



Mine Residue &
Environmental
Engineering
Consultants

Epoch Resources



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Not just Built to Solve. Built to Lead. Built to Last.

At Epoch, our work begins and ends with people.

Engineering decisions carry consequences beyond the drawing board, shaping communities, environments, and long-term outcomes. We approach this responsibility with care and deliberation.

Since 2005, our reputation has been grounded in integrity and sustained involvement. We remain closely engaged in our projects, developing capable professionals who take ownership of detail and delivery. Trust is established through consistent performance and a commitment to doing work properly from the outset. Our ambition has always been to build an engineering practice defined by awareness, shared knowledge, and steady resolve.

By understanding the full life cycle of a facility, from concept through to closure, we recognise the cumulative impact of each decision. It is through this continuity that meaningful engineering contribution is achieved. We aim to build with endurance in purpose, in people, and in practice.

————— The Directors of Epoch Resources

Summary of Capabilities

Engineering that meets the highest standards.

Epoch focuses on four core areas: design, construction quality assurance, Engineer of Record services and independent technical reviews. These capabilities support the safe development, operation, and closure of mine residue facilities across their full life cycle.

Our work includes site selection and options assessments, tailings characterisation, facility design, risk assessment, construction oversight and operational support. Together, these disciplines allow Epoch to support complex tailings facilities from early planning through to long-term operation.

Mine Residue Storage Solutions

Design of tailings and mine residue facilities from concept and feasibility through to detailed engineering, tailored to the conditions and operational requirements of each site.

Construction Quality Assurance (CQA)

Independent oversight during construction to confirm facilities are built in accordance with approved designs and technical specifications.

Due Diligence & Independent Reviews

Technical reviews and due diligence assessments that provide an objective evaluation of facility performance, risk, and compliance.

Engineer of Record (EoR) Services

Ongoing engineering oversight of tailings facilities, including inspections, performance assessments and technical guidance to operators.

Mine Residue Closure Solutions

Planning and engineering support for closure and rehabilitation, ensuring long-term stability and regulatory compliance.

Company Overview

Engineering is a people industry.

Odd thing to say for a team that spends its days buried in the details of engineering designs and their execution, but we stand by it. Behind every technical decision runs a ripple that reaches people, communities, and ecosystems. Our job is to understand those ripples.

As specialists in mine residue management, we combine technical depth with considered judgement and undertake complex assignments across a broad number of regions, whilst maintaining a direct and attentive approach. This balance enables us to deliver work that is both technically robust and contextually informed.

Our Story

Epoch was inceptioned in 2005 in Johannesburg, South Africa. The objective was to build a company that valued its people and the complex challenges posed by the mine residue and tailings engineering global environment.

From those early foundations, the company has grown into an established consultancy in its field. Today, Epoch operates from offices in both Johannesburg and Cape Town and supports projects across Africa and selected international jurisdictions, combining regional understanding with international experience.

The principles on which the company was formed continue to guide its work. Experience, trust, and steady determination shape how projects are approached and delivered. Our teams work closely with site conditions, operational realities, and regulatory frameworks, often over extended periods, developing solutions progressively and with attention to long term performance.

The aim is consistent: to deliver long-term assets that perform and remain reliable throughout their life cycle with a dedicated team who are committed.

The Epoch Ethos

Our ethos is grounded in intent, integrity, and understanding. We regard sound engineering as the creation of robust value that lasts the test of time. This requires careful thought, collaborative effort, disciplined execution, and accountability at each project stage.

Delivering quality work from the outset is central to our approach and reflects the standard of our firm and the responsibility we carry in designing and overseeing critical mine residue facilities.

Epoch Built: To build with discipline, and to build for permanence.

