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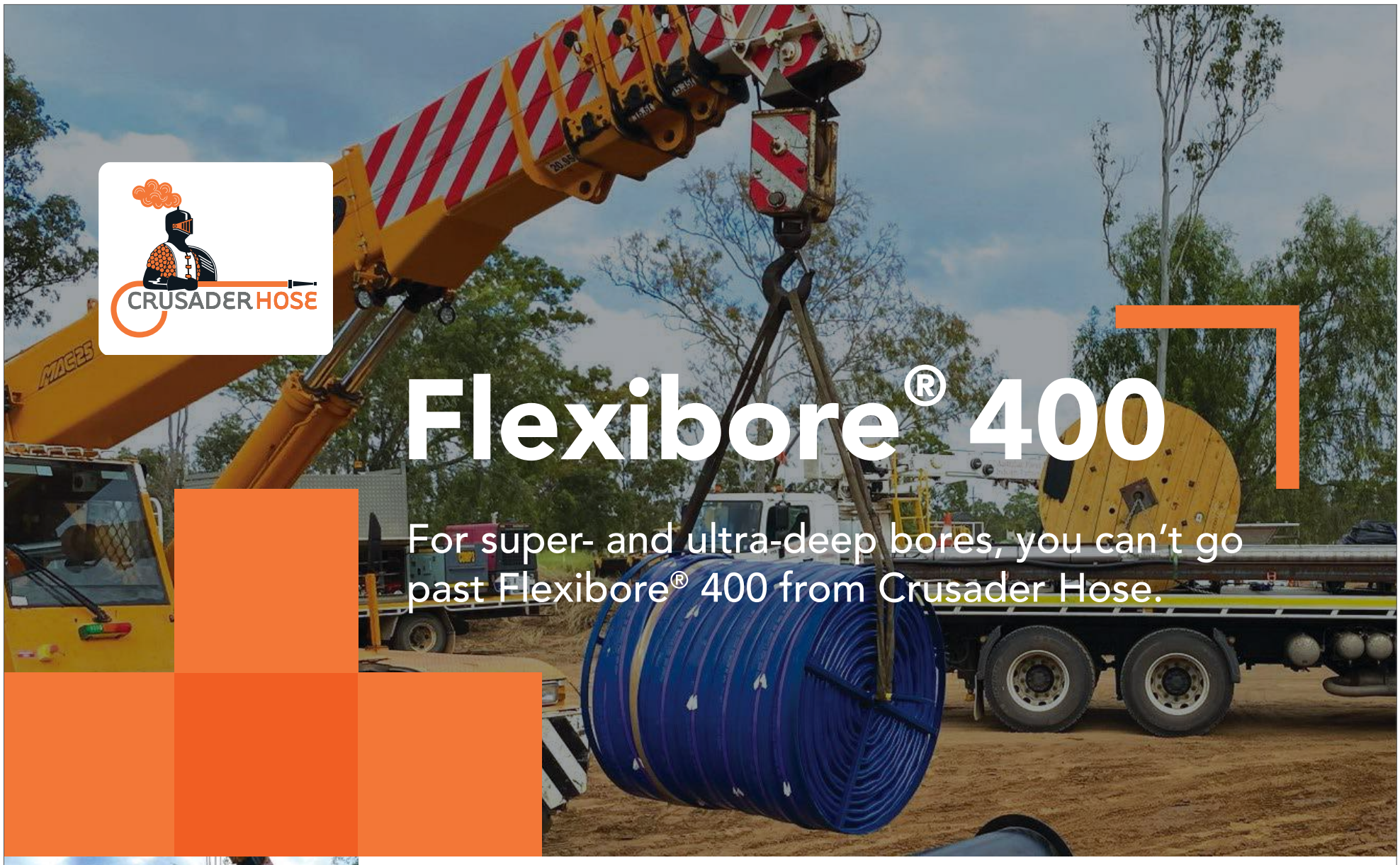
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REZ Completes Successful Granny Venn Toll 3 Milling Campaign

Resources & Energy Group Limited (ASX: REZ) has successfully wrapped up the third Granny Venn milling campaign (T3) in Western Australia.

A total of 29,641 tonnes were milled at St Barbara's Gwalia Processing Plant which resulted in the production of 97.3kg of gold dore, with an estimated and unreconciled gold content of 2,847oz.

An additional 614t of lower grade flushing ore was put through the mill on the final day of processing to liberate any entrained gravity or leach recoverable gold before completion of the toll campaign.

All campaign dore will be shipped to Perth Mint on Wednesday 20th April with outturns expected the following week. Final reconciliation will be completed as soon as all assays and outturns are received from the Perth Mint Refinery, and gold in circuit adjustments to production accounted for.

The completion of Toll 3 also marks the completion of waste and ore mining activities at the Granny Venn Cut-back. Operations are now focused on waste dump profiling, and haulage of ROM stocks to the Lakewood Gold Mill.

In this connection 10kt has been hauled to Lakewood as of 15th April. Ore carting of remaining ROM stocks, which are estimated to be between 20 and 25kt have recommenced in preparation for the projects fourth and final toll campaign. The fourth milling campaign is scheduled to commence at Lakewood in early May.

Hauling for the 4th Granny Venn milling campaign is now underway and further drilling and exploration work on various projects has also commenced.

With mining operations nearing completion, the Companies mining partner BM Mining Services will complete dump profiling, deep ripping and topsoil spreading of waste emplacements and commence demobilising.

Whilst these activities are underway the company is stepping up exploration across the broader East Menzies Project area.

This includes:

- a) drilling investigations within the Granny Venn, Maranoa, and Springfield Prospects. This work has already commenced.



- b) Planning work for a scout programme at Cock Robin (E29/979) is underway.
- c) At Springfield, work on reprocessing existing EM data-to remove IP effects has also commenced.
- d) Quotations for a Moving Loop EM survey at Springfield have been floated and are being reviewed by the Company.
- e) At Gigante Grande cultural heritage clearance surveys are scheduled to commence in late Aprill. Pending a successful outcome, this work will unlock 2000ha of prospective ground, enabling the company to advance exploration activity to test mineralisation north and south of exiting extents.

AMR

Australia Records Significant Jump In Critical Mineral Resources

Australia has seen significant increases in its inventories of critical mineral resources according to a report released by Geoscience Australia.

The annual Australia's Identified Mineral Resources (AIMR) report has tracked the nation's known mineral resources using industry data since 1975.

It found in the year to December 2020, Australia's economic inventories increased for rare earths (up 4%), lithium (up 8%), vanadium (up 23%) and platinum group elements, which increased an impressive 185%.

In the same reporting period, Australia:

- was the world's leading producer of iron ore and bauxite, and the critical minerals rutile and lithium,
- provided 49% of the global supply of lithium, which is essential for battery storage technologies and the transition to electric vehicles, and
- was a top five producer of cobalt, ilmenite, manganese, rare earths and zircon: essential critical minerals for advanced technologies and the modern economy.

AIMR also reports that in 2020, mineral exports were valued at $231 billion and investment in mineral exploration reached $2.8 billion, an increase of 6% compared to the previous year. This is the highest spend on exploration since 2012.

Geoscience Australia's Director of Mineral Resources Advice and Promotion, Allison Britt, said the increase in critical minerals was largely driven by additional exploration and rapidly rising global demand.

"We're seeing demand for these minerals grow, particularly as the world transitions to low-emissions technologies," Ms Britt said.

"The International Energy Agency forecasts nickel and lithium use in batteries will increase sixfold and thirteenfold, respectively, by 2040. There is an urgency to discover new world-class resources to meet this projected demand and further develop the pipeline of mineral resources that will anchor secure supply chains for Australia and our partners."

Ms Britt said the report also shows a boost to Australia's emerging potash industry. Potash is an essential fertiliser mineral used by the agriculture industry.

"Australia's economic resources of potash increased 21% in 2020. While not included in this report, it is exciting to see the first commercial domestic production of potash in Australia achieved in late 2021. With this, Australia is on its way to reducing its reliance on imports and strengthening national food security," Ms Britt said.

"The new potash industry, stimulated by Geoscience Australia's salt lake study in 2013, clearly shows the benefits of government leadership in delivering precompetitive geoscience data and information through initiatives such as the $225 million Exploring for the Future programme."

The Geoscience Australia-led Exploring for the Future programme is supporting industry to discover new mineral resources across the country. From 2016 to 2020, the programme mapped more than three million square kilometres of northern Australia.

AIMR 2021 provides valuable insight for governments and industry to measure the impact of COVID-19 on our minerals industry and monitor the recovery. ***AMR***



Musgrave Confirms "Blue Sky" Upside At Big Sky

Musgrave Minerals Ltd (ASX: MGV) has obtained further strong assay results from reverse circulation (RC) and diamond drilling at the Big Sky Prospect along the new gold corridor south-west of Lena and Break of Day, on its 100% owned ground at its flagship Cue Gold Project in Western Australia's Murchison district.

Managing Director Rob Waugh said all recent drilling results for Big Sky have now been received and will form the basis for a maiden Mineral Resource Estimate that will focus on the near surface mineralisation at Big Sky.

The scheduled mineral resource update will also include a maiden resource for the high-grade White Heat-Mosaic deposit and is expected to be completed in May-June 2022.

Highlights:
New intercepts include:

- 6m @ 19.2g/t Au from 87m (22MORC039)
- 3m @ 20.3g/t Au from 26m (21MORC274)
- 2m @ 34.9g/t Au from 62m (22MORC038) o 8m @ 6.0g/t Au from 65m (22MORC008)
- 9m @ 5.4g/t Au from 53m (22MORC010) o 5m @ 5.9g/t Au from 29m (21MORC025)
- 6m @ 4.1g/t Au from 114m (22MORC037)
- 5m @ 3.4g/t Au from 53m (22MORC035)
- 2m @ 9.0g/t Au from 18m (22MORC024)
- 2m @ 7.6g/t Au from 18m (22MORC023)
- 2m @ 7.6g/t Au from 60m (22MORC028)
- 2m @ 7.0g/t Au from 10m (21MORC273)
- Diamond drilling has also confirmed the mineralisation with intervals of:
- 6.3m @ 9.7g/t Au from 39.6m (22MODD003)
- 2.0m @ 9.0g/t Au from 127m (21MODD043)

"The latest assay results from resource drilling at Big Sky confirm the potential of the system to host higher grade zones and improves the confidence in the geological continuity of the system," Mr Waugh said.

"The scheduled May-June resource update will focus only on the top 100 vertical metres (dominantly weathered open cuttable mineralisation) and be an interim Mineral Resource update (adding Big Sky and White Heat-Mosaic) as we continue to grow our resource base.

"The high-grade gold mineralisation at Big Sky remains open down dip in fresh rock, which will be the focus of subsequent drill programs planned to commence in late May 2022."

Background
RC and diamond drilling at Big Sky, 2km south-west of Lena-Break of Day within the new 7km-long gold corridor on MGV's 100% ground continues to intersect significant gold mineralisation below thin transported hardpan cover (~1-6m thick).

The Big Sky gold prospect extends for over 2.6km of strike and has only been tested near surface to date (within ~100m). It remains open depth.

The current phase of resource definition RC and diamond drilling that focussed on the top 100 vertical metres at Big Sky is now complete with assays results received for the final 43 RC and 8 diamond drill holes in the program.

The drilling was focussed on testing the continuity, grade and down dip extent of the Big Sky mineralisation from surface through the weathered zone and into the top of fresh basement rock.

Significantly, drilling has continued to intersect multiple, parallel, high-grade mineralised zones often associated with larger envelops of lower grade mineralisation. Grade variability is significant within the regolith. The gold mineralisation is hosted within a package of sedimentary rocks and porphyry intrusives.

The extensive nature and continuity of the gold mineralisation supports the view that the Big Sky prospect has strong potential to significantly add to the company's existing resource base at Cue.

The collection of specific gravity (rock density) data from drilling is ongoing, along with the geological modelling that will focus on delivering a maiden Resource Estimate for Big Sky in May-June 2022. ***AMR***

Rox Lifts Youanmi Near Surface Resource To 1.0Moz Au

West Australian gold exploration and development company, Rox Resources Limited (ASX: RXL) has reported a significant increase to the Mineral Resource Estimate (MRE) for the Youanmi Gold Project near Mt Magnet, WA.

Highlights:

- Youanmi Near Surface Resource increased by 204Koz Au to 1,004Koz Au
- This resource upgrade incorporates 16,000m of additional RC drilling above 160m vertical depth and delivers a 26% increase in the Near Surface Resource contained gold.
- Youanmi Mineral Resource inventory has increased by 93% from 1.7 million ounces (June 2021) to 3.2 million ounces following an intensive exploration campaign throughout 2021 and early 2022.
- All in exploration costs on a rolling average basis for the project (Underground and Near Surface Resources) since project acquisition indicate an average $7 per ounce discovery cost (approximately $10 per ounce discovery cost for the Near Surface Resource in this update).

Drilling and exploration work at the Youanmi Gold Project predominantly in the OYG JV area (Rox 70% and Manager, VMC 30%) has yielded substantial increases in known and defined tonnages and ounces since acquisition and commencement of drilling in Mid-2019.

"We are very pleased to announce this increase to the Near Surface Resource Estimate at Youanmi following the inclusion of newly delineated mineralised zones along the mine corridor including the Link, Footwall Lodes and Hanging-wall Lodes," Managing Director, Alex Passmore, said.

"The lift in the Near Surface Resource incorporates data from 16,000m of RC drilling undertaken in the second half 2021 and early 2022.

"The substantial increase in both Near Surface and Underground resources at Youanmi is testament to the strong geological understanding our exploration team has developed, allowing for precise and effective targeting of gold lodes that continues to deliver strong results.

"The scale of Youanmi is starting to become more apparent and in line with our high level of confidence in the Project. This resource will underpin the open pit component of the company's Scoping Study which is on track for completion in the middle of the year." ***AMR***

Winsome Advances Exploration as Canada Moves on Critical Minerals



The odds keep stacking in ASX-listed Winsome Resources' (ASX:WR1) favour with lithium demand going from strength to strength and commitments from the Canadian and US governments to sure up domestic and allied critical mineral supplies.

Following US President Joe Biden's recent commitments to secure supplies of critical minerals internally and from allies including Australian and Canada, Canada's Federal Budget announced last week included up to C$3.8 billion to implement the country's first Critical Minerals Strategy. And lithium plays a major role in those strategies.

The announcements come as Winsome progresses its drilling programme at the company's flagship Cancet project and plans for additional exploration work at two of its other projects in the James Bay region of Quebec.

