

Tailings management

Sustainable and
complete dewatering
solutions



A complete tailings solution for every mine

When it comes to tailings management, our goals are the same as yours: to provide your operations with the best option possible.

The full package

Every mine site has unique considerations, whether it be high fresh water costs, permitting, stability issues or the threat of seismic activity. We work with you to determine the tailings solution that's right for your unique mining conditions and local regulations.

We offer complete dewatering, material handling and co-mingling solutions, such as EcoTails®, in-house. We also provide all the required testing to ensure we supply the most economic tailings solution to each customer on a site-by-site basis.

Investing in the future

Our robust research and development programme has allowed us to develop and bring innovative tailings solutions to market. We are constantly working to help our customers develop upgraded processes and technologies that will improve safety, reduce risk and minimise their environmental impact.

Our experience, across varied mining environments, allows us to appreciate the nuanced characteristics of different mining operations and what works best under specific conditions. Some of the operational considerations we evaluate include:

- The effect of grind size and ultra-fines on tailings dewatering
- Tailing dewatering and conveyability
- The total cost of ownership economics related to thickening versus vacuum filtration versus pressure filtration.

Advanced feedwell technology

The EIMCO® E-Volute™ feedwell is our latest evolution of feedwell design. With its patent-pending, advanced involute design, E-Volute evenly distributes feed within the thickener and minimises flocculant shearing.



Tailings management concerns



Water management

High water usage in areas of increasing scarcity and cost. Water management challenges in wet climates.



Waste management

Optimising waste storage can reduce footprint requirements of the mine site.



Environmental management

Pollution and contamination of ground water. Reclamation of tailings and waste areas at closure.



Risk management

Dam failures, which can be caused by a variety of sometimes unpredictable factors, can pose significant risk to people and the environment.



We partnered with a major gold producer to develop EcoTails®. Up until our collaboration, filtered tailings solutions had been uneconomical for mines with a throughput of more than 30,000 tonnes per day. This partnership changed that.

Our AFP-IV automatic filter presses are designed for the high-efficiency and high-availability requirements of tailings filtration. Not only does this equipment require significantly less space than old dewatering equipment, it also increases the amount of water for reuse, as well as decreasing the amount of water lost to evaporation and seepage.

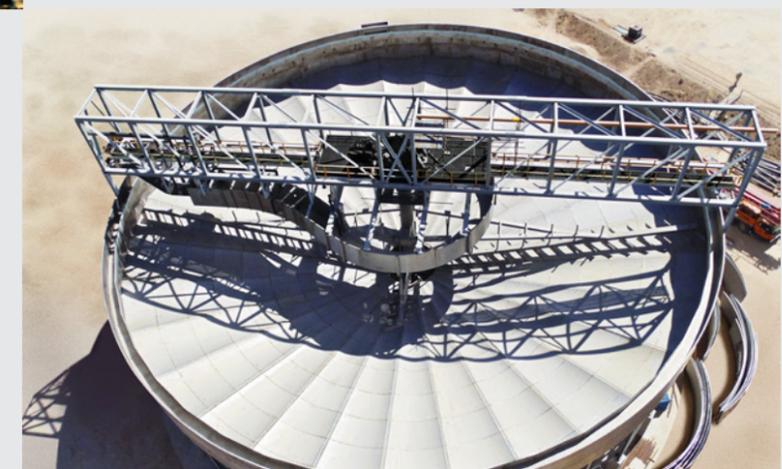


Technology highlights



EIMCO Deep Cone paste thickeners produce underflows concentrated to near their limit of pumpability. The deep tank design maximises solids concentration, and produces uniform, non-segregating underflow slurry with a paste consistency.

In developing our high-rate thickeners, we draw upon decades of experience in flocculation, feed dilution, and sedimentation technology from EIMCO and Dorr-Oliver®.



