoring for acid sulfate soils in the Brisbane River drawdown zones.
- The groundwater inflow will be monitored and will be compared to predictive modelling. If the rate of groundwater inflow exceeds 1L/sec in any worksite, work methods will be revised, and mitigation measures devised and implemented as soon as practicable.
- Prior to commencement of construction, a specific management plan will be prepared and implemented for construction works that may disturb groundwater. These would include, but not be limited to, measures to address the potential for, and prevent environmental impact from, groundwater drawdown.

3.2.2 Surface water

- The Water Quality Monitoring Plan incorporates a surface water monitoring program.
- Minimisation of vegetation clearing and progressive rehabilitation and restoration of cleared areas.
- Installation of effective erosion, sediment, dust and stormwater controls.
- Avoidance of flood-affected areas, drainage lines and waterways during the stockpiling and placement of spoil and other materials.
- Implementation of water-sensitive urban design measures at worksites.
- Implement surface drainage measures for the collection, treatment, diversion and assessment of wastewater generated from construction activities via an authorised system, including the provision of

temporary water treatment facilities at the southern portal, Boggo Road, Woolloongabba, Albert Street, Roma Street and northern portal sites (OWQMP p9).

- Stockpiles shall be located away from and above drainage areas and flood affected areas, proposed stockpile locations have been detailed on each relevant construction worksite plan and governed by the overarching Construction Worksite Management Plan (OWQMP p9).

3.2.3 Flood Management - Construction

- Construction flood protection measures have been designed and implemented so as not to impact on third parties for a 1 in 5 year AEP flood event or greater.
- Bulk storage facilities containing hazardous substances have been designed and sited to protect against flooding from a 1 in 50 AEP flood event. The location of these facilities have been shown on the construction worksite plans for each site.
- Site access to all worksites has been designed and constructed for all-weather access for construction vehicles and equipment.
- Construction activities, including any temporary works and spoil placement has been designed to prevent flood waters being re-directed over other private property.
- The location of plant and equipment has been designed to enable the items to either be relocated or prevent them being inundated or submerged with flood waters.
- Safety measures have been developed including emergency measures to prevent flooding in tunnels during construction.

4 Compliance Management

4.1 Roles and Responsibilities

The organisational responsibilities and accountabilities in relation to environmental management throughout Project construction works are outlined in the overarching CEMP.

4.2 Induction and Training

4.2.1 Environmental Induction

All CBGU staff, subcontractors and visitors to worksites must attend general induction training that covers general environmental management requirements, site-wide controls and site-specific and work specific risks and mitigation measures. Further details regarding environmental induction requirements have been outlined in the overarching CEMP.

4.2.2 Environmental Training

Details regarding environmental training requirements have been outlined in the overarching CEMP.

4.3 Incidents and Emergencies

4.3.1 Incident Notification

The immediate response to all incidents is to make the area safe and undertake measures to prevent further environmental harm. The Environment and Sustainability Manager, Shared Services Director and Project Director should be notified immediately in the event of an environmental incident.

Further details regarding Incident Notification, have been outlined in the overarching CEMP, and Emergency Response and Incident Management Plan.

4.3.2 Incident Types

For the purpose of this WQMP, incidents may include, but are not limited to:

- Any breach of the legislation or an approval or permit condition
- Contamination of waterways or land
- Impact to level or contamination of groundwater

4.3.3 Incident Prevention Management

Incident Classification and Procedure has been identified within the overarching CEMP

4.3.4 Incident Investigation

The Incident Investigation process has been specified in the overarching CEMP.

4.3.5 Complaint Management

All complaints are to be dealt with in accordance with the complaint's management procedure outlined in the CEMP.

5 Inspections, Monitoring, Auditing and Reporting

This section outlines the compliance processes that have been adopted by CBGU to ensure compliance with the Coordinator-General Conditions and any other legislative requirements. The section below details specific requirements relating to Inspections, monitoring, auditing requirements have not been outlined in the overarching CEM.