With snow beginning to melt in Quebec, field teams will commence exploration work at Sirmac-Clappier and the company's latest acquisition, Decelles, which make up two of Winsome's four projects in the province.

Initial work will include rock sampling, processing magnetic data and generating targets for future drilling campaigns.

Winsome Managing Director Chris Evans recently returned from three weeks visiting the projects. "We have acquired magnetic data, aerial photographs and satellite images for the properties which are very useful because of the huge granite outcrops found in the area," Mr Evans said.

"The first thing we're going to do is to get out to these targets via helicopter and take rock samples, while processing the magnetic data and generating targets. And when the snow is fully melted, we'll get field teams on the ground there again."

Mr Evans said it was an exciting time for the company with the team aiming for a maiden resource at Cancet next year and exploration activities soon to be up and running across three of the company's projects. Winsome commenced drilling 20 holes at Cancet last month with visible spodumene crystals detected in the initial drill core.

While Mr Evans says this does not necessarily equate to lithium mineralisation until confirmed by chemical assay, the signs are encouraging.

With contractors unavailable, Mr Evans and Winsome Country Manager Carl Caumartin spent 10 days clearing the drill pads and establishing the site at Cancet – in more than a metre of snow and minus 30C temperatures – so the drill program could begin.

Core samples from the first six holes at Cancet have been shipped to the laboratory for assay, with results from the initial batch expected in the next four weeks. The remaining drilling is expected to conclude in the next week with additional sampling results expected within six weeks.

Winsome is also completing a two-week gravity survey of the area with results due in about a month.

"The survey will enable us to match resulting gravity anomalies with the magnetic anomalies already identified over the existing ore body, allowing targets to be generated for the spring and summer exploration activities," Mr Evans said.

The surveying provides Winsome with targets identified over all of its 395 claims at Cancet. Two field teams will then be deployed to investigate these targets.
"One field team will be investigating the targets, taking rock chip samples and finding out if there is likely mineralisation there," Mr Evans said.

"There will also be a field sampling team sitting on the known pegmatite we have already found. This team will be doing channel sampling, sawing through the pegmatites at outcrop, taking samples to work out structurally how it is sitting in the ground.

"This gives us more knowledge on where it is formed, how it is lying and where it is likely to extend to so we can try to find more pegmatites and more lithium."

Mr Evans said by October, when exploration has homed in on the targets thought to be mineralised, Winsome would be able to get drill rigs on to those sites.

"It really becomes a continual cycle of target identification, drilling new targets and drilling the current area where we know we have this mineralised pegmatite," he said.

"We can then aim towards a maiden resource at Cancet by this time next year." Mr Evans said the Canadian trip also reinforced to him the country's reputation as a quality mining jurisdiction and support for new ventures.

"We are definitely in the right place at the right time," he said. "Quebec is a great place to be establishing a project and the Critical Minerals Strategy announced in the Canadian Budget, coupled with the US moving to secure supplies, puts us in a very enviable position." ***AMR***

Estrella Finds Further Sulphides At Depth Below T5

Estrella Resources Limited (ASX: ESR) has intersected a broad ~24m wide zone containing a cumulative 17.5m wide Ni-Cu sulphide intersection below the T5 nickel discovery in the 946m deep downhole electromagnetic (DHEM) platform hole CBDD067 at the Carr Boyd Project in WA.

The intersection occurred between ~782m-806m on the T5 Basal Contact, 80m south and 150m below the massive sulphide discovered in CBDD042A1 which until now has been the deepest intersection informing the known T5 mineralisation.

The drillhole was designed to intersect the basal contact underneath a set of flat faults that have been inferred from geological studies on previous drilling.

DHEM will be used down this hole to explore a large vertical section of the basal contact for additional massive sulphides often seen associated with the silicasulphide plume material identified in CBDD067. This method of establishing deep DHEM platform holes was used successfully by Estrella in 2020 to discover the T5 mineralisation along the basal contact of the Carr Boyd Intrusion.

"Making further sulphide discoveries at depth is very encouraging as this is the deepest intersection of T5 mineralisation drilled to date by Estrella, further highlighting the continuing expansion of T5 mineralisation," Managing Director Chris Daws said.

"Through methodical drill testing, we are gaining a better understanding of the geological setting at T5. CBDD067 will allow our teams to undertake a DHTEM survey to further test the surrounds for possible massive sulphide accumulations.

"There is still a very large area of highly prospective basal contact at the Carr Boyd intrusion yet to be fully tested and we look forward to the second new diamond rig arriving on site to expedite the exploration activities."

Regional Exploration

The Phase 5 regional programme continues with the diamond drill rig moving back to Mossgiel to continue a series of DHEM platform holes, the latest of which is CBDD068 (Figure 2). Phase 5 involves drilling a series of holes where previous RC and diamond drilling has located nickel sulphides in pyroxenites on the basal contact.

Some 12km of fertile basal contact has been mapped to date, comprising three main prospects; Mossgiel, T5-Broonhill and Gossan Hill. Scout drilling at all three prospects had proven that the rocks in these positions are fertile, containing nickel-copper sulphides.

Phase 5 is aimed at systematically covering a cross-section of the contact with diamond drilling and DHEM so as to locate additional massive sulphides. To assist in timely exploration, a second diamond drill rig is expected on site shortly to assist in completing a series of exploration holes between T5 and Broonhill. ***AMR***

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First Au granted Victorian Exploration Licenses

First Au Limited (ASX: FAU) has been granted four Exploration Licenses at its Victorian Goldfields project in East Gippsland, Victoria.

The granted licenses constitute a substantial increase in area for the VicGold project and are considered to be of significant strategic importance to the project.

The newly granted tenements EL006975, EL006976, EL006977 and EL007335, cover an area of ~2,200 sq. km and collectively contain numerous, highly prospective prospects including the Dogwood Porphyry Copper-Molybdenum project, the greater Haunted Stream area, the Birregun Orogenic Au, the Dargo High Plains Deep Leads Au projects and open westerly extension to the Snowstorm Project area.

Update on planned drilling at Dogwood

EL006977, containing the Dogwood Porphyry Copper project, is currently a high priority project, prospective for copper, gold and molybdenum. With the tenement now granted, the Company can proceed with its planned drill programme.

The company has a rig secured and plans to commence drilling within the next month, further details regarding the program will be provided once the Company has confirmation the rig is on site.

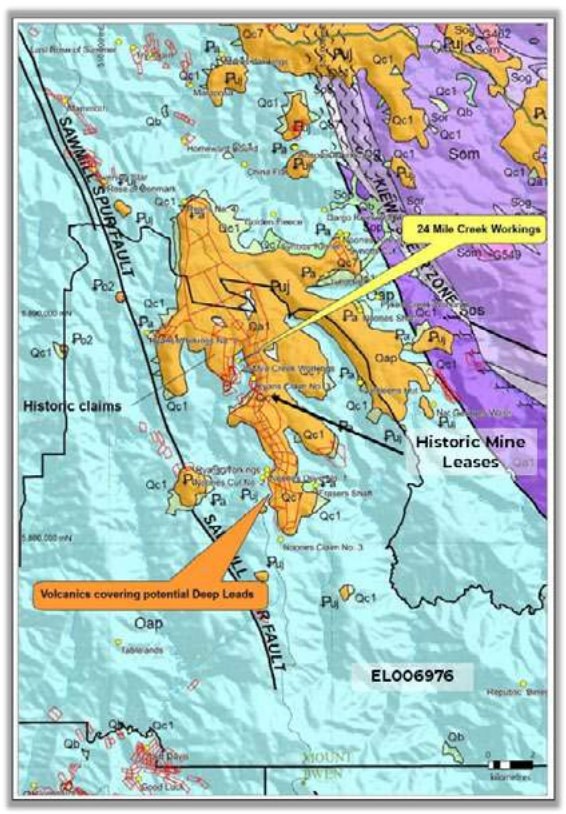
The Dogwood project was discovered by Australian Anglo America Prospecting (AAAP) in 1980 and last drilled by CRA Exploration in 1994, but more recent exploration in the area has been limited. Historic exploration has underlined its potential, with best intersects from drilling by CRA, including 13.2m @ 1.33% Cu (from 28m; DD94OR46) and 30m @ 0.5% Cu, including 8m @ 1.2 % Cu (from 54m; RC93OR25).

The upcoming drill programme will focus on testing the extent of economic grade potential within the project area specifically for copper, molybdenum and gold commodities.

EL006975, EL006976 and EL007335

EL006975 surrounds the Haunted Stream Au corridor and forms the greater exploration area for the central corridor (EL006816). FAU has developed a new understanding for mineralisation controls across the region which has significant implications outside of the immediate Haunted Stream EL006816 area. The newly expanded tenement area hosts numerous highly prospective target zones, including the Yahoo Creek Au zone, Sandy Creek and Black Snake Creek Au zones in the south and Joe's Reef and Ensay Syndicate workings in the north, hosted in Pinnak Sandstone. These prospects underpin the extended prospectivity extended well beyond the Haunted Stream workings.

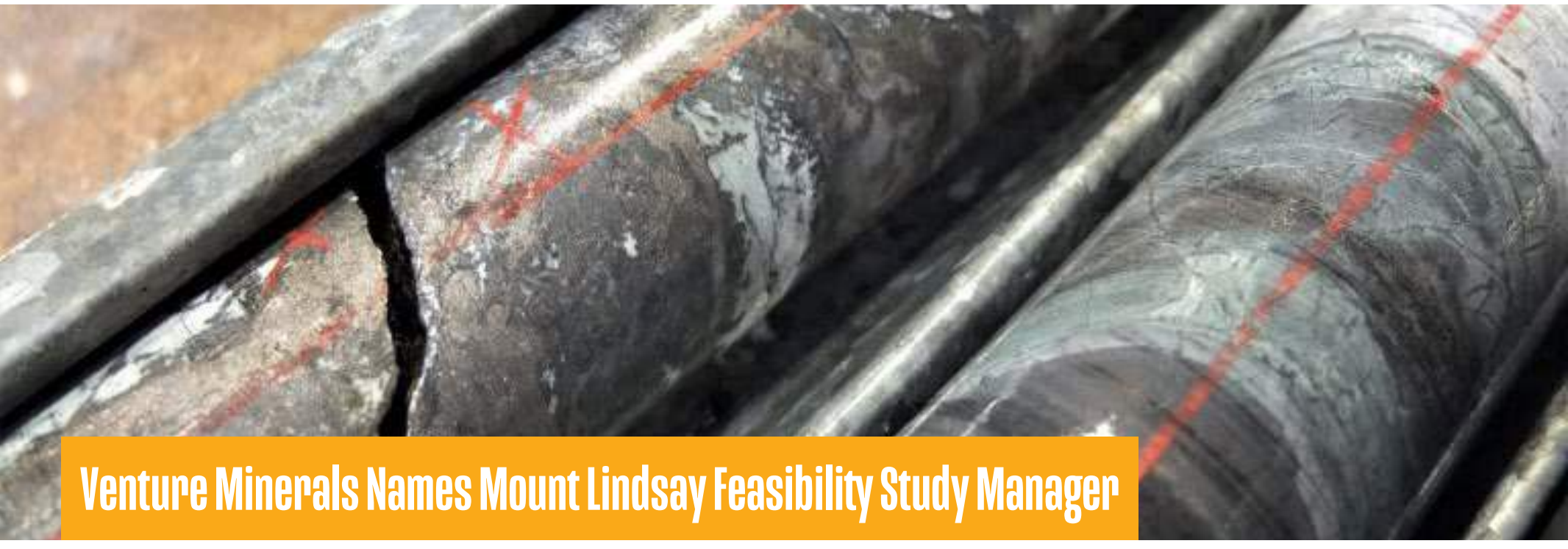
EL006976 is north-west of the town of Dargo, with the tenure containing numerous historic gold workings including highly prospective orogenic auriferous reef and lode deposits as well as recent stream alluvial "Deep Lead" deposits. Recent geological data is limited across these deposits. However historical production reporting suggest that they were quite Au-rich in places. Across the main historic mine workings, an encouraging historical production record minimum of > 2,000 Oz production indicates the opportunity for gold exploration across this tenement.



EL007335 is the extension of the Snowstorm project, FAU's most advanced project in the area and contains numerous highly prospective historic workings. Importantly the extension to the Snowstorm mineralised trend, hosted by the Cassilis shear zone, extends west into the newly granted tenure. Of significant interest are the historic gold workings adjacent to and hosted within biotite-hornblende granodiorites.

The **EL007335** tenement contains numerous high-potential targets and when combined with the adjacent Snowstorm tenement package (EL5505 & PL007319), underpin FAU's belief in the economic potential of this district. The recently acquired LIDAR data highlights historic workings along strike to the west of the Snowstorm project.

The integration of both 'boots on ground' coupled with the application and use of new exploration technologies (LIDAR), provide FAU with a more detailed understanding of the mineralisation systems across the district and assists in further drill hole targeting. ***AMR***



Venture Minerals Names Mount Lindsay Feasibility Study Manager

Venture Minerals (ASX:VMS) has appointed highly experienced Mining Engineer Glenn Van Vlemen to lead the Mount Lindsay underground Feasibility Study in Tasmania.

The Feasibility Study is well underway with the recent completion of the Metallurgical Drilling Programme, the critical long lead item of the Study.

Meanwhile, new drilling at the Mount Lindsay Tin-Tungsten Project continues to deliver outstanding intersections of high grade mineralisation whilst targeting high grade zones within the existing Main Skarn deposit including 158.5 metres (m) @ 0.8% Tin (Sn) and 0.1% Tungsten (WO3) from 78 m in ML344M and likewise within the No.2 Skarn deposit with 99 m @ 0.3% WO3 from 63 m in ML347M.

The intersection in ML344M included a high grade zone of 39 m @ 2.6% Sn and 0.04% WO3 from 165 m or 12 m @ 7.0% Sn and 0.1% WO3 from 192 m, whilst the intersection in ML347M included a high grade zone of 21 m @ 1.2% WO3 from 87 m.

The significant intersections from ML344M in the Main Skarn include the following:

- 158.5 m @ 0.8% Sn and 0.1% WO3 or 1.0% Sn Eq from 78 m including 123 m @ 1.1% Sn and 0.1% WO3 or 1.2% Sn Eq* from 81 m, or 39 m @ 2.6% Sn and 0.04% WO3 or 2.7% Sn Eq* from 165 m, or 12 m @ 7.0% Sn and 0.1% WO3 or 7.0% Sn Eq from 192 m.

