

# Hydrology and Water

Capability Statement



# Acknowledgement of Country

**BG&E Resources acknowledges Aboriginal and Torres Strait Islander peoples as the first peoples of Australia and the Traditional Owners and Custodians of lands and waterways on which we work and live.**

**Our operations are conducted on the traditional lands of the Whadjuk people of the Noongar nation in Perth, the Bindjareb people in Mandurah, the Larrakia people in Darwin, the Kurna people in Adelaide, the Gurambilburra Wulgurukaba, Bindal, Nywaigi, and Gugu Badhun peoples in Townsville, the Turrbul and Jagera peoples in Brisbane, the Awabakal people in Newcastle, the Gadigal people of the Eora nation in Sydney, and the Wurundjeri and Boon Wurrung peoples of the Kulin nation in Melbourne.**

**We honour the wisdom of, and pay respect to, Elders past and present, and we acknowledge the cultural authority of all Aboriginal and Torres Strait Islander peoples across Australia.**

**We also acknowledge the vital contribution made by our Aboriginal and Torres Strait Islander employees and we thank those who have guided our approach and generously shared their insights.**

Image: Aboriginal artwork created by Jayda Sebire (Indigenous Artist and former BG&E Resources People and Culture Assistant).  
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# Hydrology and Water Services for a Sustainable Future

BG&E Resources (BGER) is a multidisciplinary engineering, EPCM and ESG consultancy, delivering technical solutions for clients in the Resources, Energy and Industrial sectors.

With offices on the East and West coasts of Australia, we are majority owned by our employees and committed to helping clients decarbonise in a net zero economy.

Our fit-for-purpose engineering solutions enable mining and raw material proponents, energy and water utilities, and port authorities to optimise the performance of their assets, minimise operational disruption, improve safety and mitigate risks.

BGER's proven approach to deliver schedule and cost benefits through clever engineering and true collaboration is what sets us apart.

Our people pride themselves on providing smart and sustainable solutions to complex engineering problems; and importantly, on being great people to work with.





# Technical Excellence

**Our people are passionate about leveraging their technical ingenuity to solve complex problems.**

Technical excellence is the bedrock of our business. It drives our people and propels the outcomes that we provide for clients, communities, asset owners and operators, and financiers.

Our dedicated professionals and subject matter experts focus on understanding our clients' business objectives, their desired project outcomes, as well as the latest industry research for the sectors in which we operate.

#### A Premium Client Experience

The success of our project work depends on leveraging the best expertise of our people. That's why we allocate the most qualified professionals to help realise our clients' development vision and bring their projects to life.

Our work is underpinned by strong engineering design principles, industry-leading technology and pragmatic advice to deliver exceptional outcomes, every time.

This approach provides the following benefits:

- Ease of understanding of regulatory frameworks
- Efficient navigation through the development approvals process
- Protection and preservation of our cultural heritage, the environment and waterways
- Healthy, transparent and trusted relationships are established with stakeholder groups
- Respectful liaison with Traditional Owners is undertaken
- Fair and equitable outcomes are achieved for First Nations' communities
- Project knowledge is retained, including lessons learned
- Innovation is embraced and deployed.

#### Technical Leadership Team

The quality and excellence of our world and ability to deliver the best technical and cost-effective solutions for our clients is guided by our Technical Leadership Team.

Led by the most senior members of our business, this team facilitates learning and knowledge transfer, professional collaboration and mentorship to drive continuous excellence in our technical capabilities. It also encourages our people to perform to high technical standards and rewards staff for incorporating innovation into projects.

Image: Steve Ash and Kanishka Pathirana at Paraburdoo Train Load Out Facility, Pilbara WA.



# Safety is at the Heart of our Business

**Our diverse and culturally aware teams embrace safe work practices that are environmentally sound.**

Safety is integral to everything we do at BG&E Resources. We care about our people, clients, and the communities in which we operate, and strive for zero harm in everything we do.

Health, safety and quality are embedded in our work practices, while heritage and sustainability are considered throughout the entire project life cycle.

We recognise the importance of continuously reviewing safety in design issues at all stages of a project, from investigation, design, construction, operation (including maintenance), closure and rehabilitation.

Exceeding regulatory obligations, we leverage a formalised Health, Safety, Environment and Quality Management framework that allows us to analyse and implement practical measures to mitigate risks.