Tailings management is changing

Miners are looking to reduce the risk and consequences of dam failures. Regulation is likely to become tighter and affect mining globally. These risks and consequences can be reduced by cutting the amount of water stored within the tailings.

Challenges

- Acid rock drainage
- Regulatory risk
- Mine life
- Seismic activity
- High rainfall
- Water scarcity
- CAPEX limitations
- OPEX limitations

Filtered tailings

Paste thickener underflow

High-density thickener underflow

High-rate thickener underflow

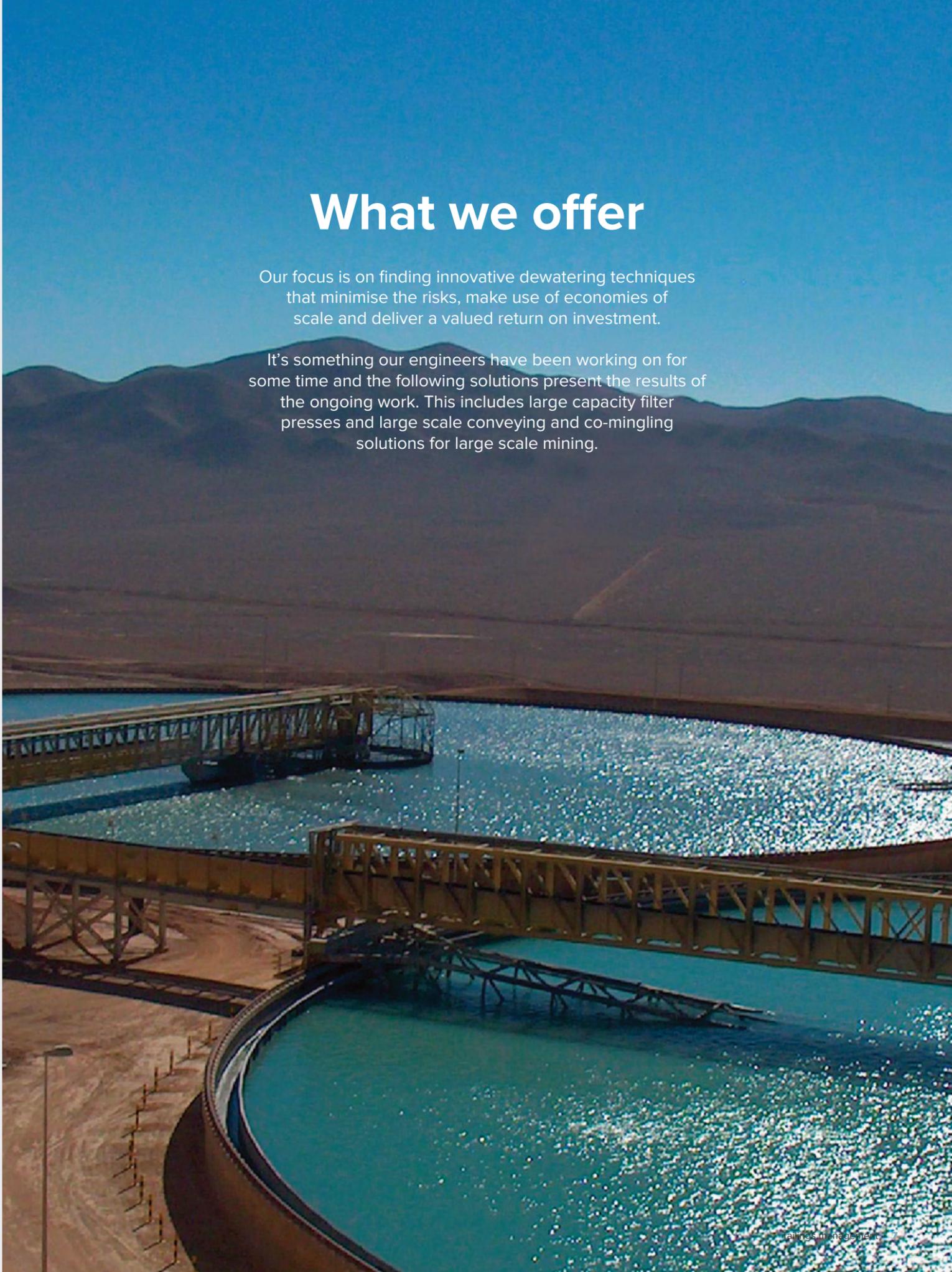
Cyclone sand dam



What we offer

Our focus is on finding innovative dewatering techniques that minimise the risks, make use of economies of scale and deliver a valued return on investment.

It's something our engineers have been working on for some time and the following solutions present the results of the ongoing work. This includes large capacity filter presses and large scale conveying and co-mingling solutions for large scale mining.



Sand dam tailings solution

Sand dams are the most common tailings storage facility and are made by splitting whole mill tails, typically 25 to 30% solids, into coarse and fine material using cyclones. The coarse material, potentially with waste rock, is used to build the walls of the dam. The fine material is pumped into the containment area and allowed to settle.

Advantages

- Low capital cost
- Low operating costs
- Suitable for a wide range of mining applications and volumes.