The significant intersections from ML347M in the No.2 Skarn include the following:

- 99 m @ 0.3% WO3 or 0.7% Sn Eq from 63 m including 21 m @ 1.2% WO3 or 1.6% Sn Eq from 87 m.

"Venture is fortunate to have engaged a very experienced underground mining engineer who has worked in Tin and is therefore well suited to run the updated Mount Lindsay Feasibility Study," Managing Director Andrew Radonjic, said.

"Glenn's appointment has coincided with the completion of the metallurgical drill programme, a significant milestone for the company as it moves through the Study.

"The Feasibility drilling at Mount Lindsay continues to deliver excellent tin and now tungsten intersections within the high-grade shoots of the Main Skarn and No.2 Skarn.

"Mount Lindsay clearly demonstrates the potential to be a vital source of EV metal and Critical Minerals for the world and can be developed in a net zero emissions environment, and is therefore an important part of the decarbonisation of the global economy.

"The Metallurgical Drill Programme is now completed, and Venture looks forward to ramping up our exploration efforts with drilling scheduled to test multiple high priority targets over the coming months within Australia's premier tin district in the Northwest of Tasmania."

Mount Lindsay is already one of the largest undeveloped tin projects in the world, containing in excess of 80,000 tonnes of tin metal and, within the same mineralised body, a globally significant tungsten (Critical Mineral in Australia) resource containing 3,200,000 MTU (metric tonne unit) of WO3. Over 100,000m of diamond core drilling has been completed on the project predominately by Venture, which hosts a JORC compliant resource, 70% of which is in the Measured & Indicated categories.

Tin is an EV Metal. It is listed as a Critical Mineral (as is Tungsten) by numerous countries around the world and is currently trading at ~US$42,500/t which is over four times the price of Copper at ~US$10,000/t.

There is currently about two days' global supply of tin held in stockpiles by the London Metal Exchange (LME). ***AMR***

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- POA



2017 CATERPILLAR 966M

8,885Hrs. A/C Cabin, Auto Lube, GP Bucket, Ride Control

- POA



2016 CATERPILLAR 914K

1,580Hrs, GP Bucket, Forks, Hyd Coupler, Ride Control, Auto Lube, 3rd Valve

- POA



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4,647Hrs. GP Bucket, Forks, Fusion Coupler, EStops, Isolators, Loadrite

- POA



2016 CATERPILLAR 980M

10,700Hrs. GP Bucket, Auto Lube, Ride Control, Reverse Camera, Tyres 50%

- POA



2020 CASE 1650M LGP

28Hrs, VPAT Blade Folding, MS Ripper, Accugrade Ready, Diff Steer, EStops

- POA



2018 CATERPILLAR D8T

1,565Hrs, TIER 4, SU Blade, MS Ripper, ARO Ready, Diff Steer, EStops

- POA



2017 CATERPILLAR D8T

1,900Hrs. SU Blade, Single Tilt, A/C ROPS Cabin, MS Ripper

- POA



2013 CATERPILLAR D9T

12,590Hrs. A/C Cab, SU Dual Tilt Blade, Ripper

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2018 LIEBHERR PR766

1,744Hrs. Fire Supp, EStops, Isolators, Rear Camera, Touch Scrn, SS Ripper

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2008 CATERPILLAR 740

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Western Australia Tops Global Rankings For Mining Jurisdictions

Western Australia is the most attractive jurisdiction in the world for mining investment according to the prestigious Annual Survey of Mining Companies recently released by the Fraser Institute, an independent, non-partisan Canadian policy think-tank.

WA was named on top followed by Saskatchewan (second) and Nevada (third) with Zimbabwe last.

"The Fraser Institute's mining survey is the most comprehensive report on government policies that either attract or discourage mining investors, and Western Australia ranks highest of anywhere in the world," said Elmira Aliakbari, director of the Fraser Institute's Centre for Natural Resource Studies and co-author of the report.

This year's report ranked 84 jurisdictions around the world based on their geologic attractiveness (minerals and metals) and government policies that encourage or deter exploration and investment.

Rounding out the top 10 jurisdictions are Alaska (fourth), Arizona (fifth), Quebec (sixth), Idaho (seventh), Morocco (eighth), Yukon (ninth), and South Australia (10th).

This year's least-attractive jurisdictions include Zimbabwe and four jurisdictions in Latin America (including Argentina and the Caribbean).

"A sound regulatory regime coupled with competitive taxes make a jurisdiction attractive to investors," said Jairo Yunis, Fraser Institute policy analyst and report co-author.

Australia Remains A Mining Leader

The Minerals of Council of Australia (MCA) has welcomed the news that the latest release of the Fraser Institute's Annual Survey of Mining Companies has confirmed Australia as a world-leading destination for mining investment.

Australia ranked No.1 of all countries with Western Australia ranked the highest of any mining region in the world.

The report ranks mining regions on their geological potential and investors' perceptions of policy to provide an overall rating of investment attractiveness.

MCA CEO, Tania Constable, said Australia has again rated favourably against its competitors, with five states ranked inside the top 20 mining regions in the world.

The report also notes that Australia continues to be the most attractive region in the world for mining investment based on an average of all states; however, it also highlights that all States experienced a deterioration in their ratings of policy perception.

"There is an urgent need for governments to address this slide. Australia cannot continue to rely on its geological potential alone to attract investment with key competitor regions for mining investment in Canada and the United States being more favourably viewed on their policy settings," Ms Constable said.

"Policies that deliver globally competitive tax rates, greater regulatory certainty particularly in streamlining environmental assessment and approvals between the Australian Government and States, more workplace relations flexibility and increased government funding for pre-competitive exploration programmws are all essential to mining's long-term future and Australia's economic prosperity."

Victoria Moving Up But Still A Way To Go

Meanwhile, the latest Fraser Institute survey shows an improvement in Victoria's ranking on mining investment policy perceptions up from 56th in 2020 to 39th in 2021 out of 84 mining jurisdictions.

The MCA, said that while this is a welcome improvement, Victoria has a lot of work to do to improve the regulatory environment and tax regime to attract investment into the State with Victoria ranking lowest of all Australian states.

According to James Sorahan, Executive Director, MCA Victoria, the overall improvement investment attractiveness has been driven by Victoria's minerals potential and exploration effort by industry.

"Victoria's ranking was negatively impacted by a decline in policy perceptions driven by poor government regulation and skills challenges, particularly uncertainty concerning the administration of regulations," Mr Sorahan said.

"Victoria is still dealing with the repercussions of the State Government's gold royalty which imposed a higher royalty on Victoria than Western Australia – Australia's biggest gold mining state. Victoria's reputation as a high taxing jurisdiction ranks the State as the worst in Australia on tax.

"Victoria's minerals potential means the state is well placed to continue to see exploration spending remain strong."

Mr Sorahan said a growing minerals industry is good for all Victorians.

"Minerals projects play an important role in regional development by creating high paying jobs and supporting a supply chain of Victorian businesses to the tune of over $300 million in 2021."

Victoria is home to two of the world's highest grade gold mines and gold production has more than doubled in the last five years.

"There are a number of potential new projects across the state in mineral sands, and copper and zinc," Mr Sorahan said.

"Exploration spending is at a record high with $220.4 million spent in 2021 – an 822 per cent increase since 2015.

"However, the record investment in exploration in recent years must be able to be converted into new mines where clear and consistent environmental, social and safety requirements are met," Mr Sorahan said.

"Investors require clarity on approval processes and timeframes and certainty that meeting or exceeding environmental, safety and social requirements should lead to a project being developed.

"As a highly regulated industry, efficient government policy and regulation is critical to ensure the minerals industry can contribute to regional development. Delays in approvals and additional or changing unnecessary regulation has significant impacts in investment and jobs.

"A well-funded regulator that meets its own timelines for permit approvals, confidence in the permitting and environmental approvals, and clear regulations will help improve Victoria's policy perceptions.

"The 2021 Fraser survey is a reminder that Victoria requires modernisation of the regulatory framework to improve approvals timeframes, urgent reforms to the exploration licensing regime to bring Victoria's licencing in line with other states on longer licence terms and less land relinquishments, and royalty reform to bring the effective rate into line with other states tailored to Victoria's geology.

"Mining and exploration needs to be a high priority for Victoria so that the state can compete for investment in this global industry to the benefit regional jobs." ***AMR***

WA Mining And Resources Contributes $100B To Australian Economy

An analysis of 56 Western Australian resources sector companies has found the State's mining, oil and gas, energy and contractor industries contributed a direct $100 billion to Australia's economy in 2020-21 and directly provided more than 70,000 full-time jobs.

The survey asked Chamber of Minerals and Energy of WA member companies how much they contributed and where.

CME Director of Policy and Advocacy Rob Carruthers said the data provided a telling snapshot of the day-to-day impact of the WA mining and resources sector to economies and communities across the country.

"It's well-acknowledged that the past couple of years have involved some significant challenges for our sector – including the management of COVID-19 and ongoing skills and supply chain constraints," Mr Carruthers said.

"CME is extremely proud of the way WA mining and resources has been able to operate both safely and effectively during the pandemic, and we're extremely grateful for the hard work, professionalism and dedication of our workforce.

"They haven't just got the job done, they've doubled down when the sector needed them most, and this economic contribution data reflects that.

"The results of this survey capture only a snapshot of our members' direct contribution, so the 'total' sector-wide figure to the broader economy is likely to be significantly more than the $100 billion."

The annual economic factsheets produced out of the data show:

- The direct contribution by the 56 CME member companies to the WA economy was more than $61 billion.
- More than $52.5 billion was spent by the companies on purchasing goods and services from more than 18,700 businesses, and financially supporting more than 1100 community organisations and 85 local governments across Australia.
- More than $12.67 billion in wages and salaries was paid to more than 70,000 full-time Australian workers. Those member companies also employed a further 13,177 full-time on-site contractors.
- More than $10.98 billion was contributed in State Government payments, with more than $24.21 billion contributed to the Federal Government.

The analysis also found supply chain spending by the 56 companies created an additional 493,852 full-time jobs and generated $78.43 billion in gross value add to the Australian economy. Some of this value add is created through the sector's demand for construction, exploration, mining support, financial and other goods and services. It is estimated through all this activity, these companies helped contribute around eight per cent of gross regional product to Australia's economy.

Because the data has been collected on a postcode basis, the economic contributions of these companies can also be narrowed down to regions, and most State and Federal electorates in WA.

"It's not hyperbole to say that every community in WA has locals people living there who work in our sector, and local businesses who benefit from and supply goods and services to it," Mr Carruthers said.

"Both the direct and indirect contributions of CME's member companies spread far and wide throughout communities around WA and, indeed, across Australia.

"In fact, our sector supports close to one in four full-time jobs in Western Australia and at least one in 16 Western Australian businesses have resource sector companies within their customer bases.



"With more than $127 billion of projects under development in the WA resources sector pipeline, these types of contributions should continue to flow through for decades to come.

"We're very appreciative of the significant amount of collaboration that has helped us operate safely during the pandemic, including working with government, health authorities, police, aviation and port partners.

"We look forward to continuing to work with them, as we look to tackle key shared challenges like current and future skills shortages."

The data collected from 56 member companies covers more than 100 operational sites across the State, representing more than 70 per cent of the WA resources sector by production. ***AMR***

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MCA Says Mining Underpins Federal Budget And Australia's Prosperity

The 2022-23 Federal Budget has highlighted the significance of mining to the improved budget in 2021-22 and the ongoing contribution the industry will continue to make, according to the Minerals Council of Australia (MCA).

MCA CEO, Tania Constable, said the strong performance of the mining industry is boosting the broader economy.

"This means the Budget can provide the temporary and targeted measures to help alleviate cost-of-living pressures on households and support for small and medium sized businesses," Ms Constable said.

"Extensive commitments made in the Budget to generate and expand export hubs in the Hunter, Pilbara, North and Central Queensland and the Northern Territory, upgrade freight corridors and support minerals development and clean energy are welcome. This is a generational investment for the nation and the communities in which mining operates.

"With record low unemployment, targeted measures to address the skills shortage are necessary and timely. While industry welcomes continued investment in apprenticeships and traineeships – with the industry having delivered more than 6,700 new apprentices since late 2020 – the government needs to ensure there is no reduction in these roles in key mining occupations.

"Greater economic participation of women is critical to achieve gender equity and support the productive capacity of the economy. Access to fully flexible, equal parenting payment leave for families aligns with the significant strides the mining industry has made to improve access to paid carer's leave."

The MCA said the establishment of a new $2 billion Regional Accelerator Program will improve infrastructure, manufacturing and industry development, skills and training, research and development, and education in the regions.

"Funding for critical mineral processing projects and initiatives to accelerate other projects will expand Australia's capacity to meet future global demand for critical minerals, and further enhance Australian mining's position at the forefront of driving technological advances and lowering global emissions.

"Investments to support First Nations skills, business and wealth creation will help maximise community outcomes from mining partnerships with Traditional Owners across Australia.

"The $636 million to fund an additional 1,089 new Indigenous rangers and 88 new Indigenous ranger groups will support economic opportunities and environmental outcomes."

Ms Constable said that while industry and Traditional Owners have worked together for decades to support community aspirations, targeted Commonwealth funding to position Prescribed Body Corporations for the future and in Indigenous leadership and governance will help strengthen partnerships and broaden opportunities.

"The decadal contribution of Australian mining to the economy is stellar – $2.1 trillion in resources export revenue, $246 billion in mining wages and 21 per cent of Australia's GDP growth.

"The industry can also be relied on to generate large fiscal returns to the economy, having contributed $132 billion in company taxes and $106 billion in royalties over the last decade from significant capital investments in regional and remote Australia.

"The Budget is optimistic about labour productivity. To achieve this Australia needs enabling policy reforms, particularly modern workplace relations rules to foster more innovative and adaptable enterprises.

"Ensuring the mining industry remains productive and competitive is essential for positioning Australia for the next wave of mining investment and maintaining its position as the largest exporter of minerals and metals in the world," Ms Constable concluded.

WA CME Buoyant

The Chamber of Minerals and Energy of WA welcomed the 2022-23 Federal Budget and the ambitious measures announced to accelerate critical minerals projects, encourage the development of low-emissions technology and minerals processing, streamline regulatory processes and grow Australia's workforce of the future.

CME Director of Policy and Advocacy Rob Carruthers said the budget highlighted not just Australia's strong recovery from the COVID-19 pandemic but the contributions from the WA mining and resources sector which had underpinned that.