## Leadership

- Understanding of client needs
- Technical Leadership Team governance
- Strong Chartered presence
- Adherence to Technical Standards & Regulatory Instruments
- Committed to Technical Excellence
- Striving for low-carbon impacts



## Systems

- ISO Accredited Quality Management System (QMS)
- Design Assurance
- Engineering Verification Procedures
- Safety in Design
- Net Zero in Design
- Risk Mitigation & Management
- Project Governance (Action Tracking, Monitoring, Performance & Auditing)
- Continuous Improvement (Lessons Learnt)



## Characteristics

- Client Centric
- Risk Adverse
- Reliable
- Accountable
- Innovative
- Simplification
- Community & Culture



Image: Lucy Nguyen at Cape Lambert Port Facility, Karratha WA.





Image: Indigenous peoples' hands. Copyright approved via Shutterstock.

# Respecting, Protecting and Preserving our Cultural Heritage

## Diversity across our workforce and our supply chain is vital.

Our clients trust in our ability to enhance their social license to operate, including through the provision of mutually rewarding cultural heritage consultation and management, healthy Indigenous partnerships, and ethical procurement from Aboriginal-owned and operated businesses.

Working with Traditional Owners, First Nations peoples, Indigenous Prescribed Body Corporates and Aboriginal Corporations, is seeded in early engagement as it enables our team to deliver benefits for today (across the life cycle of proponents' projects) and for future generations.

Early engagement underpins our approach to cultural heritage management as it enables us to understand the needs and desires of all stakeholder groups, as well as any existing Indigenous Land Use Agreements (ILUAs) which have been registered with the National Native Title Tribunal (NNTT).

We partner with highly experienced local archaeologists and ethnographic specialists to provide clients with access to an abundance of heritage site data, and to collectively undertake walk-throughs of proposed project sites.

From the Kimberley in the North to Esperance in the South of WA, across central Australia and along the Eastern seaboard – we engage with Traditional Owners and Custodians, Prescribed Body Corporates (PBCs), Aboriginal development corporations and First Nations communities to preserve their cultural heritage and when helping proponents and/or government agencies to deliver projects.

### Cultural Heritage Management Capabilities

- Stakeholder consultation and engagement to help Traditional Custodians of the land and Native Title Claimants to establish IULAs, registration to the NNTT and compensation frameworks (among others).
- Advice for proponents regarding the application of legislation including the Native Title Act 1993, Heritage Act 1972 (Aboriginal Cultural Heritage Bill 2021) and Repeal Bill 2023.
- Developing scopes for archaeological and ethnographic surveys.
- Indigenous business contracting (including teaming with Aboriginal-owned and Supply Nation-certified businesses to develop First Nations regional workforces).
- Capacity building (including coaching, mentoring and career pathway development, etc. for First Nations peoples).
- Reconciliation Action Plans.

### First Nations' Partnerships

We have a range of actions in place to increase Aboriginal and Torres Strait Islander employment and engagement in our business, to help First Nations communities become self-sustaining (current participation is approximately 1.5 per cent of our workforce and we are striving to increase that to three per cent by December 2025).

We proudly support Aboriginal and Torres Strait Islander owned businesses and have established a majority-owned Aboriginal company, TICS (WA) Pty Ltd (TICS). TICS is a NATA-accredited laboratory to ISO 17025, providing non-destructive testing (NDT) services.

Similarly, we have strategic partnering arrangements with several Aboriginal-owned businesses, including Karlayura Contracting, which provides design and construction support for clients.

We have also established a similar partnering agreement with i24s, an Aboriginal-owned and operated workforce company, providing security, civil works and commercial cleaning services for mine sites in remote locations across Australia, as well as for commercial premises in capital cities (their clients include BHP, Horizon Power and Cundaline Resources, among others).

Most recently, we also established a partnership with Pirrpala, a 100 per cent Aboriginal-owned and operated small scale project delivery provider.

Our partnerships also span the globe, specifically in China, for the procurement of equipment and professional services, including on Country inspections of fabrication, testing, compliance and design reviews.

### Reconciliation

Review our [Innovate Reconciliation Action Plan](#), [Aboriginal and Torres Strait Islander Engagement Strategy](#), [Human Rights Statement](#) and [Anti-Discrimination Policy](#).



# Hydrology

**Providing specialised hydrological services and advice, BGER assists clients throughout the planning, design, construction and operation of process and non-process infrastructure.**

BGER's dedicated hydrology team are skilled in the use of the most up-to-date software and application of the latest tools and analysis methods.