People First

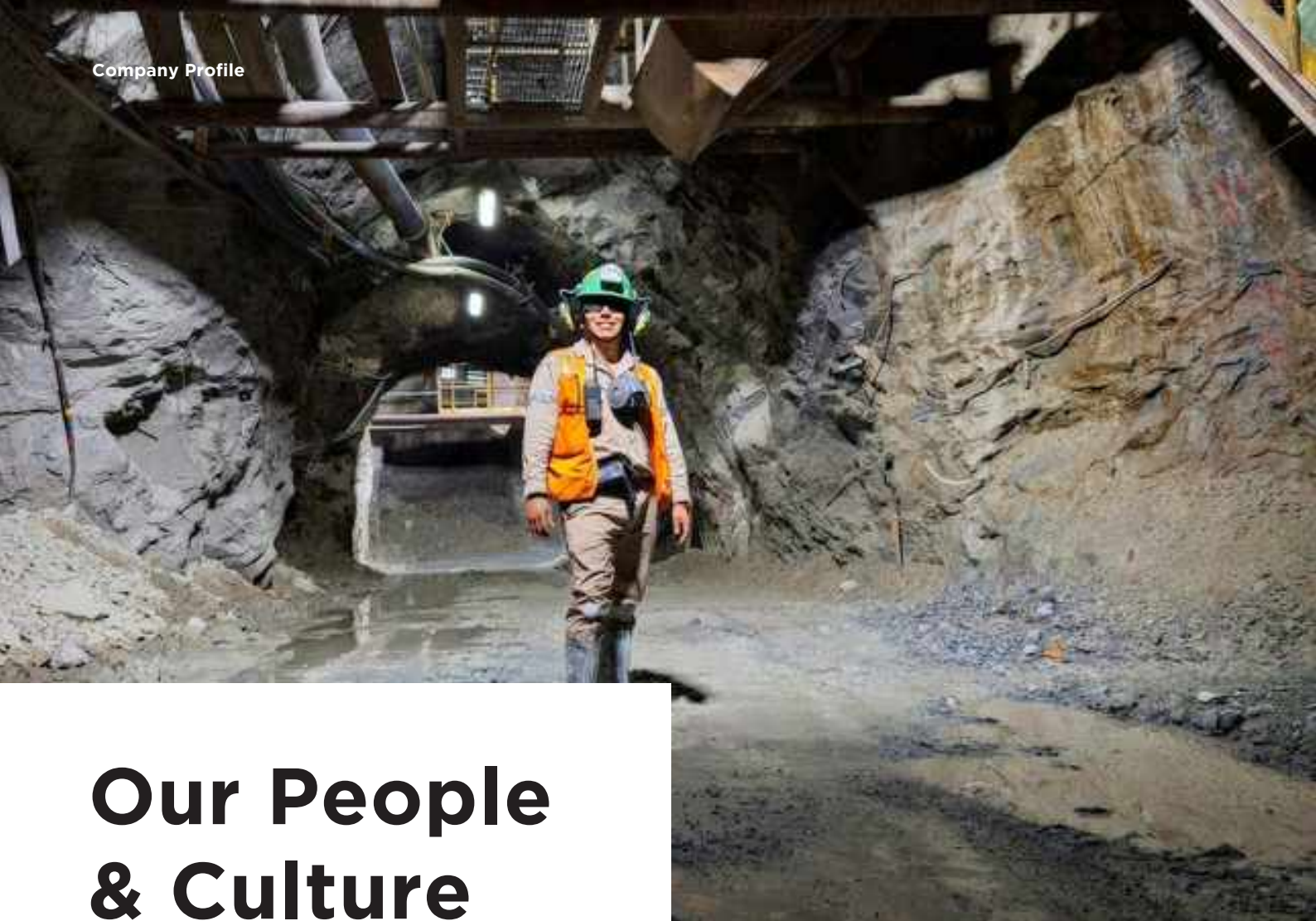
Engineering is a people business. We treat every relationship: client, partner, community, as a long-term commitment.

Integrity Always

We don't overpromise or oversell. We do what's right, even when it's hard.

Impact That Lasts

We design solutions for the long term. Solutions that continue to perform long after we've left the site.



Our People & Culture

Grit is our Dress Code.

We recognise that the quality of our work depends on the quality of our people.

For that reason, we place significant value on attracting, developing, and retaining capable engineers who take responsibility for what they design and deliver.