"The mining and resources sector's ability to continue operating safely and effectively through the COVID-19 pandemic amid a positive commodity cycle has resulted in record terms of trade," Mr Carruthers said.

"In addition, the sector's direct contribution of taxes and royalty contributions to government has helped fund important national economic recovery initiatives, including targeted assistance measures for job seekers, job trainers and small-to-medium businesses.

"In turn, this budget includes a range of initiatives designed to capitalise on the $127 billion of projects currently in the WA resources pipeline, as well as growing and diversifying Australia's resource exports. It's telling that the budget forecasts a further 10 per cent increase in mining investment over the next 12 months.

"CME welcomes well-targeted initiatives in value-add processing and forward-leaning export growth across iron ore, critical and battery materials, and development hubs for nascent hydrogen and ammonia production from low emissions energy sources. Locking in advancing onshore processing and modern manufacturing opportunities across the supply chain are areas CME continues to advocate for and support.

"There are a range of initiatives, announced both in the lead-up to the budget and tonight, which will be very beneficial for our sector. These include a $1.5 billion investment in the Pilbara that will feature increased mineral processing and a strong focus on investment to create a 'next generation export hub', with an emphasis on low emissions technologies, including renewable energy hydrogen, ammonia, and carbon capture and storage.

"The additional $2.8 billion for new trade apprenticeships will be essential to developing the workforce of future. A further $3.7 billion investment aimed at encouraging small businesses to invest in training is also applauded.

"Fundamentally, international skills migration will be critical to filling widespread skills shortages, particularly in specialised and hard-to-source roles, so we are pleased to see a revised optimistic outlook in the budget which forecasts that net migration will return to 213,000 by 2024. Noting this forecast is still 50,000 people short of pre-pandemic peaks, more work needs to be done collectively by government and industry to attract the best and brightest to come and work and build a life in Australia.

"CME and its member companies are very proud of the enormous contributions the WA mining and resources sector has made over the past two years to the State and Federal economies and communities around the nation."

Among the other significant announcements contained in the Budget, or unveiled in the lead-up to it, and welcomed by the WA mining and resources sector:

A $2 billion Critical Minerals Facility providing loan capabilities for projects to help secure supplies of vital resources.

A $2 billion increase in funding for the Northern Australia Infrastructure Fund

A Low Emissions Technology Commercialisation Fund, providing $500 million to boost investment in Australian companies to develop new low emissions technology.

$128.5 million to advance environmental law reform, including single touch approval processes, on-time assessment determinations and modernised offset policies.

A further $200 million in grants through a Critical Minerals Accelerator Initiative, aimed at accelerating project development and attracting private sector financing

$158.7 million in funding to support two additional clean hydrogen hubs

A $1.3 billion package to support women's health and end violence against women and children

$547 million over five years towards national mental health and a suicide prevention plan, including $52.3 million for Lifeline to provide mental health support

New funding of $177.7 million for the Future Fuels Fund, supporting new technologies for heavy and long-distance vehicles and hydrogen refuelling stations

Investment of $365.3 million to extend the Boosting Apprentices Commencement and Completing Apprentices Commencements wage subsidies

$752.1 million to continue support for states and territories in their responses to COVID-19

A further $328.3 million commitment of funding to the Modern Manufacturing Initiative

$346.1 million towards enhanced paid parental leave over the next five years

An expansion to the Indigenous Rangers program facilitated by an investment of $636.4 milion over six years

$1 billion in taxation relief for businesses with turnover of less than $50 million, via the ability to deduct an additional 20 per cent in relation to cyber security and e-invoicing software. ***AMR***

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JETCRETE

Australia's Resource Earnings To Hit Record $425 Billion



Australia's resources and energy export earnings are forecast to surge to a record high $425 billion for 2021-22.

Federal Minister for Resources and Water Keith Pitt said the latest forecast, from the Department of Industry, Science, Energy and Resources' March 2022 edition of the Resources and Energy Quarterly (REQ), is up a stunning 12 % on the December 2021 REQ projection of $379 billion.

"The March 2022 REQ has found that soaring demand and high prices for Australia's gas, coal and oil are a key contributor to our record export earnings. In short our resources sector is knocking it out of the park and underpinning our economic growth, our energy security and our national security," Minister Pitt said.

"Critical global shortages in energy and resource commodities have led to record prices for many of our commodities."

"The REQ notes that with international coal prices at record levels – as the war in Ukraine and the ongoing La Niña weather conditions affect supply and demand – Australia's combined coal export earnings are forecast to rise to about $110 billion in 2021–22.

"Coal becomes only the second Australian commodity after iron ore to break through the $100 billion annual export mark.

"The combined export earnings for lithium, nickel and copper will likely exceed $23 billion in 2021-22, which would be an increase of 38 per cent on the 2020-21 earnings.

"These forecasts again confirm just how important Australia's resources and energy sector is to the nation's economic and energy security.

"These record earnings will keep the benefits flowing to all Australians, including through company taxes, the taxes paid by the more than 270,000 people in high paying resources jobs, the more than one million in indirect jobs generated by the sector and the royalties the states and the Northern Territory use to pay for services such as the hospitals, roads and schools across regional Australia."

The REQ also says the further outlook, for 2022-23, could see resources and energy export earnings easing off record levels to $370 billion as bulk commodity prices return to more familiar levels. However global uncertainty and strong global demand sees plenty of upside in this forecast. ***AMR***

Liebherr Awarded Australian Engine Contract With BHP

Liebherr has signed an agreement with BHP to integrate Liebherr engines into BHP's existing R 9600 600-tonne excavator fleet at South Flank mine in Western Australia.

Liebherr-Australia executive general manager customer service, Tony Johnstone, said the integration will mark an important step in the partnership, while helping the customer to reduce maintenance and standardise parts capability.

Mr Johnstone and BHP general manager South Flank Steve Campbell recently met in Perth to mark the signing of a deal to repower the South Flank R 9600 fleet with D9812 Liebherr engines and the strong ongoing partnership between the OEM and the miner.

Repowering the R 9600 fleet enables reduced maintenance and standardised parts capability.

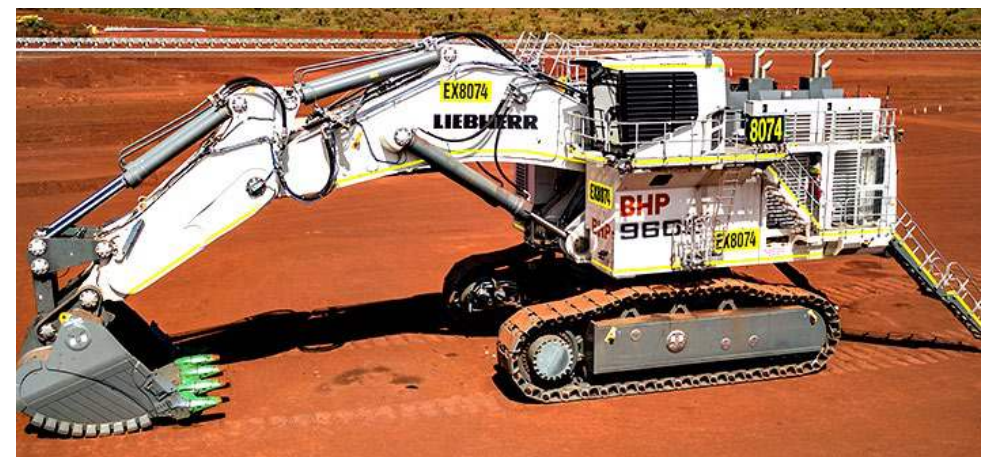
The integration follows intensive factory and field validations on the D98 engine series which includes a two-year validation study at BHP's Jimblebar mine where the Liebherr D9812 has successfully powered an R 9400 for almost 20,000 hours.

"BHP has a long-standing relationship with Liebherr across our Western Australian Iron Ore operations, and we have six of their largest machines in operation at South Flank. We're looking forward to continuing with this collaboration which promises to bring performance and availability improvements to South Flank as we continue to ramp up production," Mr Campbell said.

Mark Pickett, vice president, Minerals Australia Supply, said the Liebherr engines will deliver a more sustainable outcome and lower overall cost, as well as allowing Liebherr to have better control of product improvement.

Building on the Liebherr Group's shared in-house competencies across different product segments, the D98 series completes the existing Liebherr engine portfolio for mining equipment by expanding into the upper power range. Designed specifically for the mining industry, the D98 series engine offers low fuel consumption and consequent emission reductions. The engine is also compatible for use with sustainably produced Hydrotreated Vegetable Oil (HVO) fuel which can significantly reduce CO2 emissions.

The new engines will be supported locally by Liebherr-Australia. The first D9812 repowered R 9600 is scheduled to be operational by early quarter 1 2023, with repowers of the remaining R 9600 fleet to occur over 2023 and 2024. ***AMR***



Underground Mining Recommences At Red 5's KOTH Project



Red 5 Limited (ASX: RED) remains on track for first gold production in the current quarter at its 100%-owned 2.4Moz, 16-year life-of-mine King of the Hills (KOTH) Gold Project, after achieving further key construction and operational readiness milestones during March 2022.

Construction and Commissioning Key construction progress for March included:

- Commissioning of the crushing circuit has been completed;
- Commissioning of the gas pipeline has been completed;
- Commissioning of the power station has been completed to the stage where it is ready to power the process plant;
- Installation of the solar panels has been completed and wiring is being finalised; and
- Commissioning of the SAG mill has commenced, with the current critical path to first gold being the commissioning of the Variable Speed Drive.

Mining Red 5's mining business partner, Macmahon Contractors, recommenced underground mining at King of the Hills on March 31, 2022, in line with the project execution schedule.

The start-up underground mine fleet comprises one jumbo, two boggers and a supporting fleet.

The initial focus is on mine development, with the first stopes planned to be fired later in the quarter. In the open pit, two fleets are now operating on both day and night shifts as Macmahon ramps up its on-site teams, with a third and final fleet planned to be operational in May 2022.

"With first gold production expected in the current quarter at King of the Hills, our open pit mining teams are operating 24/7 and underground mining is now ramping up on schedule,: Red 5 Managing Director, Mark Williams, said.

"Commissioning of the crushing circuit is complete, commissioning of the SAG mill is underway, and ore is being stockpiled for when processing begins.

"We're also completing the site power supply, with the gas pipeline fully operational, the installation of the solar panels complete, and the power station now ready to power the process plant.

"The sheer scale of the mine development is impressive, and I encourage shareholders to watch the latest flyover video to get a sense of the team's achievement over the past 18 months.

"It really has been an incredible effort, and I would again like to commend all members of the team for their outstanding work." ***AMR***

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New Tech Makes Eco-Mining a Reality for Rare Earths

They're the driving force behind electric vehicles and crucial to the manufacture of many high-tech products, but while rare earth elements are highly valued across many sectors, they're extremely hazardous to extract, posing significant issues for the environment.

Now, new research from the University of South Australia could transform the way rare earth elements and other vital battery metals are recovered from the earth, enabling safer extraction with fewer environmental impacts.

Dr Richmond Asamoah from UniSA's Future Industry Institute is developing new ways to safely extract critical minerals from downstream ore processing, tailings reprocessing, and wastewater treatments. He is also developing mechanisms to safely recycle spent products from scrap batteries and magnets.

"Rare earth minerals and battery metals are vital for the economic wellbeing of the world's major and emerging economies, yet, their supply is not reliable because of geological scarcity, geopolitical issues, and trade policy," Dr Asamoah says.

"Accumulated mining wastes are becoming an increasingly valuable source of metals and energy, but because there's a lack of productive and economically viable extraction technologies, there's also a notable loss of valuable metals.



Uni Rare Earths Manganese.

"The process of extracting these critical materials is very damaging to the environment, with conventional mining methods generating large volumes of toxic and radioactive materials.

"Our research will identify new technologies that have the capability to both extract minerals from existing industrial wastes and mineral tailings and recycle and source minerals and metals from spent batteries and magnets.

"As a result, we should be able to significantly reduce the amount of waste and harmful materials that can seep into the environment."

The project will test two metal recovery processes – resin in pulp and resin in moist mix – to extract target metals from low grade ores, fine minerals and wastes such as tailings.

These processes can also be used to remove harmful substances from water and soils to minimise their environmental impact.

Funded by the Australia-India Strategic Research Fund, Dr Asamoah says that the research will deliver significant benefits to both countries.

"We're not only talking about environmental benefits, but also economical and sustainable technologies that both countries can use to extract rare earth and battery minerals from current mining operations," Dr Asamoah says.

"Rare earth elements contribute nearly $200 billion to the Indian economy, yet despite India having the world's fifth largest reserves of critical metals, they mostly import their rare earth needs from China.

"This project hopes to enable Australia to export rare earth minerals to India, as an alternative to China, as well as to empower India to establish eco-technologies to extract minerals and metals within their own borders.

"Importantly, the research will build capacity for processing critical minerals in Australia and India and creating many new eco-efficient opportunities for economic growth, employment and investment."

AMR

World-first Technology Connects Underground Mine Workers to the Surface

A technical advancement made by Perth-based geolocation company, GeoMoby, will connect underground mine workers to the surface, like never before.

Developed by Australian geolocation intelligence company GeoMoby's the state-of-the-art technology is transforming the way mining companies can communicate and monitor operations.

GeoMoby recently tested their location and communication network, implemented in an underground section of Karora Resources' gold and nickel Beta Hunt mine, in Kalgoorlie.

Results gathered from the project confirms the possibility of live audio and video streams in real time, using Bluetooth Low Energy.

Before now, audio and video communication from underground to the surface has only been possible with wifi or LTE powered wireless networks.

Bluetooth capabilities enable mining companies to reach optimal connectivity without having to stop operations - at a large cost to the business - to lay cables and wires throughout the site

The technology allows the transfer of live audio and video streams to the surface in real time, in addition to existing real-time location, messaging and photo transfer capabilities, ensuring surface teams can have eyes and ears underground.

GeoMoby CEO Chris Baudia said the high-speed wireless network powered by Bluetooth Low Energy was able to transfer a range of important operations information from down the hole to the surface.

"Using our point-to-point network of nodes and technology platform, we have been able to stream audio and video in high quality and real time to the surface, allowing those above ground to hear and see what's going on beneath them," he said.

Mr Baudia said the simple, cable free, low disruption deployment method was a game changer for miners looking to improve their communication with minimal interference to operations.