5.1 Environmental Monitoring

5.1.1 Baseline Monitoring

5.1.1.1 Surface Water

A baseline surface water monitoring was carried out over a 12-month period commencing in September 2018 and the final round of sampling will be completed in August 2019. The baseline surface water quality monitoring occurred at two (2) surface water locations that are applicable to the TSD Package (SW1 and SW2). Sampling location SW3 is further downstream however results will be included within this report when the data becomes available. The intent on the baseline surface water monitoring was to derive groundwater quality compliance limits in accordance with the Queensland Water Quality Guidelines (2009).

The baseline data will be included within this report when the data becomes available.

5.1.1.1 Groundwater

A baseline groundwater monitoring was carried out over a 12-month period commencing in September 2018 and the final round of sampling will be completed in August 2019. The baseline groundwater quality monitoring applicable to the TSD package occurred at eight (8) existing groundwater monitoring well locations that were previously installed across the footprint of the proposed Cross River Rail Corridor (MW1 to MW8). The intent on the baseline groundwater monitoring was to derive groundwater quality compliance limits in accordance with the Queensland Water Quality Guidelines (2009).

Appendix A provides the median of the test site $\leq 80^{\text{th}}$ percentile of the baseline data.

5.1.2 Performance Monitoring

Monitoring will be undertaken as per the Water Quality Monitoring Plan at various sensitive receptors to validate the impacts predicted for the Project to measure the effectiveness of environmental controls and implementation of this WQMP. The monitoring may also help to address potential Community Complaints that may be made.

The Water Quality Monitoring Plan outlines the water quality monitoring required for the project.

All discharge, surface water and groundwater monitoring will be completed as per the Monitoring and Sampling Manual: Environmental Protection (Water and Biodiversity) Policy 2009 and the Australian guidelines for water quality sampling (AS/NZS 5667.11.1998).

5.1.3 Auditing

Audits will be undertaken to assess the effectiveness of environmental controls, compliance with the CEMP, compliance with Environmental Design Requirements, and other relevant permits, approvals, and guidelines. There will be a monthly internal audit undertaken by CBGU as per the CEMP, who will report key findings to the Environmental Monitor and the Authority. This includes reporting on compliance with the CEMP and the Imposed Conditions.

Audits will be undertaken in accordance with the overarching CEMP.

5.1.4 Corrective Action

Corrective actions must be undertaken where monitoring or validated complaints indicate the environmental outcomes or Imposed Conditions are not achieved in relation to particular works, either because the performance criteria have not been met, or mitigation measures have not been implemented. Where corrective actions become necessary, the specific works that do not achieve the environmental outcomes or meet the Imposed Conditions must cease until the corrective actions have been developed and implemented.

The process for developing and implementing Correction Actions has been specified within the overarching CEMP.

5.2 Reporting

5.2.1 Monthly Reporting

To ensure compliance with Coordinator-General Condition 6, CBGU will prepare and submit a monthly report, details of which have been identified in the CEMP.

5.2.2 Incidents and Non-Compliance Event Reporting

Environmental incidents meeting the criteria of an NCE shall be notified verbally as soon as practical and in writing within 48 hours of becoming aware of an incident occurring. Notification will generally be undertaken by the Environment and Sustainability Manager or delegate. Additional notification of the incident to the relevant authorities, EM and parent companies will also be undertaken as required.

Further details regarding reporting, including provision of interim and detail reports have been provided in the overarching CEMP.

5.3 Documentation and Communication

Records in relation to water quality must be maintained in accordance with these requirements.

5.3.1 Document Control

Document control requirements have been specifically addressed within the overarching CEMP.

5.3.2 Review

In accordance with the General Requirements of the CEMP this construction WQMP must also be updated and revised on the basis of, changes to proposed spoil placement locations.