Many members of our team have grown within the firm, joining as graduates and progressing into positions of senior technical and project leadership. This continuity has strengthened both our technical standards and our culture of shared accountability.

We seek individuals who are thoughtful, resilient, and prepared to engage directly with complex site conditions and operational realities. In tailings engineering, sound judgement and steady application matter. We aim to create an environment in which our people are trusted with meaningful responsibility and supported in their professional development.

That sense of continuity extends beyond project work. Friday company lunches are a regular fixture, providing time to step back from delivery and reconnect as a team. Outside the office, many of our engineers can be found running, cycling, and training together, as reflected on our Strava page. These shared pursuits reinforce the camaraderie and endurance that underpin our professional work.

Our Leadership Team



Dr George Papageorgiou Pr Eng

Co-Founder & Director | BSc Eng (Civil), MScEng (Civil), PhD Eng (Civil)

George is a co-founder and director of Epoch Resources, based in Cape Town. He has comprehensive experience in mine residue and tailings engineering since 1995. He specialises in the design, operation and closure of tailings facilities, serving as Engineer of Record and on Independent Technical Review Boards. His expertise encompass analytical, design, operational, monitoring, performance and risk management aspects associated with tailings management. Before co-founding Epoch in 2005, he was a director at Metago Environmental Engineers. George leads projects across Africa, the Middle East, South America and Europe for clients such as Barrick, Gold Fields, Glencore and B2Gold. He is also a guest lecturer and examiner for various universities.



Andrew Savvas Pr Eng | EUR ING

Co-Founder & Director | BSc Eng (Civil), MSc Eng (Civil), MIMMM, MSAICE

Andrew is a co-founder and director of Epoch Resources, with proven experience in mine residue and environmental engineering since 1996. He has led and delivered tailings and water management projects across Africa, Europe, Brazil, Cyprus and Australia for clients including Glencore, Ivanhoe Mines, Pan African Resources and Tharisa Minerals. He serves as Engineer of Record on tailings storage facilities, providing leadership from concept and feasibility through detailed design, construction support, commissioning and ongoing operations. Andrew is registered as a professional engineer with ECSA and the Engineering Council of Zimbabwe, holds the EUR ING title from FEANI, and is registered with ETEK in Cyprus.



Tamryn Thyse Pr Eng

Director | BEng (Civil), BEng Honours (Geotechnical), MEng (Civil)

Tamryn joined Epoch Resources in 2015 and has extensive experience in mine residue and tailings engineering. She focuses on the design, monitoring and environmental performance of tailings facilities across South Africa and the broader African region. Her expertise spans feasibility through construction and long-term monitoring, hydrology and stormwater management, probabilistic water balances and environmental impact assessments. Tamryn holds a BEng (Civil), a BEng (Geotechnical) Honours from the University of Pretoria, a MEng (Civil) from the University of Stellenbosch and is registered as a professional engineer with ECSA (Engineering Council of South Africa). Tamryn has worked on projects in DRC, Namibia, Zimbabwe, Tanzania, Egypt, Mali, Malawi and Mozambique partnering with Barrick Gold, B2Gold, Kenmare, AngloGold Ashanti, DRA and Senet.



Kyle Liesker

Director | BEng (Civil), BEng Honours (Geotechnical)

Kyle is a director at Epoch Resources with in-depth experience in mine residue and geotechnical engineering. Since beginning his career in 2014, he has specialised in the design, monitoring and environmental management of tailings facilities across South Africa and the broader region. His expertise encompasses probabilistic water- balance modelling, seepage and stability assessments, flow-slide analysis, stormwater design and closure planning. Kyle holds both a BEng (Civil) and a BEng Honours in Geotechnical Engineering from the University of Pretoria, and he has worked with clients such as Ivanhoe Mines, Alphamin Resources, Platinum Group Metals, ERG and Tronox.

Epoch Built

We don't sell a service. We send our best.

Epoch Built reflects a way of working grounded in technical discipline, continuity of involvement and accountability across the life of a facility. Our teams apply detailed engineering assessment and structured risk methodologies to support sound decision-making in complex operating environments.