"Key data transferred from underground to surface includes speed calculation alerts for vehicles and machinery, proximity awareness and real time proximity detection alerts," he explained

"These features, along with file transfer and geofencing technology, are being delivered through our updated Underground Zero Harm application, giving miners the advantage of a one stop technology shop for monitoring people and assets."



GeoMoby underground technology.

GeoMoby recently rolled out a wireless point-to-point network at the Karora Resources gold and nickel mine.

The deployment involved the installation of 16 nodes across 2km of underground mine tunnels and was completed in 2.5 hours, with no impact on the mine's operations.

It connects a range of devices – both personal and company issue – directly to nodes, which combine to feed information in to the platform for users to see.

"Our benchmark is entry level technicians correctly positioning or replacing nodes with no or minimal assistance from GeoMoby," Mr Baudia said.

"Software diagnostic tools incorporated into the platform allow site personnel to detect any fault in the network and respond immediately, which is critical to ensuring communications remain intact at all times."

Karora Senior OHS adviser Jody Herd said there had been a steep change in operator behaviour since the GeoMoby technology was installed.

"We have 120 people on site at any given time," he said.

"Previously we tracked personnel and equipment underground the old school way with tag board systems, so we didn't always know where everyone was at any given time without using a radio.

"We've already seen a change in operator behaviour due to workers understanding that machines are now monitored using the GeoMoby solution."

Mr Baudia said GeoMoby was working through added use cases of contact tracing capability in the instance of infectious disease entering sites, individual health monitoring and geofencing solutions that are currently only available with their on-surface solution. ***AMR***

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Carnarvon's Renewable Diesel Project Awarded CEFF Grant



Canarvon Team on site.

Carnarvon Energy Limited's (ASX:CVN) renewable diesel business FutureEnergy Australia, a 50:50 joint venture arrangement with Frontier Impact Group, has been awarded a $2 million Clean Energy Future Fund grant from the WA State Government.

The funding provided by the Clean Energy Future Fund grant will go towards project development, preliminary site works, and engineering, procurement, construction, and commissioning (EPCC) activities for the first renewable diesel project in Narrogin.

On March 10, 2022 Carnarvon announced that a 12-month exclusive option to purchase a 65Ha site in the Shire of Narrogin was secured for the first project.

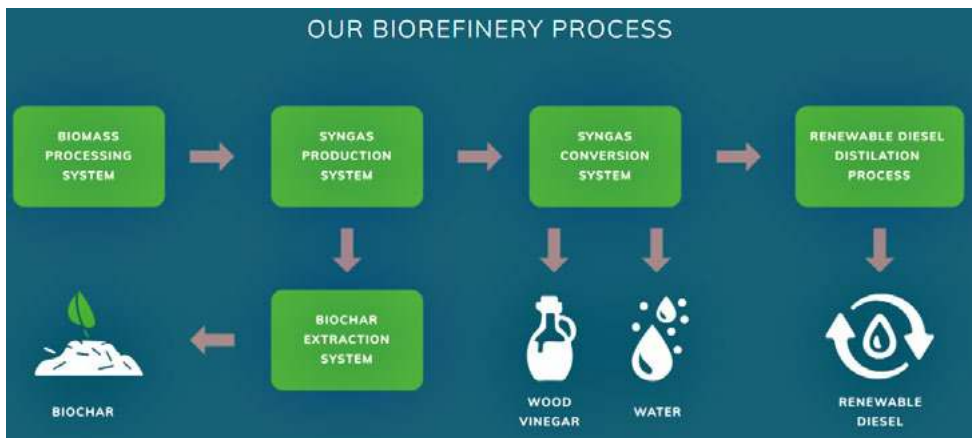
Technical due diligence on the site is progressing well, and relevant regulatory approvals for the project are in preparation.

In parallel, FutureEnergy Australia has commenced stakeholder consultations within the Shire of Narrogin to build awareness of the project's importance to the region.

The business model of FutureEnergy Australia is to convert sustainably sourced woody biomass such as ecological thinnings, oil mallees and plant-based agricultural residues into renewable diesel using hightemperature pyrolysis.

Renewable diesel can replace conventional diesel without requiring modifications to diesel engines. It burns cleaner and has a lower emissions profile compared to conventional diesel.

The produced renewable diesel also has the potential to be further refined into sustainable aviation fuel (SAF).



The high-temperature pyrolysis process also produces high-quality biochar and wood vinegar. FutureEnergy Australia is investigating the opportunity to refine the high-quality biochar into graphene, which has a number of attractive applications, including in the next generation of high-capacity, long-life, fast-charging batteries.

Carnarvon Managing Director and CEO Adrian Cook said FutureEnergy Australia aims to develop multiple biorefinery projects across Western Australia, each producing commercial volumes of renewable diesel through net-carbon zero technology and establish a substantial Australian-owned and operated renewable fuels business.

"The project receiving a Clean Energy Future Fund grant acknowledges the clear benefits renewable diesel can bring to reducing carbon emissions and creating a carbon-neutral alternative fuel in Western Australia," Mr Cook said.

"Our project has the potential to transform the approach to fuel production. The additional products produced in the biorefining process, namely biochar and wood vinegar, are also expected to provide significant benefits across a number of industries.

"We strongly believe that we have an incredible opportunity before us to create value for our shareholders and future business partners, generate important regional employment opportunities and make a significant carbon emission reduction by providing a product that customers can readily use once we are in production."

For more information,
visit **www.carnarvon.com.au**

AMR

Epiroc Introduces DM30 XC Blasthole Drill

Epiroc, a leading productivity partner for the mining and infrastructure industries, has introduced the DM30 XC blasthole drill that is suitable for a variety of multi-pass rotary and down-the-hole (DTH) drilling applications. Built off the same proven, reliable platform as the Epiroc DM30 II, the new DM30 XC offers 33% more power and many benefits to customers.

The DM30 XC is designed for maximum productivity and efficiency due to increased rotary torque, increased pulldown and a larger hole range capability. The DM30 XC is built to handle a 4- to 6¼-in (101 - 159 mm) drill pipe and has a weight on bit up to 44,000 lb (20,000 kg). The heavy-duty, crawler-mounted, hydraulic top head drive drilling rig features a 30 ft (9.1 m) drill pipe change and a standard carousel.

"The DM30 XC is built tough for the most demanding jobs, and high quality at an excellent value is what sets it apart from other drills in its class," said Mark Stewart, Regional Business Manager, Epiroc Surface division.

"The drill is designed for mining so the structural components will hold up to the heavy-duty cycles required in a mining drill. The robust frame and tower weldments are manufactured to last the lifetime of the machine."

With a starter rod under the rotary head, the DM30 XC can achieve a total clean depth capacity of 148 ft (45.1 m) for multi-pass applications and 28 ft (8.5 m) for single-pass applications. High efficiency and a 300-gallon fuel tank allow the rig to run for up to 16 hours before needing a refill for continuous operation. In addition, the smaller, compact footprint of the DM30 XC makes it easy to maneuver on tight benches and simple to transport over between pits.

No matter the customer's need, the DM30 XC offers options to suit any application. Customers can choose a low- or high-pressure compressor to create the right configuration for their drilling operation.

A spacious one-piece FOPS (Falling Object Protective Structure) rated cab with electric over hydraulic controls offers enhanced safety, visibility and operator comfort. The DM30 XC is easy to operate, especially for drillers who have experience in other DM series machines. The ergonomic controls layout allows immediate switchover from drilling to tramming mode, maximizing time available to drill.

The DM30 XC is equipped with an Electronic Air Regulation System (EARS) that provides low load start up and easy adjustment of bailing air to save horsepower and lower fuel consumption, extending power component life and decreasing total cost of ownership.

Customers can add even more flexibility to their DM30 XC with Epiroc's Rig Control System (RCS) Lite, which offers several safety and productivity features. It also provides a convenient foundation to add more functionality and technology options in the future without a major rebuild of the machine.

RCS Lite allows all Epiroc rotary drills to have the same onboard display and system for consistent operator training and service. RCS Lite offers customers three different packages to choose from. It is a modular solution that delivers efficiency now, along with the opportunity for customers to enhance their equipment down the road as their mining requirements grow.

Epiroc's blasthole drills are designed for safety, productivity and reliability for rotary or DTH drilling applications. Enhancing profitability for customers' businesses and offering advanced performance, Epiroc blasthole drills are your drilling solution. ***AMR***



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Glen Set To Take To The Sky Thanks To Drone Competition Win



Winner of the Australian Mining Review & Global Drone Pilot Course Competition, Glen Donaldson.

Mining Engineer Glen Donaldson is celebrating his win in the Australian Mining Review and Global Drone Solutions sponsored drone skills course.

Glen, who has a growing passion for flying drones, was drawn out from a large list of entries for the recently completed Drone Pilot Course Competition.

Busselton, WA-based, Glen is looking forward to eventually adding drone piloting skills to his role as work as a consultant Senior Mining Engineer.

"This is unexpected and quite exciting. I was just flicking through the AMR issue at the lunch table at work and saw the comp, thought it sounded interesting a great opportunity, so I entered it then and there and never really gave it another thought," Glen said on being informed of his competition success.

"I started my professional career as a Mine Surveyor in the mid-1990s, before stepping away from surveying and transitioning into mine engineering by the mid 2000's. Since I stepped away drone technology has really developed, particularly in the surveying field and I have always felt that it was unfortunate that I missed the opportunity to work with them.





"I'm not entirely sure where I'd like some drone experience to take me really, but I would like to see how I could possibly incorporate the data and visual capture capabilities provided by drones into mine engineering (design and scheduling in particular) and possibly having some drone operation skills and knowledge could help me do this," Glen added.

Civil Aviation Safety Authority (CASA) and the Australian Skills Quality Authority (ASQA) accredited, Global Drone Solutions helps organisations establish compliant Drone operations within their business.

The company has long standing partnerships with organisations in the mining, oil & gas, government, construction, utilities and education industries, ensuring Global Drones Solutions is well placed to understand the dynamic evolution of Drone applications and business requirements.

The company trains Drone Pilots in a broad range of industries as Drone applications continue to grow at an unprecedented rate.

The company's courses include:

- Remote Pilot Licence (Repl)
- Aeronautical Radio Operator Certificate (Aroc)
- Remote Operator's Certificate (Reoc)
- Cert Iii in Aviation (Remote Pilot)
- Chief Remote Pilot
- Powered Lift Endorsement
- Manned Aircraft Pilot Endorsement
- Night Visual Line of Sight.

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https://gdronesolutions.com/

AMR

It's a Game Changer



Perth based pump design and manufacturer, PumpEng, is busy rewriting the record books for dewatering pump performance. Over the last year, the company has opened new interstate offices and connected with a network of keen international distributors.

Australian company PumpEng is raising the standard of dewatering pumps with their expertly designed range.

Drawing on more than 100-years of experience, the leading pump designer and manufacturer has collaborated with Australian maintenance and mining staff to become a well-established specialist submersible pump supplier.

The company is a full-service provider, offering Australian wide sales, hire, genuine parts, improvement focused repairs, aftercare services and ongoing consultative data-based assistance.

Their solutions are backed by a vigorous research and development program, installation practices and innovative thinking.

Primarily supporting the underground mining sector, PumpEng's submersible pump components are purpose-built for domestic conditions and the tough products routinely surpass industry performance standards.

Though mining operators have largely flocked to PumpEng for their pump's long operating life, companies have also praised the Perth-based manufacturer for their data-driven approach.

PumpEng follows trends, performs site inspections, analyses repair data, conducts quarterly reporting and works closely with industry to gauge modern underground dewatering needs.

The company understands a pump that doesn't require replacement and repair generates benefits beyond just reducing maintenance costs.

It also means reducing the number of times an operator needs to interact with water and electricity, which is a significant safety development for underground mining managers.

There is a reduction in labour costs and expensive production delays caused by pump failure.

PumpEng has developed a team of experienced staff dedicated to supporting industrial working environments safer and more productive.

Their commitment extends to the design, manufacture, and supply of pumps, right through to the expedient repair or rebuild and full aftermarket support of the product range.

PumpEng has also partnered with major foundries and quality manufacturing facilities located within Australia and abroad to facilitate the reliable supply of quality parts and pumps.

While the manufacturer has a primary focus on supplying underground mine operators and contractors, it also has a national footprint across several other industries.

Their branch network spans Perth, Kalgoorlie, Townsville and Adelaide, while on the international stage the company also maintains officers in Indonesia and North America as well as emerging markets in South America.

About PumpEng

PumpEng evolved from a venture between Paul Meneghel and the owners of Galvin Engineering.

With over 100 years' experience in foundry processing and manufacturing, they set out to improve the design of mass-produced submersible pump components for Australian operating conditions.

As company founder, Paul drew on his extensive experience with submersible pumps in mining, stretching back to the 1980s.

His initial vision was for pump parts tough enough for Australian conditions. PumpEng has grown well beyond Paul's original 2001 intention to improve pump component design.

PumpEng is a manufacturer with its own patents with its products are breaking industry pump performance records. ***AMR***

The PumpEng Range

Created with a mix of design expertise and durable materials, all PumpEng products are built to last. Among the products earning an industry-wide reputation for extraordinary performance is:

JetGuard



This has an all-metal wet end with a high chrome impeller and is designed for use in the harshest environments. The product is perfect for when polypropylene fibres for shotcrete, high amounts of aggressive sulphides or drill fines and tramp are in the wastewater. The hydraulic water curtain guards against floating fibre entering the pump. JetGuard is suitable for underground mining, surface mining and general dewatering applications. It is available in 10kW and 20kW in 415V or 1,000V in 50 cycle and 480V or 600V in 60 cycle.

Raptor

This pump is suitable for underground mining, surface mining, construction and general applications. Parts interchangeable with other OEM supplied BIBO ranges. The Raptor is available in 5kW, 8kW and 20kW to suit all markets.



Guardian

No more pumps with rubber and polyurethane components! The Guardian is an upgrade to the Raptor range. It incorporates an all-metal wet end and the high chrome impeller which extends pump life and reduces repair costs. The Guardian is available in 8 kW to suit all markets. With the 20kW model to be available soon in the same combinations.



ScatPump

This is a heavy-duty submersible slurry pump with high chrome impeller and agitator. Flows available up to 100l/s and heads up to 32m. ScatPump is available in 1.5kW - 22kW to suit all markets.



Metal Vest

The all-metal design of MetalVest™, together with the impeller constructed of HRC provide a longer wear life which extends the life of this high head dewatering pump and reduces repair costs. The MetalVest™ are available in 37kW - 110kW to suit 50 cycle markets.