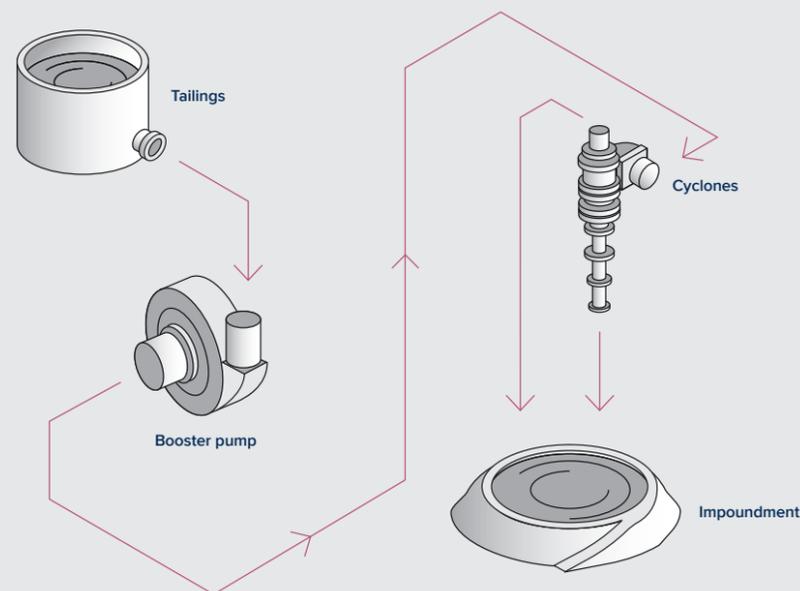
Technical challenges

- Requires high-availability, high-performance proven separation and pumping equipment.

Our technology solution

- KREBS® gMAX® cyclones incorporate performance-enhancing improvements to the inlet head, cylinder section, cones and apex to optimise cyclone performance by minimising turbulence while maximising tangential velocity.
 - Finer, sharper separations at high capacities
 - Fewer cyclones required for optimal performance
 - Extends liner wear life
 - Retrofit into existing installations

- SmartCyclone® is our monitoring and control solution that reduces cyclone-related process issues, improves cyclone overflow particle size distribution, and predicts and controls maintenance schedules.
 - Stabilised cyclone operation
 - Continuous wear monitoring and management
 - Predictable cyclone circuit maintenance
 - Increased production capacity: the process can be operated closer to the limits of the cyclone manifold design.
- KREBS® slurryMAX® pump range includes proven features such as an adjustable wear ring that closes the suction side impeller clearance between the suction liner and the eye of the impeller. This reduces hydraulic recirculation and helps maintain the design flow over the life of the pump, increasing the life of the impeller.
 - Even and predictable wear life
 - Interchangeable material options
 - Energy savings
 - Eliminate gland water requirements.