This includes FMEA, SQRA, MAA, CPTu analysis, well analysis, and support for Filter Stack TSFs, together with governance processes such as OMS and Emergency Response Plans. Epoch engineers also serve on various Independent Tailings Review Boards (ITRBs), contributing to broader oversight and technical governance where required.

Our work is carried out across a range of projects, operating conditions and jurisdictions, applying internationally recognised standards alongside host-country legislation and permitting requirements.

Standards

All work carried out by Epoch would conform to the requirements of host country legislation and permitting conditions as well as all applicable standards and guidelines, most of which are internationally recognised.

The standards most commonly referred to in the design, operation, and rehabilitation and closure of TSFs are:

Global Industry Standard on Tailings Management (GISTM)

International Commission of Large Dams (ICOLD)

Australian National Committee on Large Dams (ANCOLD)

Canadian Dam Association (CDA), Dam Breach Analysis

Areas of Expertise & Capabilities

Built for What Matters

We focus on four core areas: design, construction quality assurance, Engineer of Record (EoR) roles, and due diligence and independent third-party reviews. Whether we're leading from day one or stepping in mid-project, we bring technical depth, clarity under pressure, and a commitment to getting it right.

One: Design

TSF design is shaped by each site's realities — from project phase to terrain, material availability, and tailings characteristics. We work across the full design lifecycle, from early concept through to detailed design, adapting to storage capacity needs, deposition rates, and geotechnical constraints.

Our portfolio includes upstream, centreline, and downstream facilities using earthworks, cyclone tailings, and waste rock; containment systems with and without geomembranes; co-disposal solutions; and in-pit disposal. We also design remedial measures for legacy facilities, ensuring alignment with current best practice and performance expectations.

Summary of Design Capabilities

Area of Expertise	Description
Site Selection and Options Assessments	Evaluation of candidate sites using risk-based assessments considering proximity to processing infrastructure, material availability, site topography, environmental constraints, tailings delivery methods and social or infrastructure considerations.
Tailings Characterisation Geotechnical	Assessment of tailings behaviour through laboratory testing of particle size distribution (PSD), specific gravity, shear strength, hydraulic conductivity and consolidation characteristics, supported by CPTu investigations.
Tailings Characterisation Geochemistry	Evaluation of contaminant concentrations, leachability and acid generation potential to inform environmental risk assessments and containment design.
Stage Capacity and Site Development Planning	Assessment of storage capacity, life-of-facility projections and staged development strategies based on site configuration and deposition methods.
Dam Break Assessment and Consequence Classification	Analysis of breach scenarios, liquefaction potential and inundation impacts to support facility consequence classification in accordance with GISTM guidance.
Seepage and Slope Stability Assessments	Evaluation of seepage behaviour and slope stability under drained, undrained and post-liquefaction conditions to confirm compliance with prescribed factors of safety.
Surface Water Hydrology and Water Management	Design of systems for separating and managing clean and dirty water streams, including flood line delineation, storm design criteria and water balance modelling.
Design of Surface Water (Decant) Management Works	Design of infrastructure to manage slurry and stormwater within TSFs, including decant structures, containment works, diversion channels and spillways.
Containment Barrier Systems	Specification of geomembranes, low-permeability soils, drainage materials and geotextiles to ensure effective containment and filtration compatibility.
Risk Assessments	Application of structured risk methodologies including FMEA, semi-quantitative and Bow Tie assessments, supported by critical controls and trigger action response plans (TARPs).

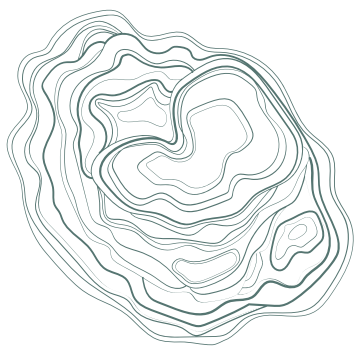
Two: Construction Quality Assurance (CQA)

Quality that's engineered from the start.

Once a TSF is designed and permitted, attention shifts to making sure it's built right — with precision, accountability, and full alignment to the design intent. That's where Construction Quality Assurance (CQA) comes in.