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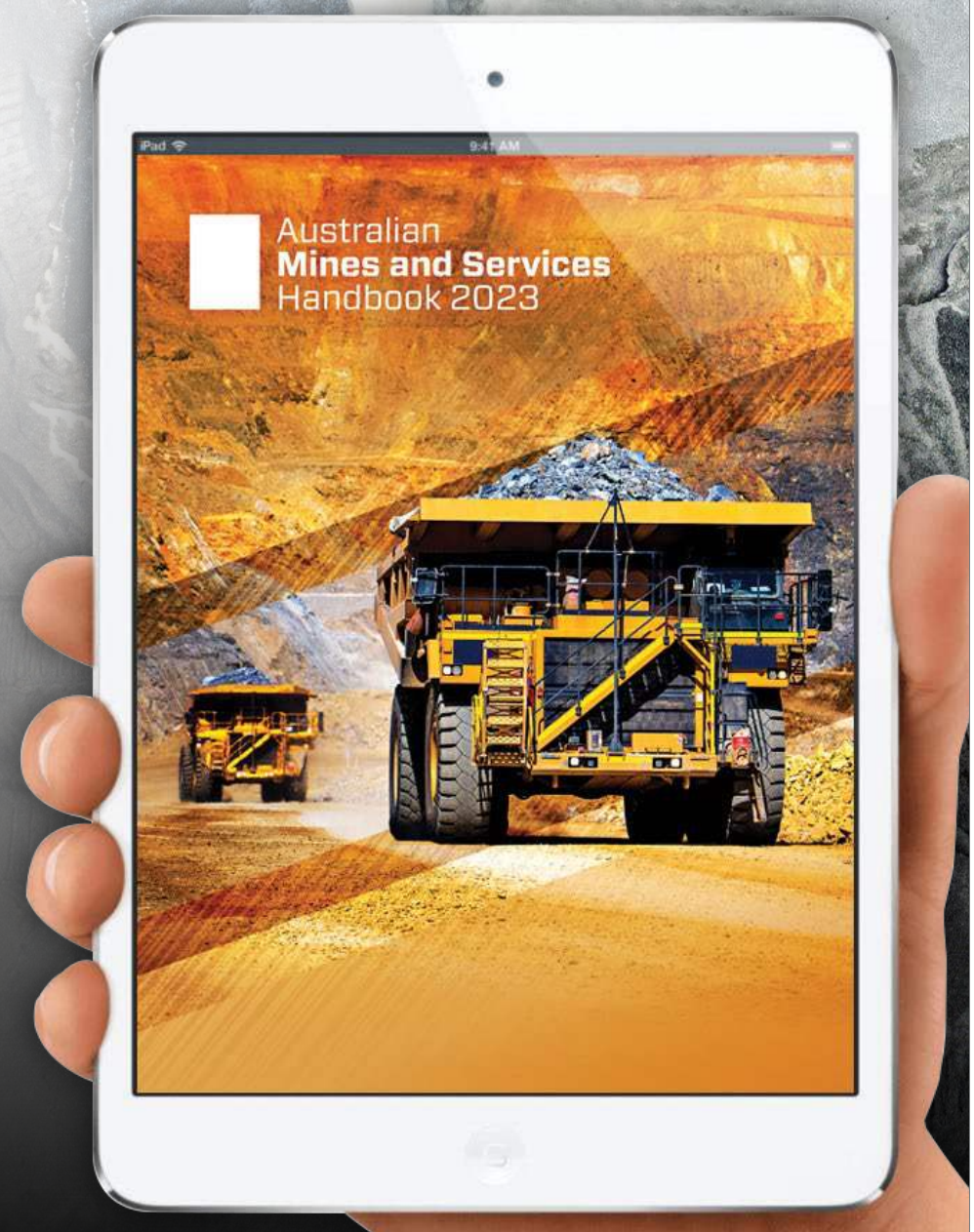
Patent Numbers:
AUSTRALIA - 2015230662 | CANADA - 2941904 | USA - 10514047
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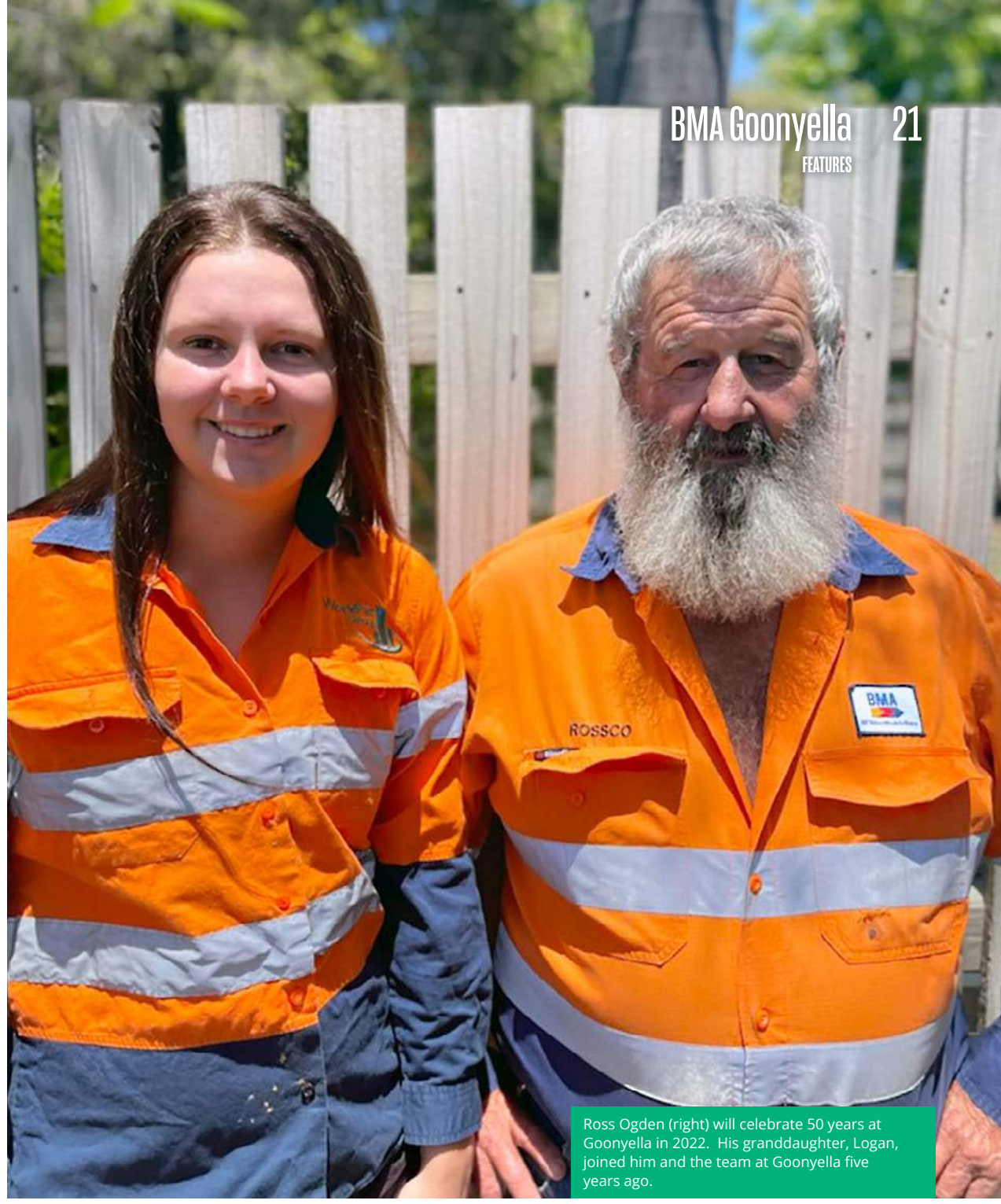
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50 YEARS OF SUCCESS AT GOONYELLA RIVERSIDE MINE AND HAY POINT COAL TERMINAL



Ross Ogden (right) will celebrate 50 years at Goonyella in 2022. His granddaughter, Logan, joined him and the team at Goonyella five years ago.

Goonyella Riverside Mine and Hay Point Coal Terminal (HPCT) both celebrated 50 years of operations in 2021. Hay Point was built to service the Goonyella Riverside and Peak Downs mine sites.

Goonyella Riverside is an open cut coal mine located 30 kilometres north of Moranbah in Queensland's Bowen Basin. Coal is exported on the Goonyella railway line to Hay Point, from where it's sent to markets worldwide.

The Gooneylla Riverside mine is a part of BMA, the 50:50 joint venture between BHP and Mitsubishi Development.

Hay Point and Goonyella were constructed by CQCA JV, established in 1968 by Utah Development Company and Mitsubishi Development. After BHP's acquisition of Utah in 1984 and foundation of BHP Mitsubishi Alliance in 2001, these operations joined the BMA portfolio.

First Load Of Coal

The Hay Point Terminal saw its first coal loaded in 1971 - with just a single berth, shiploader and crawler mounted reclaimer and stacker. Now 50 years on, Hay Point has three berths and five stacker reclaimers and has seen more than 1.3 billion tonnes through the operation.

Hay Point was built to service the Goonyella Riverside and Peak Downs mine sites.

The original Goonyella Mine, also owned and managed by CQCA JV, commenced operations in 1971 and merged with the adjoining Riverside Mine in 1989.

To celebrate and mark the occasion, Goonyella Riverside Mine decided to donate $50,000 to support the Moranbah community

- Community organisations were invited to apply for grants of up to $10,000 for initiatives that improve the liveability and vibrancy of Moranbah.
- GRM team members voted for the applications and chose to support:
- CQ Rescue Chopper – In support of operational costs. In the last 12 months CQ Rescue has rescued 230 patients located in the Bowen Basin including Moranbah.
- Moranbah Hawks Football Federation - To build a cyclone rated shed for the safe storage of sporting equipment for the growing club and future generations.
- Moranbah District Support Service - Support programs and activities for youth experiencing barriers to access to educational experiences which will help improve the quality of life and the mental health and wellbeing of young people.
- Moranbah State School - Various activities for the enhancement of student learning and opportunities to connect to the wider community to obtain valuable life skills.
- ELAM community services - To support disadvantaged youth with accredited driving lessons to help achieve independence and employability and improve quality of life.

BMA Asset President, Mauro Neves, said the two operations have been closely linked from the start with Goonyella Mine's first coal railed and shipped through Hay Point in 1971.

"Now fifty years on, the two sites have continued to grow and we've seen them remain critical assets within the BMA portfolio," Mr Neves said.

"I'd like to recognise all our teams, past and present, who have contributed to building what these are operations are today.

"The ongoing resilience and dedication of our people, and the communities where we operate, has shone through and I'm excited to see what the teams deliver next."

Sean Milful, General Manager Goonyella Riverside Mine, said BMA and Goonyella has had a long history in the Bowen Basin

"And we're proud of what we've been able to achieve in 50 years. We've come a long way and hope to continue to make our people and community proud.

"Something stopped us from having big gala celebrations - it was COVID - and the team said, 'what can we do with the funds that were budgeted?' We had a think about it and thought, "Let's do 50 for 50." We had five allocations of $10,000 and invited community organizations to apply for grants.

"COVID inhibited our ability to get together and have a big gala event, but the workforce is actually pretty stoked with what we've done.

"The way it worked was that we had a big pool of nominations for the $50,000. We actually voted and people were able to vote using their mobile phones. They put their vote forward and then we pulled them up and then allocated the funds accordingly.

"Without the community, we don't exist, whether it's the schools or the health services or critical services like these choppers. We don't exist. So it's almost a symbiotic relationship if you wanted to call it that where we're feeding off each other. So, for us, it's absolutely critical that we ensure the sustainability of those critical service, whether health, education, community groups. It's something we're pretty passion about, so we'll make sure we keep going forward.

"I love working at Goonyella Riverside. We're big contributors to the region and the economy. We're driving safety improvements. We're seeing improvements in safety. But what makes me most proud is the people: the people that we work with whether it's contracting partners or, again, service providers, people that provide us with services. It just makes me so proud and it's about our ability to work together to create a better region and a better life for us all."

50 Years On The Job

Ross Ogden will celebrate 50 years at Goonyella in 2022.

His granddaughter, Logan, joined him and the team at Goonyella five years ago and is working as a truck driver (photo of them attached).

"Back when I started, someone had to retire or die for us to get a job so it's great that future generations are able to get into mining more easily. Everyone is entitled to a job," Ross said.

Ross is planning to retire in his 50th year next year.

Ross' first day at Goonyella was in September 1972. Aged just 17 and from a farming family in West Queensland, Ross landed in mining in the blast crew through a local contact.

"I was told there was plenty of work in Moranbah, so I went where the work was."

Reflecting on his 49 years of service at Goonyella, Ross said it's the friendships and the work that has kept him in the pit for so long.

"When you move to different places you need to re-establish yourself. When I first started at Goonyella the more experienced crew members really supported me with training and my development. And I respected their guidance.

"Your workmates become good friends and everyone supports each other – particularly in those early days.

"I've had good mates, good equipment and a good working environment – why go anywhere else?"

AMR

THE 'GAMBLER' REDUCES THE ODDS





One of Australia's most established and energetic civil construction and mining contractors has embarked on a significant programme of acquisition of new machinery to meet growing demand it anticipates in the next five years.

Privately owned QH&M Birt, based in South-East Queensland, is establishing its first permanent satellite organization in Western Australia, and seeking contracts across Australia.

The ambitious programme is made more remarkable by the fact that company principal Quentin Birt recently turned 81, and is soon to celebrate half a century of ownership of a business he started with a wheelbarrow and station wagon.

Mr. Birt said, "I back my people to deliver on any contract within time and budget, and that is made possible by owning my own machinery and having full control of delivery."

Mr. Birt remains skeptical that a business model in which equipment is hired in from sub-contractors can provide the same certainty.

The current low cost of finance has fueled Mr. Birt's acquisition programme and he has worked closely with one of his key machine suppliers, Komatsu, to structure contracts which make incremental and substitutional purchases - strong value for money propositions.

He has recently taken delivery of two new Komatsu D475A-8 bulldozers to immediately go to work on road building projects on the Sunshine Coast.

Mr. Birt acknowledges his business philosophy flies in the face of conventional practices: "Owning gear might not be the brightest thing in contracting," he said, "If it fails you look an idiot, but I commenced in an era when a contract was determined by the original price".

But, Birt's steadfast adherence to a policy of moving machinery around Australia, incurring but also absorbing road transport costs, has given his company an enviable reputation for reliability.