Revisions shall be reviewed and approved prior to issue. Updates to this WQMP are numbered consecutively and issued to holders of controlled copies

Revisions to this WQMP may also be required during the Project to reflect changing circumstances or identified deficiencies. Revisions may result from:

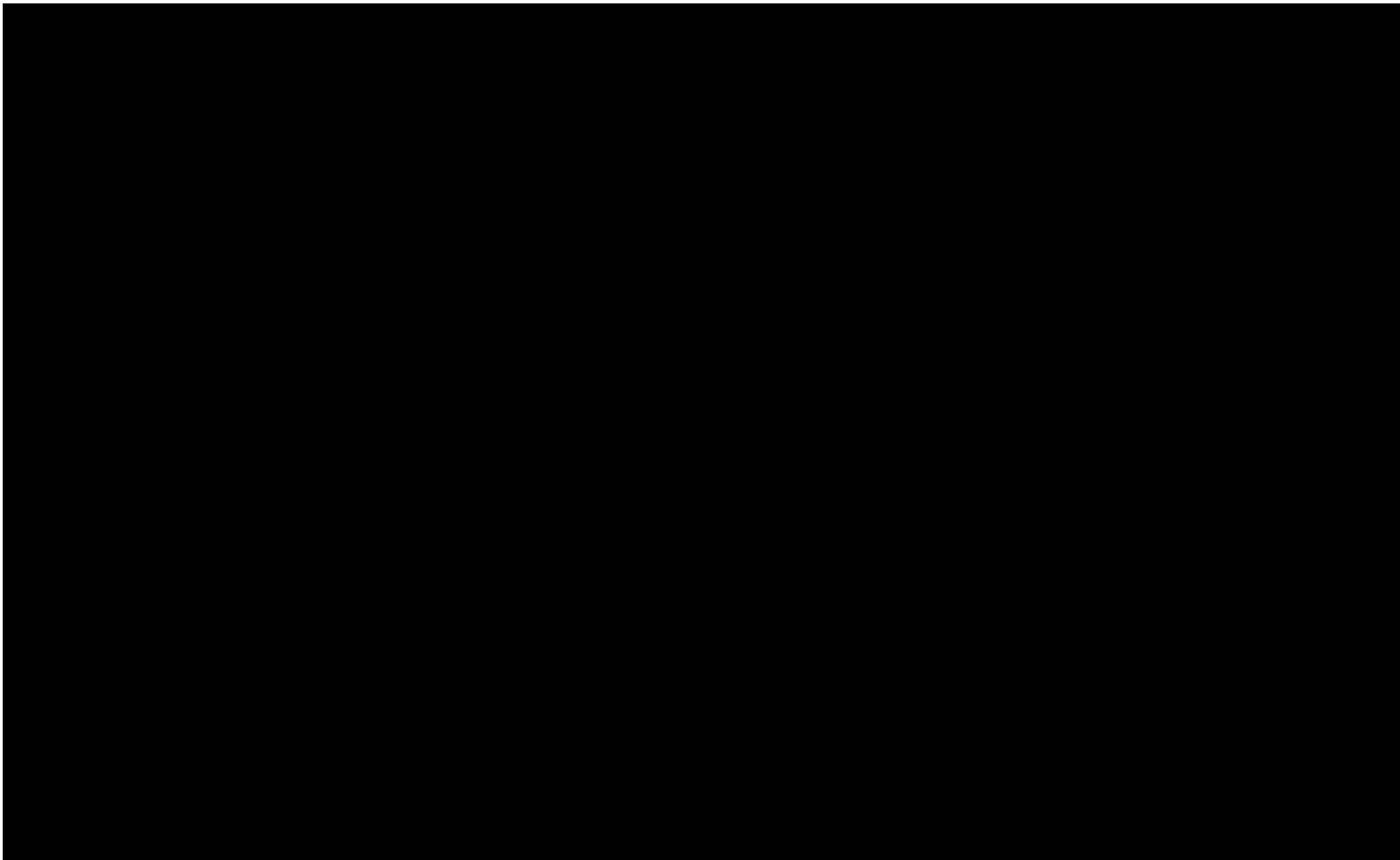
- Management Review
- Audit (either internal or by external parties)
- Complaints or non-conformance reports
- Changes to the Company's standard system.