The completion of the detailed design of a Tailings Storage Facility (TSF) and the associated permitting procedures gives rise to the need for Construction Quality Assurance (CQA) services. These services are critical in ensuring that construction is executed in accordance with the approved drawings, technical specifications, and an accepted Construction Quality Assurance Plan.

It is important to distinguish between Quality Control (QC) and Quality Assurance (QA) as defined in ECSA (2015)



Quality Control (QC)

Quality Control (QC) during construction refers to the internal processes and procedures put in place by the contractor. QC ensures that outputs are systematically controlled, that the works are completed in line with the contract requirements, that the design is correctly interpreted, and that construction methods are appropriately applied. QC is the contractor's responsibility and forms the first layer of quality protection on site.

Quality Assurance (QA)

Quality Assurance (QA), by contrast, refers to the engineering oversight implemented to provide independent assurance to the client that the constructed works are highly likely to meet the design and contractual requirements. This assurance is achieved through a combination of the contractor's QC processes and the independent inspection, testing, and verification activities carried out by the Engineer's Representative. QA ensures that compliance is not assumed, but confirmed.

The data gathered during construction becomes part of the facility's long-term knowledge base; essential for future performance assessments, troubleshooting, and compliance. Typical outputs from QC and CQA processes include a construction completion report, as-built drawings and surveys, daily site diaries, CQA and progress reports, and a register of technical queries with resolutions. Together, they document the construction history and support ongoing oversight.

Three: Due Diligence Investigations and Independent Third-Party Reviews

Independent Eyes. Uncompromising Insight.

These independent reviews include comprehensive assessment of technical, environmental, and operational TSF-specific aspects to identify risks and ensure compliance.

Key areas of investigation involve dam stability and structural integrity, environmental impact (e.g., air and water quality), ongoing monitoring and maintenance, and legal and financial liabilities, providing a detailed evaluation for stakeholders.



At every stage, we work to reduce risk, reinforce performance, and deliver with purpose.

Four: Engineer of Record Services

Epoch serves as the Engineer of Record (EoR) for several tailings facilities, reporting directly to the Accountable Executives in line with the requirements of the Global Industry Standard on Tailings Management (GISTM).

Each appointment includes the nomination of suitably qualified and experienced personnel to act as EoR and Deputy EoR, assuming direct responsibility for the facility on behalf of Epoch.

These roles are supported by a wider team of engineers, enabling thorough inspections, analyses, and assessments, and allowing the team to scale up when needed — whether in response to emerging issues or ahead of scheduled reviews. This team-based structure also supports succession planning and ensures continuity of service for our clients at all times.

Our Approach

The Epoch Mindset

We take a hands-on approach to engineering - where understanding the ground comes before moving it.

Design, construction, operation, and closure are treated as one connected system, ensuring what's built in principle performs in practice, by people who get it right.



Every project is guided by a commitment to reduce uncertainty, strengthen performance, and uphold the highest standard of engineering integrity.



Areas of Operation

Epoch is headquartered in Johannesburg, South Africa, and operates across Africa and internationally.

Since 2005, we've delivered projects in South Africa, Namibia, Botswana, Zimbabwe, Tanzania, Ghana, Mali, Lesotho, Mozambique, Zambia, and Burkina Faso, as well as in Armenia, Georgia, Malaysia, and Australia.

This footprint has given us firsthand experience across an extraordinary range of geographies; from arid plains to high rainfall zones, and a deep understanding of the geological and regulatory conditions that shape each site. That exposure sharpens our ability to anticipate challenges, adapt solutions, and maintain the same high standards of performance and compliance, wherever we work.

Project Experience

In an industry defined by its extremes and intricacies, we're proud to have our Epoch team behind us, capable of:

Closure design and rehabilitation project management

Life cycle cost estimation for tailings facilities

Due diligence reviews for tailings, closure, and compliance

Feasibility and detailed design of residue storage systems

Flow slide and liquefaction risk analysis

Water use licensing and risk-informed design

Recent Projects

Bisie Tin Mine - DRC **(Alphamin Resources, 2018—2024)**

Tailings facility design and operational monitoring in a remote environment.