"Reliability and competitive price are the two cornerstones of our business, and they are what we seek from our suppliers as well," he said.

In 2020 QH&M Birt moved almost 100 pieces of machinery into Fortescue Metals Group's Eliwana Mine project, 90 kms north- west of Tom Price in the Pilbara to complete 57 kilometres of rail line extension, excavating 3.2 million cubic metres of material and laying 1.9 million cubic metres of engineered road formation fill.

"We were called in when the job started falling behind," Mr. Birt said. It was the third assignment Birt had successfully completed for Fortescue.

It is Mr Birt's firm conviction to maintain high level of in-house operator skills rather than rely on freelance operators untrained in his company's procedures.

"People are as important as machines, and operator efficiency is an essential part of successful delivery," he said.

The company maintains a rigid policy of training and a three-month probation period for all new operators to assess their skills acquisition.

"For some machinery we have simulators in place and for highly efficient machines like the new Komatsu range, we rely on their trainers to assist in bringing our operators up to speed," Mr. Birt said.

QH&M Birt bought its first Komatsu, a D155 bulldozer, in the early 1980s: "the most reliable dozer I've bought in my life," according to Mr. Birt and after some "ebb and flow" the two business have been close partners for the past 15 years.

The next move is his company's first serious move into Komatsu's IMC (Intelligent Machine Control) range. The company's first IMC machine a D65PXi iMC is due for imminent delivery.

It's a step-up for which the industry veteran says he is willing, but admits he is personally ill-prepared.

"Most of my staff embrace the technology." Like many early baby-boomers Mr. Birt chuckles at the proposition that the generation which was there at the birth of the computer is the only one which has not totally mastered its use.

"My father was a dairy farmer – definitely not a gambler," Mr. Birt said.

"But he insisted that I get a good education and I was the first kid in my district to attend secondary school instead of quitting early to drive tractors."

With a totally open mind, Mr. Birt sees as a worthwhile development a future in which efficient machine control relies as much on skilled programming as it does on conventional operation, and he foresees the next half decade, at least, as being a good time for the industry.

In regard to his own involvement, he has no intention of backing off: "I just enjoy doing it," he said.

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BUMA Australia is adapting to the changing needs of the mineral resources sector with their comprehensive and sustainable services – an approach helping operators achieve both successful and green outcomes.

Harnessing more than 75 years of industry experience, BUMA is fast becoming a leader in eco-friendly operations by reducing energy emissions, minimising water use, decreasing fuel usage, cutting back waste and continually progressing environmental goals.

A BUMA Australia spokesperson said the company's focus on sustainable practices from the start to the closure of a project meant it was becoming the partner of choice for Australian mining companies on the hunt for sustainable contractors.

"BUMA Australia's environmental strategy is progressive, adaptive, responsive, and backed by commitments to set and report targets for CO2 intensity. We are constantly looking to improve our management systems and performance."

"Our well-established systems and processes cover each phase of a mining operation and central to this is our ISO 14001 certified Environmental Management System.

"All sites have Environmental Management Plans in place to ensure we meet compliance requirements and our environmental targets and objectives.

"This includes end of mine life care, where we ensure rehabilitated land meets sustainability requirements and post-mining land use criteria," the spokesperson said.

Aside from strong environmental objectives, BUMA Australia has a strong reputation for its reliable delivery of services, experienced management and, operations teams and innovative approaches.

From long-term life-of-mine optimisation to short-term daily planning, the company can execute any project with their technical teams of mining and geotechnical engineers, surveyors and geologists.

They provide monitoring, reporting, technical assessments, economic analysis and mine planning for tenders and potential projects, leveraging world-class expertise and cutting edge technologies.

Central to their comprehensive services is maintaining the BUMA Australia mobile fleet, as well as a variety of client-supplied equipment.

BUMA Australia's fleet is maintained to achieve the lowest unit operating costs and is sourced from all recognised equipment manufacturers.

"A big reason behind the success of our support services is our strong relationships with equipment manufacturers and suppliers," the spokesperson said.

"This ensures we can access the latest technologies, equipment and up-to-date maintenance expertise.

"To strengthen our processes, we have also developed an ISO 9001-2015 quality-assured centralised plant management system.

"We utilize comprehensive maintenance management systems and support tools and, when needed, we apply the same systems to client fleets to achieve consistent, safe and effective equipment performance."

BUMA Australia's maintenance experience includes servicing ultra-class haul trucks and excavators, draglines, rope shovels, drills and CHPP's over extended periods of time.

Their plant management team includes professional engineers and qualified tradespeople with extensive practical knowledge and experience.

Leveraging advanced technologies and modern operating practices, the team can guarantee efficient and reliable mining equipment that won't hurt the bottom line.

Meanwhile, the BUMA Australia estimating team sets the industry standard for reliably and accurately evaluating projects – providing optimised tenders and successful economic outcomes. ***AMR***

For more information, visit ww.buma.com.au

Case Study - Goonyella Riverside Mine

Location: Central Queensland
Client: BHP Mitsubishi Alliance (BMA Coal)
Commodity: Metallurgical Coal

Our Operations

Located in the Bowen Basin of Central Queensland, BMA's Goonyella Mine is one of Queensland's largest coal mines. It is situated approximately 30 kilometres from the town of Moranbah, and around 190 kilometres by rail west of Mackay and the export terminals of Hay Point and Dalrymple Bay.

The BUMA Australia team have been providing mining services at the mine since 2015.

We provide labour, supervision, technical support, and mobile plant to perform truck and excavator pre-strip operations. Overburden of more than 30 million bank cubic metres is mined by our fleets every year.

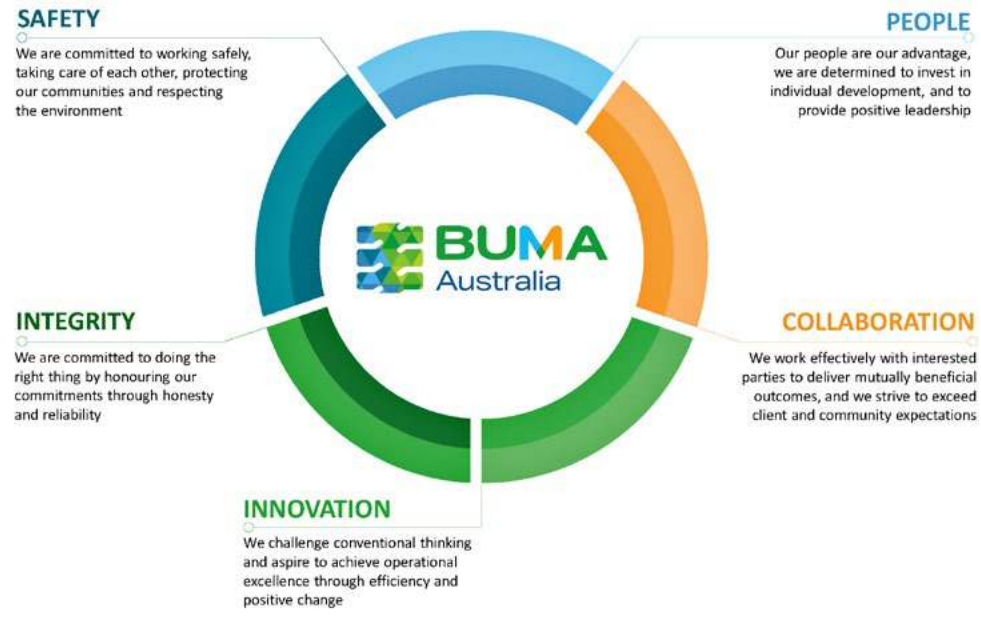
Our fleet at Goonyella comprises a combination of Komatsu 930E and Caterpillar 793 trucks with Liebherr R9800 and Caterpillar 6060 excavators.

Community and Environment

We work closely with the community to operate a safe and environmentally responsible mining operation. Dust and noise restrictions are managed to ensure minimal impact.

BUMA Australia can provide:

- Coal and hard rock mining
- Full scope Mining services
- Civil earthworks
- Creek diversions
- Tailings dams
- Technical assessments
- Economic Analysis
- Site Rehabilitation
- Mine infrastructure
- Drainage works
- Mine planning
- Asset management services
- Environmental Monitoring and reporting





BUMA Australia

Our vision is to be a leading mining service provider contributing to future energy solutions.

BUMA Australia was established in 2021 to acquire the Open Cut Mining business of Downer. This acquisition included the transition of all people, mining services contracts, assets, systems and intellectual property from a business which successfully provided mining services in diverse locations and across many commodities since 1922.

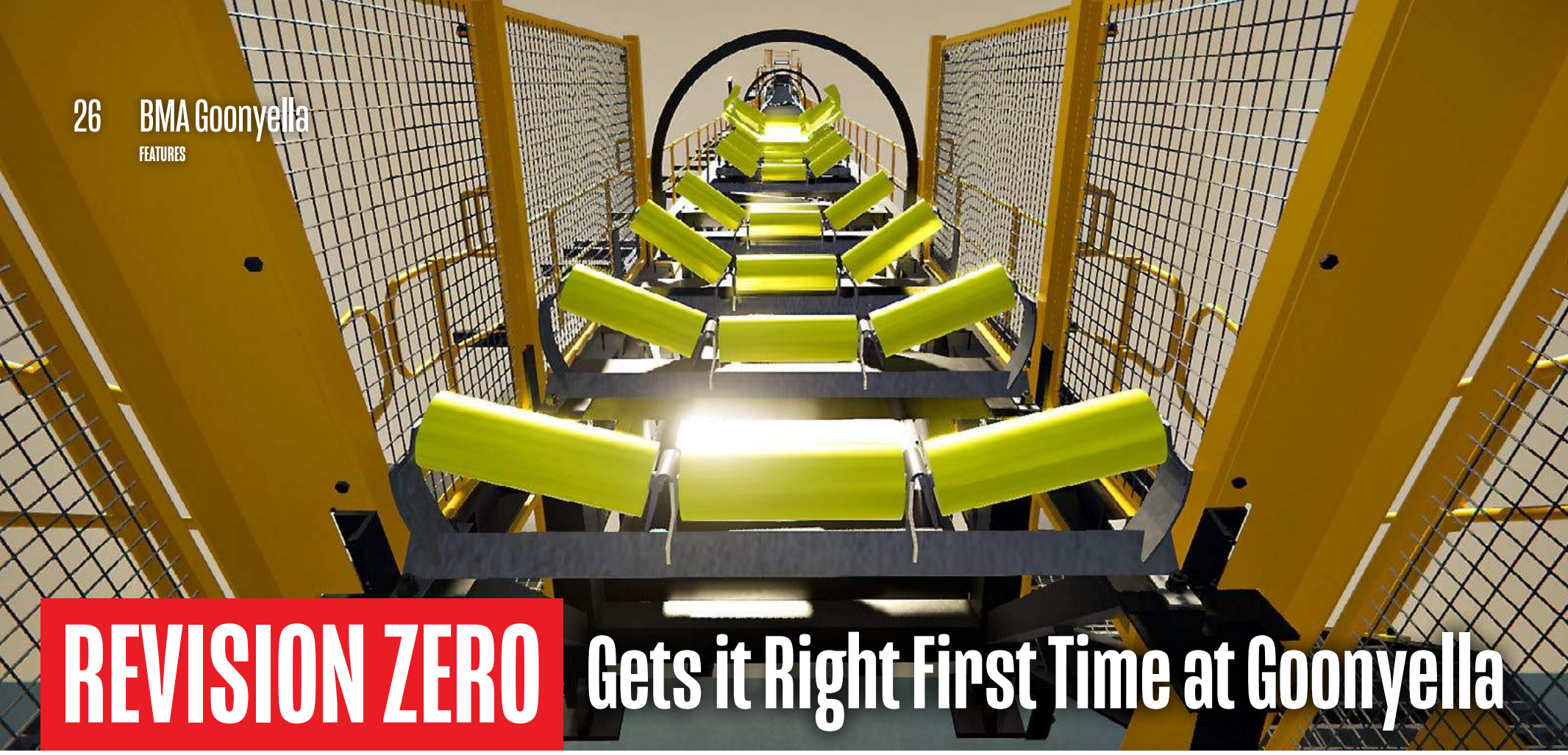
BUMA Australia offers the full scope of mine services and can tailor the offering to meet client requirements. This includes:

- Short, medium and long-term scheduling & planning
- All mine operations and statutory management
- Greenfields development and start-up
- Maintenance and management of large-scale mobile plant
- Mine site rehabilitation works
- Costing proposals and feasibility studies

With a strong focus on delivering optimal outcomes for clients and a strong commitment to safety, innovation, and technology, BUMA Australia is one of Australia's leading mining contractors.

To find out more
Visit buma.com.au or email us at info@buma.com.au

BUMA Australia



REVISION ZERO Gets it Right First Time at Goonyella

Specialist Construction Modelling and Steel Detailing company Revision Zero was engaged to perform the 3D BIM modelling and detailing of approximately 143 tons of structural and mechanical steel for the Goonyella Conveyor Upgrade.

Specifically, the works included steelwork items:

- Gantries,Trestles and their associated mechanical components
- Handrails and Grating
- Guards
- Ladders

The scope was completed within the desired schedule and with zero defects in the field.

The Goonyella site is located in the northern part of the Bowen Basin, approximately 30 kilometres north of Moranbah and 190 kilometres south-west of the Hay Point port facilities in Central Queensland.

Goonyella Riverside is an open-cut coal mine, Australia's third-biggest coal mine by recoverable coal reserves, and one of the nine metallurgical coal mines in Queensland's Bowen Basin.

About Revision Zero

Revision Zero evolved out of the Founder's extensive experience in the Steel Detailing, Engineering and Construction industries. The Founder previously owned Steel Detailing companies and has extensive experience in owning and managing offshore Steel Detailing offices in South East Asia.