Thickened tailings solution

Our thickened tailings solution uses a high-rate or high-density thickener, resulting in 50 to 65% solids, to recover water in tailings prior to disposal. With this option, you will recover higher volumes of water and reduce losses to seepage and evaporation.

Advantages

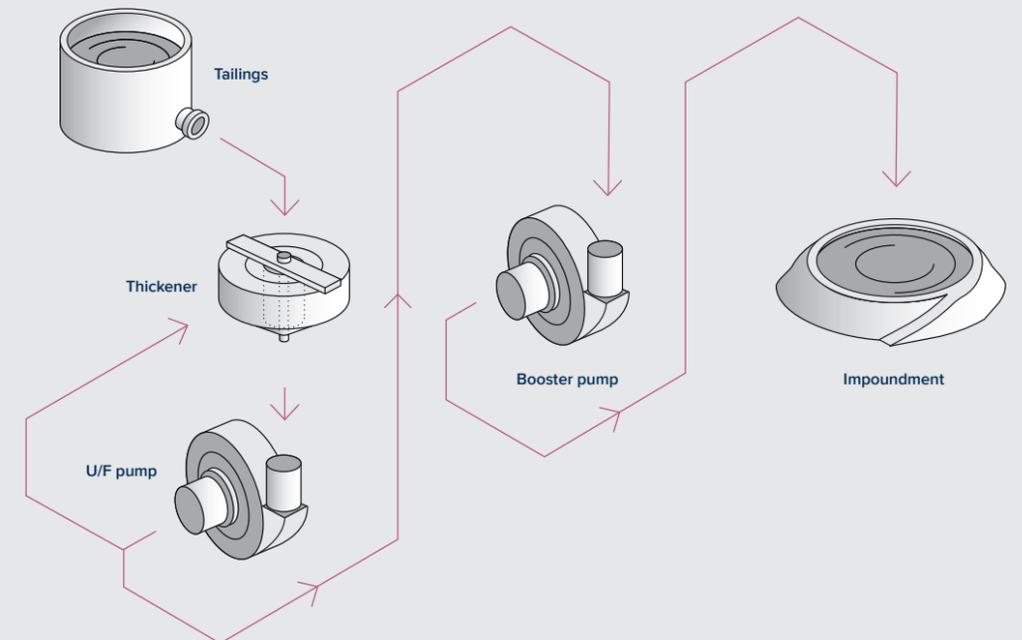
- Higher water reclamation for re-use
- Reduced chance of seepage and evaporation.

Technical challenges

- Requires large-volume thickening technology that incorporates optimised feedwell design and feed slurry dilution methods.
 - Energy dissipation and solids distribution need to be evaluated and feed-dilution systems should maximise flocculation efficiency and settling rates.

Our technology solution

- Derived from Dorr-Oliver® and EIMCO® technologies, our thickening equipment includes bridge-supported and column-supported designs to suit both smaller and larger throughput mines. Tanks can be in-ground, on-ground or elevated.
- High-rate and high density thickeners are designed to provide roughly 12 times the throughput of conventional machines of similar size.
 - Maximum capacity
 - Improved control
 - Increased underflow density
 - Lower flocculant dose.



Paste tailings solution

Our paste tailings solution uses a thickener, resulting in 65 to 70% solids in underflow, to recover water in tailings prior to disposal. With this option, the tailings have been significantly dewatered to a point where they do not have a critical flow velocity when pumped, do not segregate as they deposit, and produce minimal (if any) bleed water when discharged from a pipe.