The team prides itself on providing site-specific, quality and accurate services and advice. Our 'boots-on' leaders are experienced in project delivery, at all scales and across many global locations.

## Capabilities

- Waterways Investigation and Design
- 1D and 2D Surface Water Modelling
- Flood Risk Assessment
- Hydrological and Hydraulic Analysis
- Water Supply and Yield Studies
- Water Balance
- Modelling
- Mine Site Water Management
- Surface Water Management Plans
- Yield Assessment Studies
- Dam Design and Dam Failure Assessment
- Environmental Hydrology
- Water Quality Assessment
- Surface Water Monitoring

Image: Courtesy of Adobe Stock





# Integrated Water Management

**We are experienced in the development, management, treatment, reuse and recycling of water resources for mine sites and industrial facilities.**

We help our clients apply an Integrated Water Management strategy to bring together all facets of the water cycle — water sources, water treatment ‘fit for purpose’, recycle water systems, wastewater treatment and stormwater management — to boost ESG outcomes.

Our capabilities and specialist services focus on delivering the most efficient production, control, and management of valuable water resources. Our aim is to maximise the efficient use and reuse of every drop of water involved with a mine site or industrial operation and to minimise the long-term environmental impacts that could result from the mismanagement of water resources.

## Capabilities

- Water Storage and Treatment
- Water Distribution
- Sewage Collection and Treatment
- Water Recycling, Environmental/River Replacement Flows
- Preparation Overview PFDs of Entire Mine Sites
- Water Balance Modelling
- Water Quality Assessments
- Stormwater Management

## Specialist Services

- Water Resource Evaluation
- Water Resource Development and Infrastructure
- Sediment Control Digital Modelling of Groundwater
- Digital Modelling of Groundwater/Surface Water Interaction
- Optimisation of Water Supplies
- Water Treatment/Reuse
- Water Access, Substitute Water Supply Plans and Augmentation Plans
- Groundwater Contamination Assessment Remediation and Management
- Integrated Surface Water and Groundwater Flow and Contaminant Transport Modelling
- Borefield Design and Installation
- Dewatering Investigations and Groundwater Management for Excavations, Mines, and Tunnels

Our team is also highly skilled in stormwater and surface water specific disciplines including selection, design, and construction of stormwater treatment systems.







# Contaminated Site Assessment and Remediation

**We work side-by-side with our clients to develop fit for purpose remediation plans, consult on regulatory strategies and develop comprehensive clean up strategies.**

## **Brownfields Redevelopment**

From site identification, investigation, and remediation to design, permitting, and project execution, we provide the services necessary to redevelop an environmentally impacted site to an end use that meets environmental stewardship, regulatory compliance, and stakeholder needs.

We solve our clients' brownfield redevelopment challenges using appropriate and efficient environmental remediation approaches as well as geotechnical engineering solutions.

## **Groundwater Assessment and Remediation**

BGER delivers services to manage the complexities of contaminated sites and navigate regulatory frameworks for remediation.

Our team of professionals address a range of contaminants – metals, chlorinated organic chemicals, petroleum hydrocarbons, and emerging contaminants – and use appropriate technology-based remediation strategies.

We combined our knowledge of ground conditions – with practical and innovative investigation, diagnostic, modelling and characterisation techniques – to accurately profile mine sites and industrial facilities.

## **Hydrogeological Characterisation and Modelling**

BGER helps proponents to understand how water interacts with the surface and sub-surface environment at any contaminated location.

We undertake investigations and models to determine flow directions, pathways, and rates of groundwater flow, potential receptors of groundwater, potential contaminants, and the extent of contamination in the subsurface environment.

By gaining a detailed understanding of the geology and hydrology of a contaminated site, we strengthen the site model and provide the framework for design of a groundwater remedial program, if needed.



# Environmental Assessment, Investigation, Monitoring and Permitting Remediation

**Project proponents face an increasingly complex environmental approvals and permitting landscape and growing environmental performance expectations from regulators and communities.**

Impact assessment and permitting play an essential role in project investment and securing a social license to operate.

We adopt a collaborative approach with our clients to develop permitting strategies, time frames, and information requirements that are necessary for development, operation, and post closure planning.