5.3.3 Communication

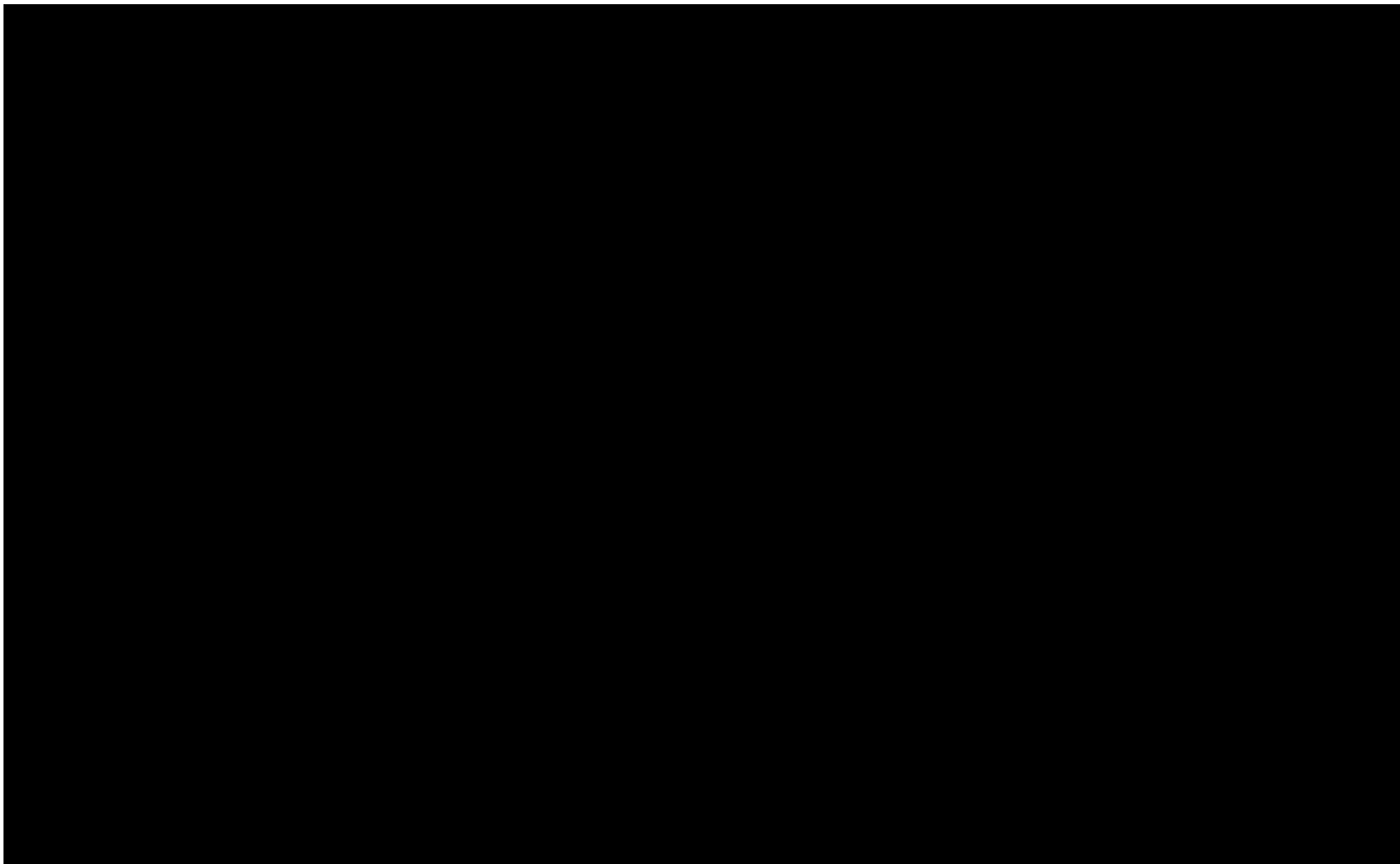
All internal and external communication with all stakeholders including the public, Coordinator-General, government agencies and the Delivery Authority must be done in accordance with the requirements of the overarching CEMP.