Advantages

This solution offers the same advantages as thickened tailings, including better water recovery and cost savings, but also delivers:

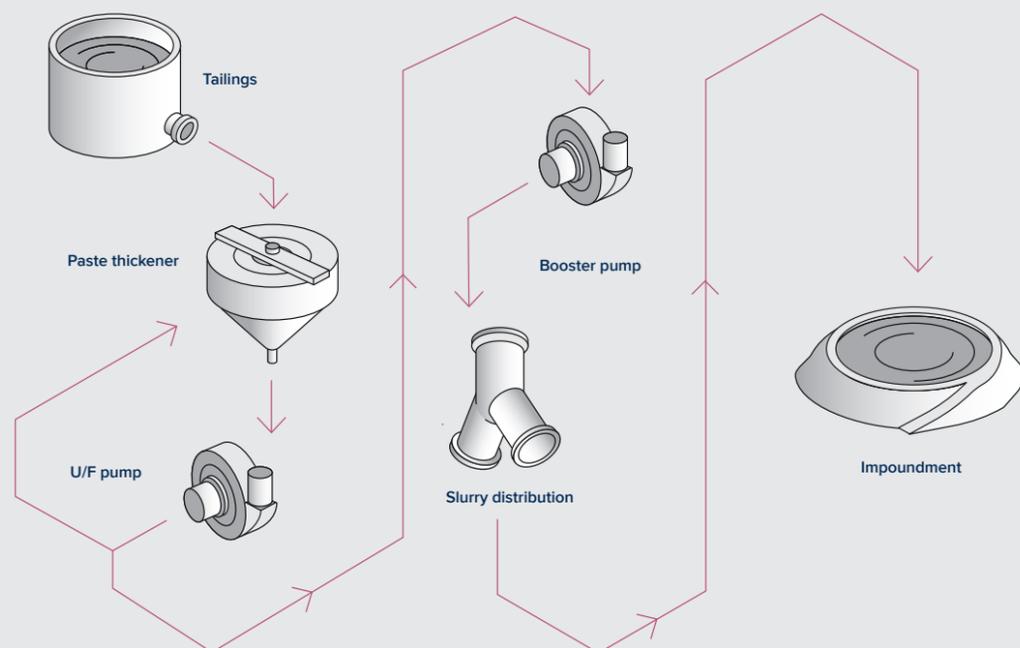
- Reduced pond size results in less seepage
- Better capacity-to-footprint ratio
- Further reduced risk of environmental damage as there is little or no water to aid the transport of the tailings if an embankment breach occurs
- Improved tailings stability.

Technical challenges

- Producing paste tailings requires a very high performance thickener. Very large torque drives and rake must be provided to discharge the paste tailings from the thickener. Special care must be taken to ensure that pumping of the discharged tailings does not limit the capacity of the thickener.

Our technology solution

- We have more experience than anyone when it comes to paste thickening. Our Deep Cone® thickeners produce underflow solids with the highest solids concentration of any thickener on the market.
 - The deep tank design maximises underflow concentration, and produces uniform, non-segregating underflow slurry with a paste consistency.