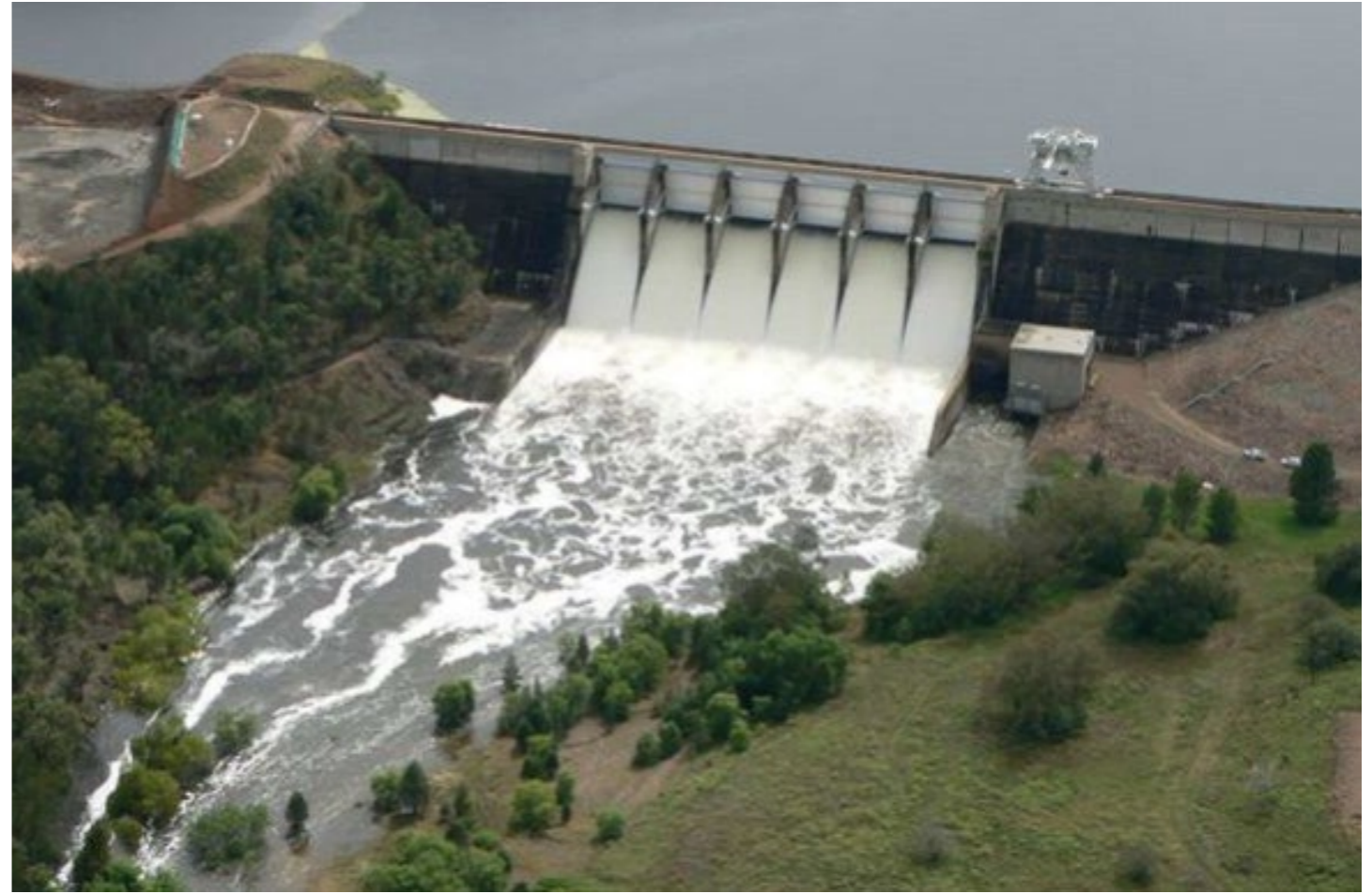
Our strong understanding of regulatory frameworks allows us to consistently meet the needs of our clients.

## Capabilities

- Water Quality Regulatory Support and Permit Negotiation
- Environmental Compliance and Sustainability Management Systems
- Air Quality Management, Permitting and Pollution Control
- Discharge Permitting
- State / Federal Mine Operation and Reclamation Permitting
- Environmental Assessments
- Environmental Impact Studies
- Cultural Heritage Advice
- Geophysics Investigations
- Surface / Groundwater Investigations
- Air Quality Assessment and Dust Mitigation
- Noise / Acoustics Analyses
- Tailings And Waste Rock Storage And Management
- Water Balance and Water Management/Treatment
- Environmental Monitoring
- Community and Stakeholder Involvement
- Soil Testing and Monitoring
- Groundwater Monitoring
- Wastewater Treatment







## Project Phases

**Our Hydrology and Water team offers services throughout the project life cycle covering concept, PFS, FS and Detailed Design through to construction and commissioning support.**

### Capabilities

- Concept Studies
- Environmental Studies
- Pre-Feasibility Studies
- Bankable Feasibility Studies
- Front End Engineering Design
- Detailed Design
- Independent Review
- Construction Support
- 2D & 3D Design



# Projects







Image: Ngungaju Plant - Courtesy of Pilbara Minerals.