Tharisa Platinum - South Africa **(2009—2025)**

Long-term engagement covering feasibility, design, and environmental oversight.

Dasa Uranium Project - Niger **(Global Atomic Corporation, 2025)**

Responsible design for a high-sensitivity mining operation.

Kamoa Copper Mine - DRC **(Ivanhoe Mines, 2016—2025)**

Design and supervision of a large-scale residue disposal facility.

Evander Gold Mine - South Africa **(Pan Africa Resources, 2022—2024)**

Mine closure planning and rehabilitation implementation.

Graduate Development & Mentorship

We place considerable importance on developing engineers over the long term.

Many of our team members join the firm early in their careers, either following work experience with us or through referrals from universities and professional networks. We maintain close relationships with South Africa's top academic institutions and industry contacts, who refer, from time to time, capable young engineers who align with our standards and values.

Development takes place through direct involvement in project work. Graduates are integrated into live assignments from an early stage, working alongside experienced engineers and gaining exposure to design, site supervision, and client engagement. Responsibility is introduced progressively, supported by practical mentorship.

Over time, this approach has created continuity within the firm. Engineers who began their careers with us now hold senior technical and leadership roles. The emphasis remains consistent: sound technical judgement, accountability, and steady professional growth within the discipline of mine residue and tailings engineering.



Equity & Empowerment

The work that changes the land also changes the people - and from that change, possibility.

At Epoch, we value transformation, and we aim to live it. The same grit it takes to reshape a landscape drives us to build a team that reflects the country we're part of.

Our B-BBEE strategy focuses on:

Graduate development and mentorship

Career progression for historically disadvantaged professionals

Pathways to ownership and leadership

Strategic Alliances

We collaborate with a trusted network of partners to extend our reach and deepen our capability. These include:

- Local universities and research institutions
- Environmental and social science consultancies
- Minerals processing experts
- Process design and project management firms
- Environmental Impact Assessment & Permitting specialists
- Geotechnical investigation professionals
- Geochemistry experts
- Hydrology and geohydrology consultants
- Contaminant transport modelling specialists

These alliances allow us to deliver multidisciplinary solutions without compromising our independence.

From first site visit to future ownership, empowerment at Epoch isn't symbolic.



Innovation & Technology

At Epoch, technology enhances understanding. It doesn't replace it.

At Epoch, technology enhances understanding. It supports engineering judgement and strengthens decision-making across the full life cycle of a facility.

We apply advanced numerical modelling and probabilistic assessment tools to inform design and risk evaluation. These include Seepage and stability analyses, liquefaction and flow slide assessment, breach and inundation modelling, and probabilistic water balance simulations. Geographic Information Systems are used to integrate spatial data, terrain modelling, and catchment analysis.

Our approach to monitoring combines traditional instrumentation with digital platforms. We work with vibrating wire piezometers, inclinometers, survey control, and remote sensing inputs to support performance tracking and compliance oversight. Data dashboards and structured Trigger Action Response Plans assist operators and boards in maintaining situational awareness and timely intervention.

Hydrological and hydraulic modelling supports stormwater design, flood routing, and freeboard verification. Closure planning incorporates life cycle cost modelling, consequence classification, and risk-based design evaluations aligned with global tailings governance standards.

Technology is selected deliberately. The objective is improved clarity, defensible design, and measurable performance rather than novelty. In tailings engineering, confidence arises from sound data, appropriate modelling, and experienced interpretation.