Paste backfill for underground mines

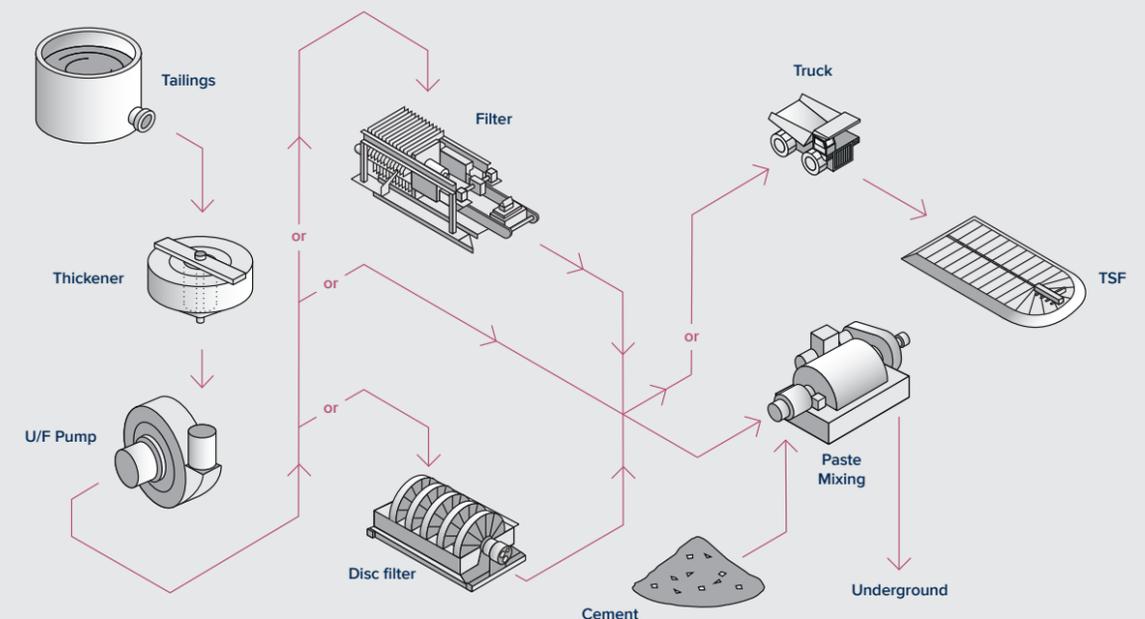
Tailings produced from our paste and/or filter tailings system can also be stored underground in previously worked-out voids. The tailings are dewatered and pumped below ground. The paste is often mixed with a binder, such as cement, to provide support to prevent heading collapse and subsidence issues. Any excess paste tailings can be transported to the surface tailings storage facility.

Advantages

- Minimal surface disturbance – reduced footprint, dust generation, visual impact and surface water contamination
- Backfill provides support to the underground workings, including reduced risk of rock bursts
- Binders help minimise groundwater contamination
- Reduced acid rock drainage (ARD) for certain ores
- Allows for previously unmined ore (pillars and supports) to be extracted.

Our technology solution

- We provide all the primary equipment for this disposal method. Our dewatering equipment has been used in the majority of paste backfill projects globally. This experience allows us to design the most economical solution - with the assurance of a single point of responsibility
 - The Deep Cone thickener underflow, or filter cake that is typically from one of our vacuum filter technologies, can be used in paste backfill operations.



Filtered tailings solution

Our filtered tailings solution, uses high-rate or high-density thickener followed by a variety of filters, resulting in 75 to 85% solids, to recover water in tailings prior to disposal.

Advantages

- Water reclamation and makeup water minimisation reduces costs
- Minimised tailings management facility (TMF) area – footprint can be less than 50% of a conventional TSF
- Reduction in closure costs at end of mine life – progressive closure possible
- Reduced tailings risk improves safety
- Suited to areas of high seismic activity.