# Mining Area C Minewater Tank Duplication

Client: BHP

**Our team developed engineering solutions that minimised construction complexities.**

The key objective of this tank duplication project was to provide duplication of the current storage and pumping system to mitigate the risk to the BHP MAC plant of being reliant on a single system regarding the plant and fire water supply.

This included the use of; skid mounted pump assemblies that removed the requirement for several additional site hours; a bolted tank arrangement that reduced the need for working at heights and optimisation of the ring beam design to minimise the need for complex circular formwork.

These design solutions enabled the construction company to minimise on site labour and remove scope from the critical path to reduce schedule risks.

Image: Ngungaju Plant - Courtesy of Pilbara Minerals.

# Hydrology and Waterways Study for Mine Road Upgrade

Client: Pilbara Minerals

**We completed a hydrology and waterways assessment of the Pilgangoora Mine Site and Wodgina Mine Access Road, including the conceptual design of floodway crossings.**

Following the conceptual design phase, BGER's Geotechnical and Civil teams work in a joint effort with Pilbara Minerals to progress detailed design and site investigations for the delivery of the road upgrade project.

The operation consists of two processing plants, the Pilgan Plant located on the northern side of the Pilgangoora area, which produces a spodumene concentrate and a tantalite concentrate, and the Ngungaju Plant, located to the south and producing a spodumene concentrate.

The Wodgina Access Road to the Pilgangoora Mine Site is situated between Port Hedland and Mulga Downs in Western Australia's Pilbara Region. The road is currently unsealed and extends approximately 24 km from Great Northern Highway, where a new intersection will be required.

The design scope involved upgrading 24 km of the Wodgina Road to a sealed road to facilitate increased haulage capacity via super quad road trains. This included 11 major floodway crossings, 12 km of site access and haul roads, and a new intersection at Great Northern Highway.

When complete, the road upgrade will improve the efficiency and safety of transporting critical minerals to Port Hedland to meet the increased demand for resources to enable the global transformation toward clean energy and a sustainable future.

BGER are currently involved in a baseline surface water assessment and wet season planning for the Pilgangoora Mine Site, looking at potential risks to operations and the downstream environment.