The Road Ahead

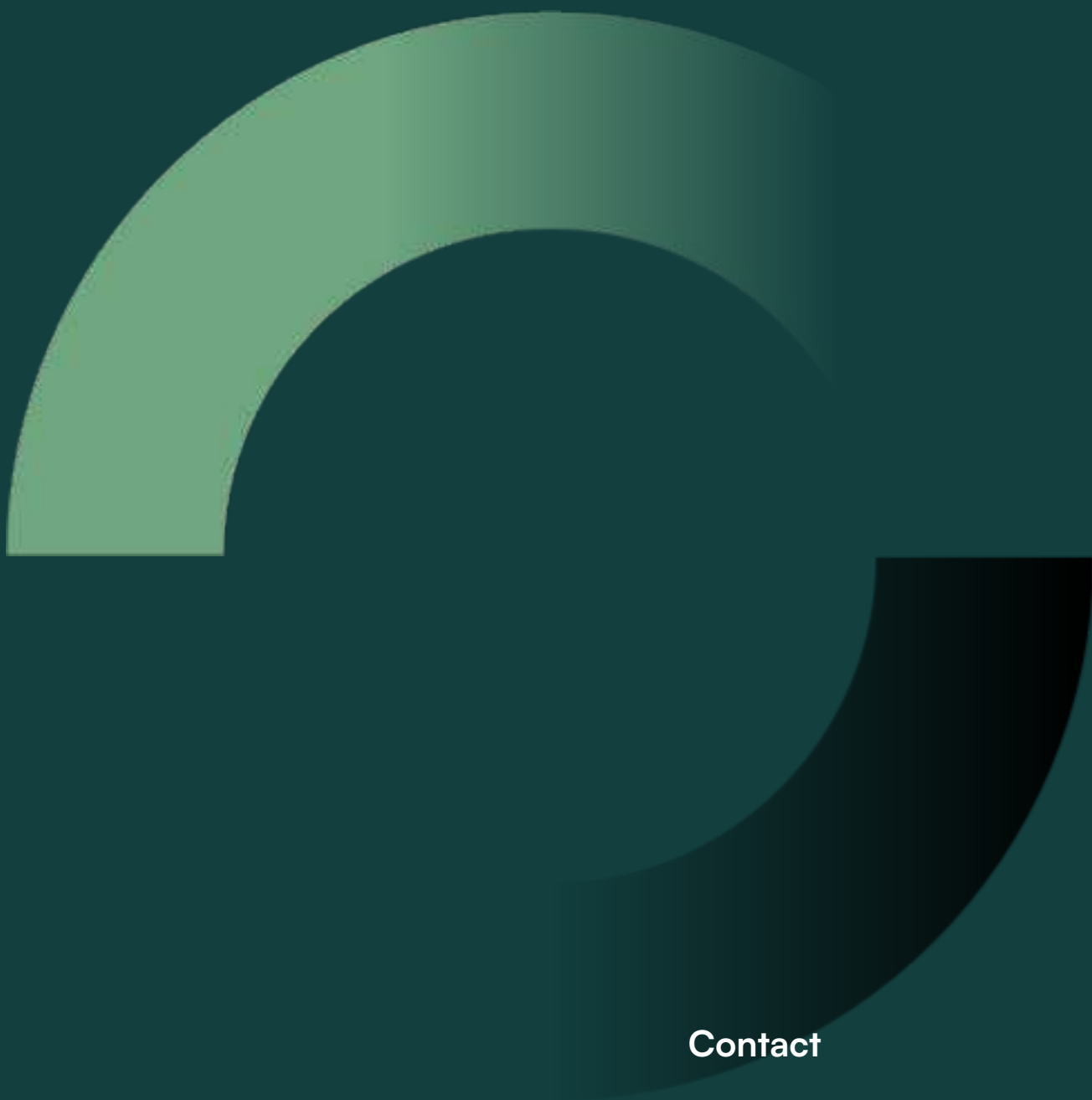
*Epoch has always
been defined by its
mindset, not its size.*

In mine residue and tailings engineering, outcomes are shaped by considered decisions made over time. Each technical choice influences land, water, operations, and the communities connected to them. How those decisions are taken, and how they are upheld, determines long-term performance.

We remain guided by the principles on which the firm was founded: technical discipline, continuity of involvement, and accountability across the full life cycle of a facility. Experience has shown that durable outcomes are achieved through steady application rather than scale.

Looking ahead, our focus remains consistent. We will continue to support clients with sound engineering judgement, careful risk management, and sustained oversight from concept through to closure.

Epoch has always been defined by its standards and its mindset. That will continue to shape its future.



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