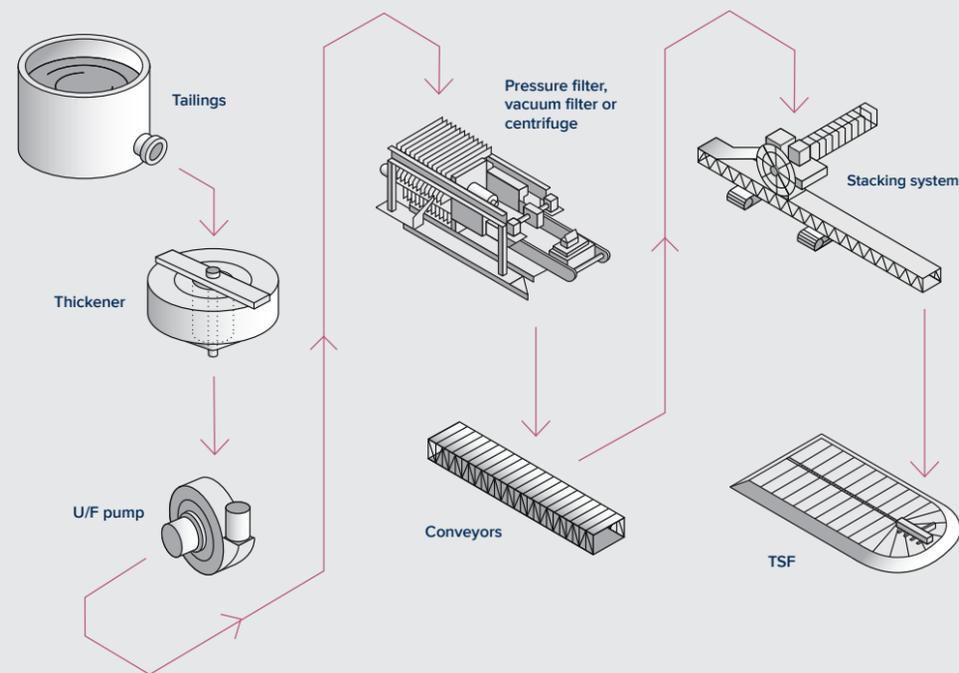
Technical challenges

- Selecting the correct filter for the tailings is critical. Some tailings can be sufficiently dewatered using a vacuum filter while other, more difficult tailings, require pressure filtration. The geotechnical properties of the stacked tailings will drive to

what degree the tailings must be filtered. The material handling system, conveyors and stackers, must be designed to match the quality of the filter cake produced. Designing a filtered tailings solution that is effective, but not capital or operating cost prohibitive, is required.

Our technology solution

- The trend in the industry is towards filtered tailings. Filtered tailings increase the amount of water returned to the plant for reuse, as well as decreasing the amount of water lost to evaporation and seepage.
 - Lower maintenance costs and higher performance
 - Easy operation and maintenance accessibility
 - Proven, high-performance design
 - Process control and DCS communication is available
 - A range of reliable dewatering equipment including vacuum filters, pressure filters and centrifuges.



Co-mingled tailings solution

We developed our co-mingling solution, named EcoTails®, in cooperation with Goldcorp. EcoTails blends “fast filtered” tailings with waste rock in transit and creates a geotechnically stable product called GeoWaste™. When blended properly, GeoWaste is easy to convey and has a high strength when stacked. EcoTails and GeoWaste make dewatered tailings possible for large scale mining, even in areas with high seismic activity.

Advantages

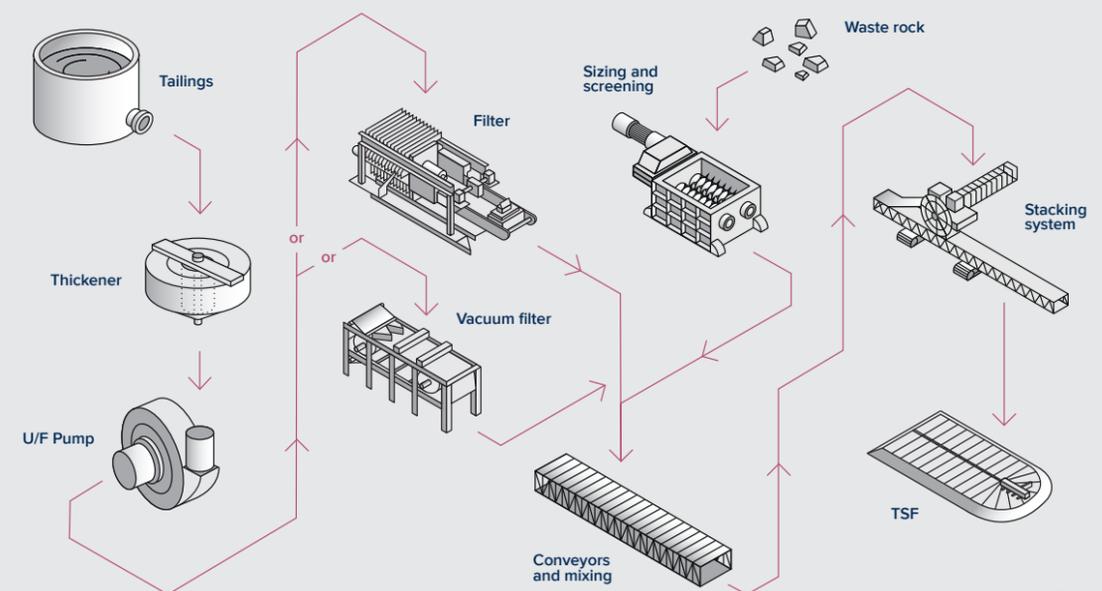
- EcoTails carries all the advantages of filtered tailings and delivers the following added bonuses:
- Tailings fill the void space between rock particles reducing the opportunity for oxygen flow
 - Reduced acid rock drainage (ARD) potential
 - Coarse waste rock particles provide shear strength for improved physical stability
 - Even smaller total waste footprint - achieved by combining both tailings and waste rock.