# Wodgina Lithium Project Surface and Water Assessment and Management

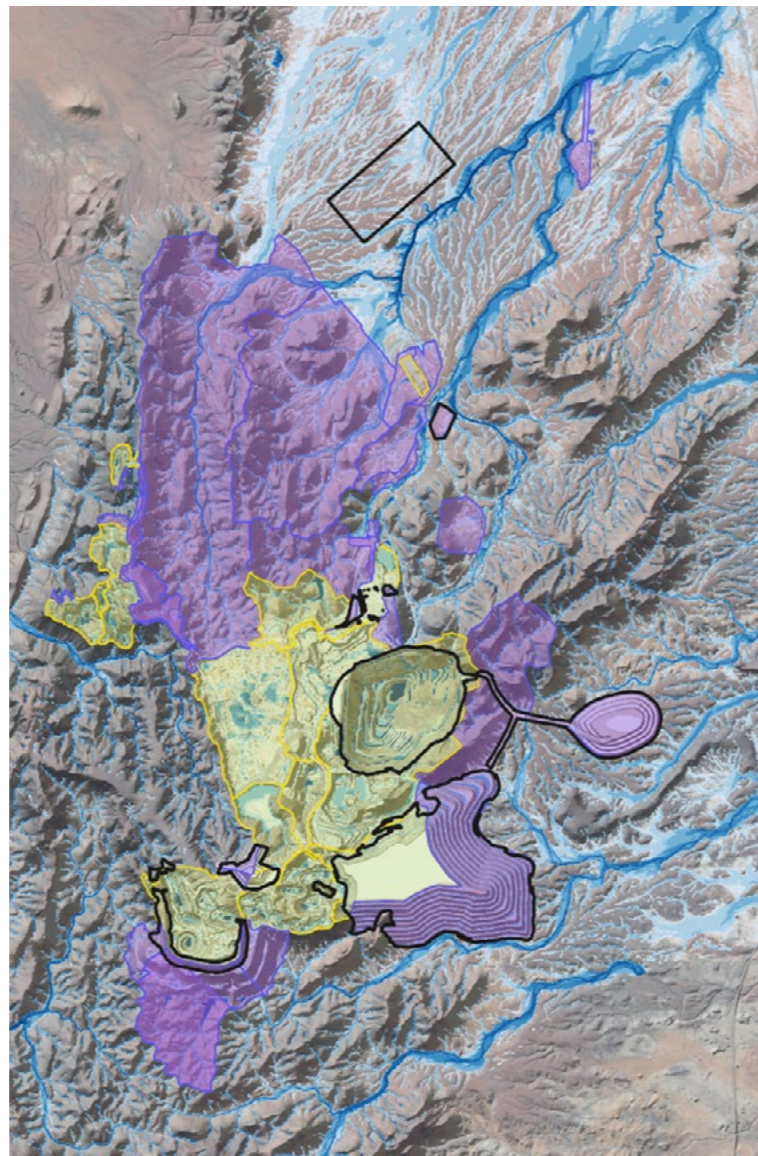
Client: Mineral Resources

**Providing ongoing advice related to management of surface water across the Project to support Mine Plan approvals.**

BGER staff have been providing advice on management of surface water across the Project for a number of years and have a positive ongoing relationship with Mineral Resources staff.

The work delivered has included:

- Assessment of baseline environmental and climatic conditions.
- Two-dimensional hydraulic modelling to establish pre-development flood behaviour and identify existing flood risks.
- Identification of conceptual flood mitigation measures for Mine Plans covering a range of periods.
- Development of Surface Water Management Plans including risk assessments of Project Infrastructure.
- Provision of advice on surface water planning for upcoming wet seasons.



# Water Dam Manifold Design

Client: Roy Hill

**Ensuring the continued safe operation of the process water dam by providing a reconfigured design.**

BGER was engaged prior to this scope to undertake studies on the failed process water dam. The scope involved the structural and civil design as well as significant hydraulic modelling to ensure the continued safe operation of the process water dam.

Our alternative design reconfigured the existing process water inlet pipes into a more robust manifold arrangement that reduced turbulence and with it, the risk of further damage to the dam.

Our team also undertook computational fluid dynamics to develop the dimensions of the manifold piping and the geometry of the spigots.





Image: Marble Bar Road, Pilbara, WA.

# Surface Water Management Study

Client: Dampier Salt (Rio Tinto)

**Our team carried out hydrologic and two-dimensional hydraulic modelling for the Port Hedland and Dampier sites to identify high-level risks to operation and corresponding risk mitigation options.**

Dampier Salt engaged BGER to conduct Surface Water Management Order of Magnitude Study (OoM) to identify controls to reduce risks associated with rainfall and cyclone events as much as reasonably practicable.

Our team provided earthworks, hydrology and hydraulic modelling that allowed for optimisation of stormwater flows during rainfall events, identification of high-level risks to operation and their corresponding risk mitigation strategies at the Dampier, Port Hedland and Lake MacLeod sites.

The SWMS resulted in fit-for-purpose solutions to mitigate existing drainage and flood risk.

# Process Water Tank Design

Client: Fortescue

**Fortescue engaged us to design a new 1,716 m<sup>3</sup> capacity steel tank to store process water at its Cloudbreak mine site.**