Appendix A

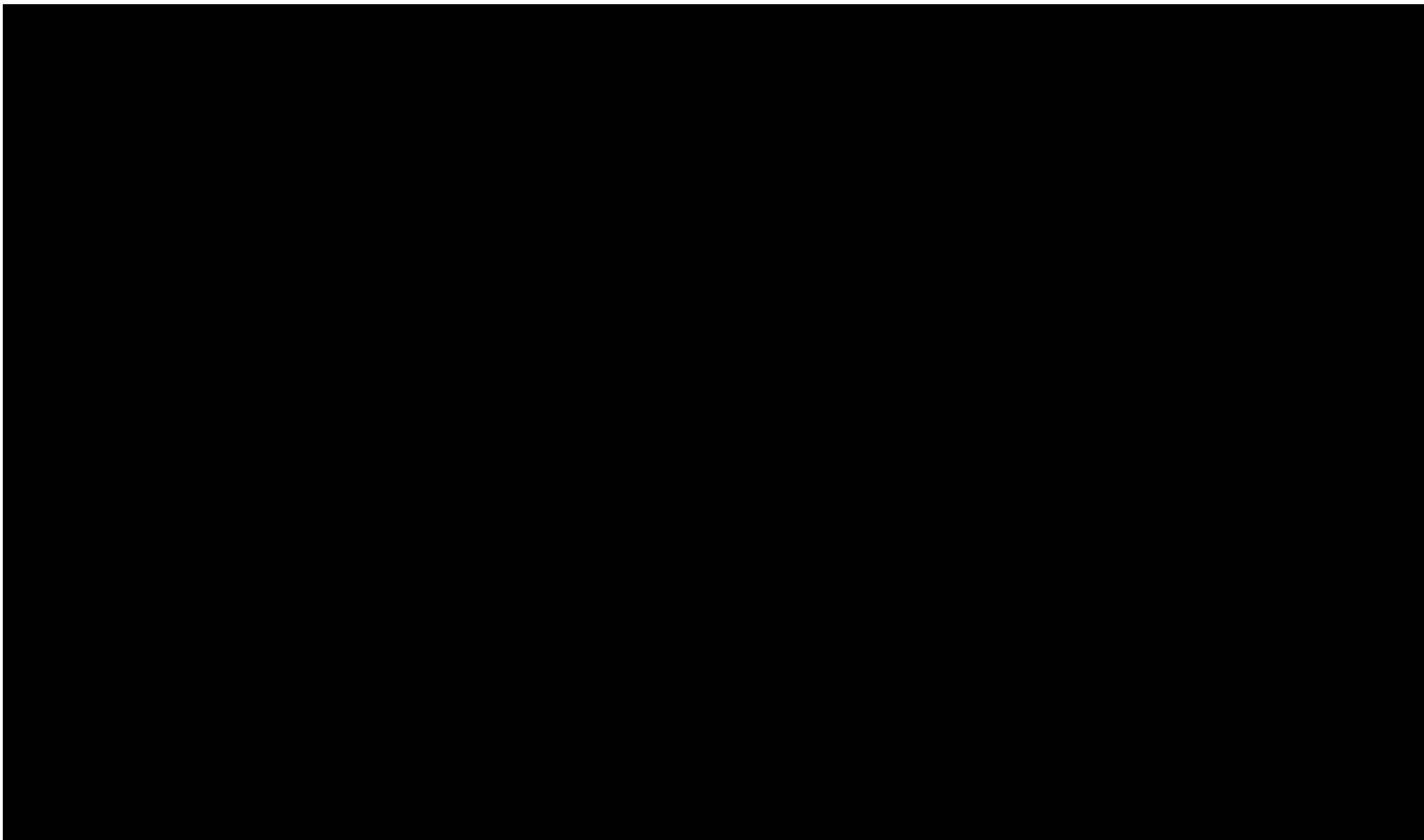
Baseline Groundwater Monitoring



CBGU D&C JV



CBGU D&C JV



CBGU D&C JV