Technical challenges

- To deliver a large-scale dewatering and material handling solution to high tonnage mines that is economically competitive over the life of the mine.

Our technology solution

- Our fast filtering technology increases the speed of the filter process allowing greater volumes of tailings to be handled in a shorter time. Through this system, filter cakes with high moisture content are co-mingled with waste rock to provide the needed geotechnical strength for stacking.
- Fixed and semi-mobile crushing stations configured to process your waste rock for efficient co-mingling.



Finding the right tailings solution for your site

Every mine is different and each site has its own unique requirements and complications. There is no one-size-fits-all tailings solution. That is why we are dedicated to finding the solution that is right for you. This includes full-service technology trade off studies. We have all the dewatering equipment in-house and will quickly and economically provide the technology answers that best suit your application.

1

Testing

Before we can recommend a solution, we first need to develop a clear understanding of your mine. To achieve this, we carry out bench and pilot-scale testing, including:

- Sample Characterisation
- Sedimentation
- Rheology
- Filtration
- Conveyability

2

Evaluation

Once we have an understanding of your sample, we can combine it with site-specific input to assess the various tailings flowsheet options. We draw on our best practices, standards and experience to evaluate the different tailings solutions, including:

- Thickened tailings
- Paste thickened tailings
- Filtered tailings
- Filtered co-mingled tailings
- Paste or thickened co-mingled tailings

3

Solution

We engineer and recommend a solution that suits your environmental and economic needs. Our proposal will detail:

- Process flow diagrams
- Major equipment lists
- Installed power requirements
- Conceptual plant layouts
- Preliminary stacking plan if applicable
- General arrangement drawings of major equipment
- Equipment delivery estimates
- Recommendation of additional required testing if required
- CAPEX breakdown
- OPEX breakdown



Healthier economy in tailings management

Discover more about EcoTails, our sustainable solution for tailings management

<https://www.flsmidth.com/discover/healthier-economy-in-tailings-management>



The full package of dewatering and materials handling equipment

www.flsmidth.com



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Bringing better solutions to light

in the cement and mining industries

The future is full of possibilities and you are leading the way. But it's never a straight journey and it's easy to lose sight of true potential. With an ally by your side, who shares your ambitions and who sees your world from different angles, we will find the right way together.

For more than 135 years, we have challenged conventions and explored opportunities. Across more than 50 countries, we are 13,000 employees who combine our unique process-knowledge on projects, products and services to drive success. We develop the most advanced technology in our industries and offer market-leading product and service ranges.

Rooted in Danish values, we activate our knowledge and experience to navigate your complexity and bring better solutions to light. So no matter where in the world you are, we are here to help you discover new ground and achieve sustainable productivity enhancement.

We are the market-leading supplier of engineering, equipment and service solutions to customers in the global mining and cement industries.

We discover potential.

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