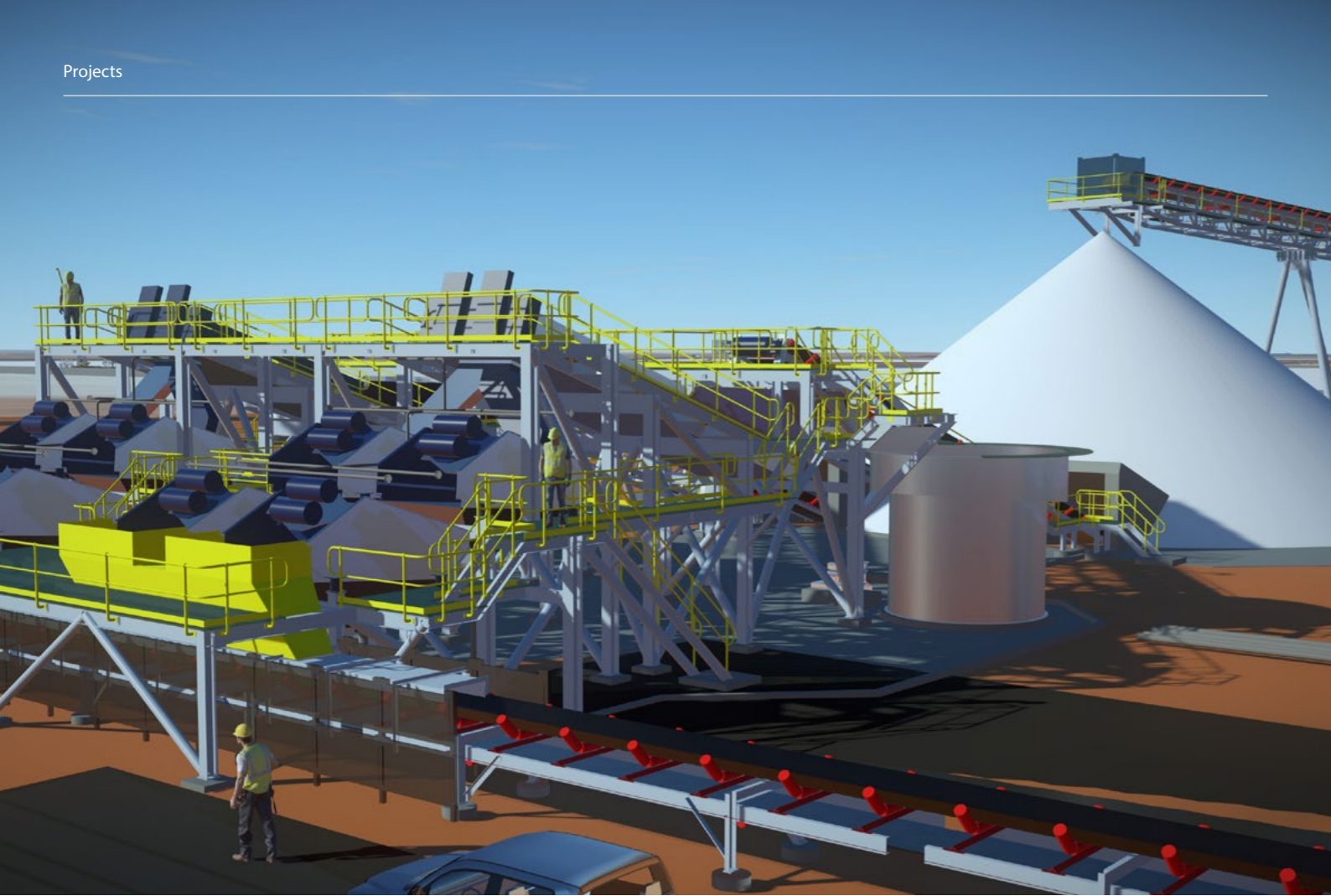
The new tank was designed to meet the API650 design code and needed to allow for a build-up of sediment up to 2.4 m above the tank floor. It has had to replace the existing bolted panel tank with a diameter of 15.75 m and height of 8.81 m.

The new tank was constructed adjacent to the existing tank pre-shutdown and then lifted into position. Our design included all the relevant lifting beams, lugs and equipment required to lift the tank into position.

Brockman 4 Mine, Pilbara WA.







# Eramurra Solar Salt Project

Client: Leichhardt Industrials Pty Ltd

**We were engaged under a multi-million dollar contract to undertake the Bankable Feasibility Study for the Eramurra Solar Salt Project (ESSP).**

Located 55 km south-west of Karratha in the Pilbara Region of Western Australia (WA), the ESSP is a new solar salt production and export facility targeting production of 5.2 Million tonnes (Mt) per annum of industrial salt to Asia-Pacific markets.

Supporting infrastructure includes seawater intake, bitterns outfall, desalination plant and groundwater bores, power supply and other infrastructure.

The salt will be transported via road train across a haul road to the approved trestle jetty at Cape Preston East Port facility for export. This would include dumping, stockpiling, reclaiming, and shipping across a marine transshipment barge facility within the Pilbara Port Authority (PPA) lease footprint.

Completed in April 2023, the BFS builds on our previous work, where we delivered Preliminary Engineering and Trade-off Studies, which have facilitated scope definition for this latest engagement.

Concurrently to the BFS, Leichhardt has progressed the collection of key input data (topography, bathymetry, geotechnical and metocean) as well as progressing Environmental and Heritage Studies.

We assembled an expert team of engineers and designers with considerable experience in the development of solar salt fields to undertake this study, which is helping inform the robust nature of the project.

The new salt project includes the development of a series of Concentrator and Crystalliser ponds, Jetty, Washplant, and Processing Plant.

# Ashburton Salt Feasibility Study

Image: Ashburton Salt Project, Western Australia.

Client: K+S Salt Australia Pty Ltd

**We have completed the Full Detailed Feasibility Study for a new solar salt production and export facility in Western Australia.**

K+S Salt Australia is seeking approval for the construction of the Ashburton Solar Salt project located 40 km southwest of Onslow.

The proposed facility is situated across existing coastal salt flats at the top of the Exmouth Gulf on a greenfield site, and is ideally positioned for solar salt evaporation and production. Once completed, the project will generate 4.7 million tonnes per annum of high-purity salt.

Work delivered by BGER included designing all components of the project including the seawater intake, transfer pump stations, salt concentration ponds, salt crystallisers, brine transfer systems, salt wash plant, stockyards and reclaim circuit, NPI facility, overland conveyor, and a new trans-shipment port marine facility.

As part of the study, we also assessed the capital cost and project implementation schedule and developed the project execution strategy. Our team also undertook Value Improvement Practice (VIP) activities to identify capital cost savings.



# Our Hydrology and Water Team



## **Dr. Natalie Horsfield** Lead Hydrologist

10 years' experience working within Australia and the UK for private consultancies and State government on projects within the resources, transport infrastructure, urban development and waste management sectors. Her focus has been on baseline assessments, Environmental Impact Assessments, Pre-Feasibility Studies, flood studies and Surface Water Management Plans to inform design of surface water management measures.

## **Fatima Kazemi** Lead Water Engineer

10 years of experience working with consulting and resources companies in Australia. She is a motivated and technically minded professional with extensive knowledge in planning and engineering design of hydraulic systems, civil and drainage infrastructure. She is proficient in hydrological analysis, hydraulic modelling, and flood risk assessment. Fatima is an expert in surface water management plans and design of drainage infrastructure, including culverts, floodways, diversion drains, levees, and scour protection measures. Fatima also has experience in planning and detailed design of dewatering systems such as borefields, transfer mains, turkey's nest, as well as raw and potable water for mining operations.

## **Ryan Brook** Lead Civil Engineer

11 years' experience in the design of culverts, floodways, drainage systems and other civil assets for infrastructure projects. Ryan has proven project management, coordination and liaison skills, with experience in tendering, contract administration and site superintendence. His technical skills include a solid understanding of AutoCAD, Microstation and 12D documentation and processes for civil works, QGIS, Python scripting and automation, and hydraulic modelling with the TUFLOW 2D fixed grid engine as well as the HEC-RAS 1D system.

## **Youmna Khalid** Senior Engineer

8 years' experience in land/subdivision development and civil transport infrastructure design and management with special emphasis on water distribution and stormwater drainage network design elements. She has provided technical support on large scale projects including Hospital Infrastructure NSW, School Infrastructure NSW, Transport for NSW, Roads and Maritime Services NSW, and PTA projects onshore. She is proficient in employing computer software packages such as WaterGEM/WaterCAD, 12D, Drains, MUSIC, and AutoCAD. She also possesses basic understanding of flood modelling and Civil 3D. She carries basic knowledge of HEC-RAS, ArcGIS and WBNM packages.

## **Charles Finlay** Graduate Hydrologist

Engineering graduate who has a solid foundation in environmental and mining principles. He originally joined BG&E Resources as an Undergraduate Engineer contributing to the Geotechnical team with the delivery of reporting, data handling, presentation and soil and rock logging. Since completing his studies, Charles rejoins us as a Graduate Hydrologist working closely with our water experts and civil engineers. He has a strong background in landscaping solutions, focused on irrigation installation and maintenance, and brings this knowledge to our hydrology team.



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BG&E Resources is a multidisciplinary engineering, design, project delivery and advisory consultancy, providing technical solutions for clients in the Resources, Energy and Industrial sectors. We are majority owned by our employees, who are united by our purpose – together, we embrace innovation to solve complex problems, for today and future generations.

[bge-resources.com](http://bge-resources.com)