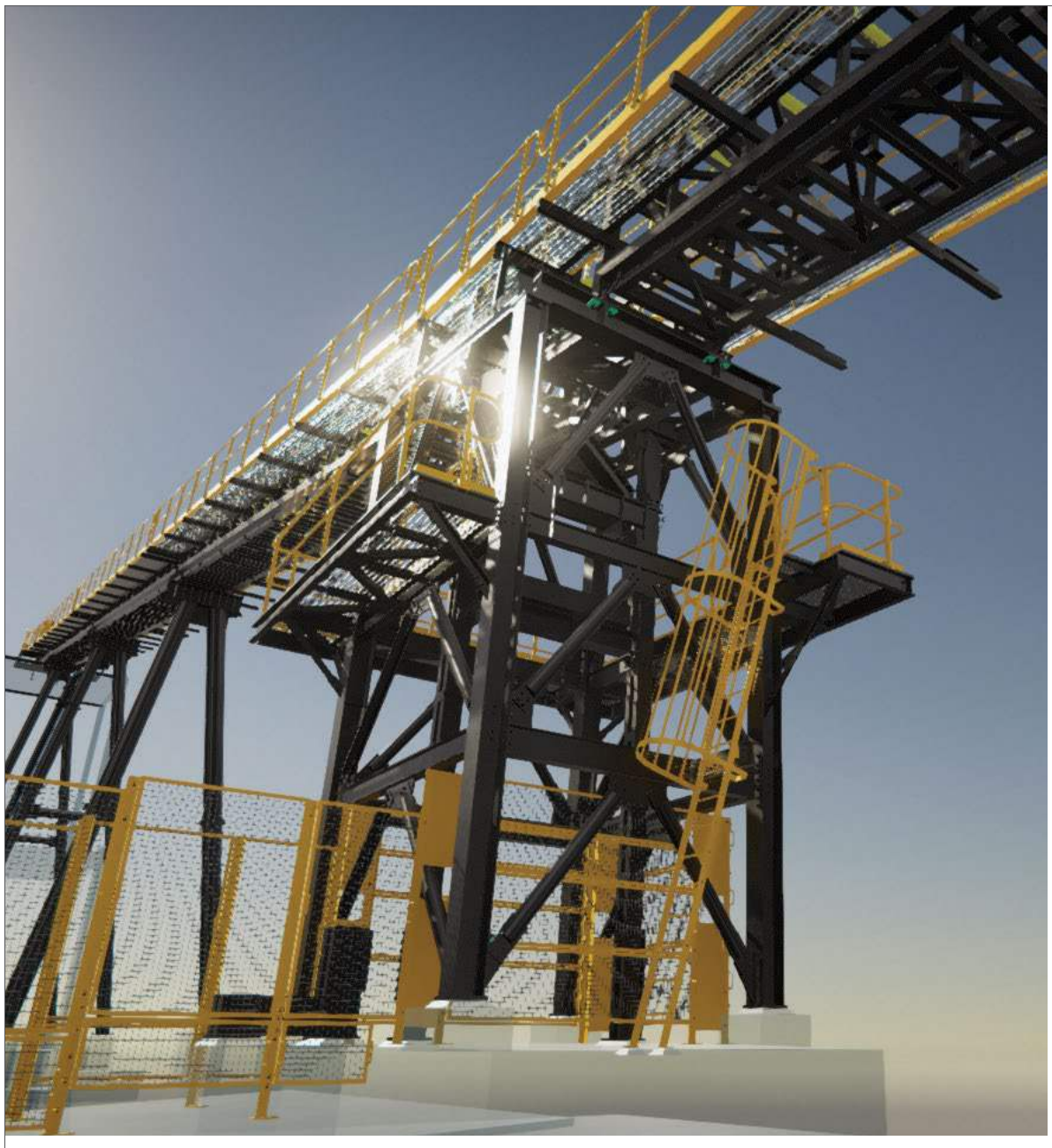
Revision Zero's main production office is based in Manila, The Philippines. The company has been structured to utilise the large pool of local detailers blended with a management team of Australian and New Zealanders to provide a lower cost solution without compromising quality, security and technical experience.

With a company representative based full time in Australia and expatriate project and production managers being a point of contact, the company can ensure projects are managed and delivered smoothly and with complete transparency.

The comprehensive industry knowledge and expertise of the current team encircling Steel Fabrication, Steel Detailing, Structural Engineering, Engineering Management, Construction Management, and Project Management ensures Revision Zero are well placed to be able to assist its clients to deliver a successful, cost effective, outcome across all facets and milestones of a project.

The company has local representation in Australia, New Zealand and the UK and have recent experience in assisting and detailing steelwork projects in Australia, the US, New Zealand and the UK.

AMR



REVISION ZERO
IFC - INNOVATIVE FOCUSED COLLABORATIVE

WELCOME TO REVISION ZERO

Revision Zero is a Construction modelling and Steel Detailing company that empowers clients globally to shape the future of the built environment. Our expertise in the use of 3D Construction models enables Revision Zero to offer a multitude of services which help reduce risk, improve quality, and enhance performance for the Mining, Resource and Commercial markets.

A range of other services are available including Model Estimating for tenders and Resource Leasing.

Back office services include Document Control and Construction Animations.

UNDERPIN BIM WITH MILLIMETRE ACCURATE, DATA RICH 3D MODELS

Revision Zero can address all your requirements to sustain an Integrated Project Delivery:

- Early engagement of Revision Zero in the project design and delivery process bridges the gap between the design team, fabricators and erectors to mitigate costly rectifications throughout the project life. We specialise in the model details and collaboration needed to span the differing disciplines
- Encompassing architectural, structural and MEP modelling
- Using a wide range of authoring tools to create our 3D models, adhering to the necessary Level of Development (LoD) and progression.
- Creating millimetre accurate 3D models of Steelwork assemblies, Platework and Vendor items. By bringing the project to life with 3D modelling, we can help you create the winning tender, achieve BIM compliancy, and produce data rich detailing models with the necessary reports and machinery data to support fabrication and erection.

MODELLING TO SHAPE THE FUTURE

Our team of over seventy skilled professionals have the knowledge and experience to accommodate structures of all sizes and types. Revision Zero take pride in utilising the latest technologies for modelling, information management and process improvement.

Follow us on in: https://ph.linkedin.com/company/revision-zero

Get in touch and find out more today: https://revision-zero.com/

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BMA Goonyella Riverside Operational Interaction with Central Queensland Hydraulics

Central Queensland Hydraulics Pty Ltd (CQH) considers BMA Goonyella Riverside Mine (GRM) a valuable customer and is proud to have been a vendor for over 25 years.

CQH has supported GRM by providing labour and materials on site for servicing, lubrication and project work. GRM also sends equipment into our Paget, Mackay Workshop for Repair and Servicing. We also sell a large range of hydraulic equipment, parts, filtration products, hydraulic filters and fittings to GRM and pride ourselves on providing an efficient service at competitive pricing.

Site Maintenance
CQH has played an important role on site providing assistance with the maintenance and servicing of the hydraulics on the following Equipment:

- Clean Coal 7M Stacker
- Conveyors Systems
- Malco Feeders
- Rom Apron Feeders
- Raw Coal Stacker Hydraulic System
- Train Load Out Hydraulic System

Current and recent Scope of Site Works include:

- Attending site regularly to conduct servicing and repairs to the above systems.
- Providing Lubrication Fitters on a permanent roster to keep all systems operational.
- CQH has replaced the Lubrication Systems on the Shakers and continues to provide maintenance in this area.
- Design, Manufactured and Installation of Hydraulic Power Units for the Malco
- Systems.
- Supply and Install on site other major equipment such as Brake Systems on the Raw Coal Stacker Equipment.

Direct Sales
CQH supplies a large range of products to GRM used for servicing and maintenance of equipment on site eg.

- Numerous Fittings, Adaptors, Gauges, Coils, Solenoids etc.
- Hydraulic Filters, Filter Elements, Pressure Filters,
- Hydraulic Motors and Pumps,
- Hydraulic Brake Systems,
- Hydraulic Valve Assemblies,
- Hydraulic Cylinders and Rams,
- Hydraulic Power Units,
- Fuel Systems components,
- Grease systems components,
- Distributor of Banlaw, Parker, Hydac, Ryco and numerous other Suppliers.
- BHP Compliant Site Vehicles.

Mackay Workshop Support
CQH has a fully equipped workshop capable of handling Cylinders, Rams, Pumps, Motors that come in from GRM for Repairs and Servicing.

- Test bench up to 55kW
- Cylinder strip down Bench
- Fixed Hone Bench
- Light Fabrication and Machine Workshop
- CQH is an authorized Build Centre for Parker Denison Goldcup Pumps & Motors
- Inline “Fluid Contamination Unit: (FCU)
- Inline “Portable Data Recorder” (HMG)
- Portable Flushing Unit

Design & Manufacture
CQH has a proven track record of being able to design and manufacture several pieces of equipment to suit GRM’s unique requirements for their site equipment, and continues to supply certain equipment on a regular basis.

These include:

- Hydraulic Cylinders
- Hydraulic Power Units
- Valve Assemblies
- Portable Lubrication Systems

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6 VITAL TOOLS
TO GROW YOUR BUSINESS

Our Mining Business Development Package has helped businesses like yours, across a range of industries, to form relationships with key decision makers on Australian mine sites.

The 12 Month Package includes:

- Access to our Mines Database (Provides details for Key decision makers across 400 mines)
- Social Media Blast to over 7000 followers across all Publications & Exhibitions platforms
- 12 hard copies of The Australian Mining Review (monthly), including The Australian Oil & Gas Review
- Weekly Mining Report (Carefully researched, real business opportunities)
- Weekly Mines Activity Report (Operational Activity specific to Mine Sites)
- Directory listing on Mine Suppliers Online



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Walz's Proud Record Of Success At Goonyella



Walz Group, an industry leader in specialist construction and maintenance services for the resources, energy and infrastructure sectors, has successfully completed a number of key projects at BMA's Goonyella Riverside Coal Mine in Queensland in recent years.

With more than 45 years of experience, Walz Group showed its versatility with the variety of important roles it has filled at Goonyella Riverside, including:

- Horizontal Belt Filter – Completed 2019
  - Installation of a new Horizontal Belt Filter for the wash plant.
  - This was the company's first time working back at Goonyella Riverside Mine in recent years and it was a great opportunity for the Walz team to demonstrate its capabilities working alongside a new client team.
- Dewatering Screens Project – Completed 2020
  - Supply and installation of a new dewatering screen platform to support the two new dewatering screens and associated componentry at the wash plant.
- Fire Water and High Pressure Water Upgrade – Completed 2021
  - Supply and installation of the new fire and high-pressure water system for Goonyella Riverside.
- R10M Conveyor Replacement – Completed 2021
  - Removal of the existing R10M conveyor and gantries
  - Supply and Installation of the new R10M conveyor and gantries.

Notably, each of these Projects were carried out safely and on time, once again highlighting the company's skill and experience, which inevitably led to Walz picking up other smaller pieces of work at Goonyella Riverside.

A Walz spokesperson told the Australian Mining Review that the company is grateful to have been given the opportunity by BMA to undertake a range of projects at Goonyella Riverside since 2019.

"Since that time, our presence and project execution has resulted in a significant amount of work at both Goonyella and now across a number of other BHP sites. We are continuing to tender work for BHP and look forward to continuing the close working relationship," he said.

Walz is currently undertaking work for BMA at its Saraji Mine in Queensland, which includes extending Saraji's existing Heavy Vehicle (HV) Workshop. The company's scope of works at Saraji includes the supply and installation of four new workshop bays and associated services.

Since its formation by Colin and Desley Walz in 1976 as a small construction business operating in and around the Central Queensland Region, Walz has grown to become an industry leader in specialist construction and maintenance services for the resources, energy and infrastructure sectors. ***AMR***

WALZ

An industry leader in specialist construction and maintenance services for the resources, energy and infrastructure sectors.

"Grateful To Be Associated With BMA Gooneylla Riverside Mine"



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To take advantage of our 45 years of experience
GLADSTONE | MACKAY | BRISBANE

UNDER CONTROL WITH GRT

DUST CONTROL
Achieved without the traction and surface integrity (rutting, potholes) issues associated with overwatering.

INCREASED SAFETY
Reduction of Road Maintenance Vehicle interactions with AHTs.

IMPROVE CYCLE TIMES
Reduction of AHTs campaigns and stoppages caused by road maintenance.

COST REDUCTION
Reduction in AHT fuel burn and maintenance costs of minimising AHT slow down and stoppage events.

INCREASED SOCIAL VALUE
Reduction in Greenhouse Gas (GHG) emissions by increasing AHTs fuel efficiency and reducing water truck run time.





Global Road Technology is meeting the needs of a fast-evolving mineral resources sector with their cutting-edge debris solutions.

Located in Queensland, the company is a world leader in dust control, soil stabilisation, erosion control and water management.

The engineering and manufacturing company leverages innovative thinking and the latest technologies to drive safer and healthier outcomes in the mining, civil, agriculture, land development and environmental management space.

Global Road Technology Managing Director Troy Adams said many of their solutions were purpose-built for the mining sector, including their Australian Made dust control products and hardware.

Mr Adams said these solutions were from "pit to port" and covered haul and light vehicle roads, drill and blast, underground operations, crushing and conveying, stockpiles and transport off site.

"We design products and services that meet the needs of mining operations and we're always keeping an eye on the mineral resources landscape in case those needs change," Mr Adams said.

"And they are changing.

"Mining companies have significantly increased their use of autonomous trucks and haulage systems.

"Australia already leads the way by deploying 575 autonomous mining trucks across its mines, with six mines using entirely autonomous trucks.

"The shift has created a significant improvement in operational efficiencies, productivity, and safety of staff.
"But it has brought new challenges – dust control, loss of traction, rutting, spillage, proximity, knock-on effects, and slow or stop events - which Global Road Technology has worked hard to address."

"We have responded with a strong shift to const effective, reliable products coupled with digital technologies, which help mine operators control dust while feeding them reliable and useful data."

The company offers industrial IoT, cloud infrastructure, machine learning, and automation, to help operators mitigate health, safety and environmental impact.

Their haul road dust control system includes Sustainable Mining Autonomously Reporting Technology (SMART), the market's most advanced and cost-effective management system for haul road dust control.

The SMART dosing units are Australia Made, used globally, and designed and assembled by a highly experienced team of engineers.

Mr Adams said the system includes a central control and communication module combined with electrical and mechanical hardware.

Sophisticated and user friendly, it provides ability to remotely control and automate product dosage, error detection, flow rates, and more.

Leveraging this technology, Global Road Technology can offer round-the-clock dust control and support strategic decisions through meaningful data, reporting and other communication tools. ***AMR***

For more information, visit https://globalroadtechnology.com/





RIO TINTO CONTINUES TO POWER AHEAD DESPITE CHALLENGES

Despite COVID-19 related issues affecting its Pilbara operation in particular, mining giant Rio Tinto continues to forecast strong future developments across its world-class operations.

Rio Tinto Chief Executive Jakob Stausholm, said recently that the company made notable progress during the previous quarter with the commencement of underground mining at Oyu Tolgoi following a comprehensive agreement reached with the Government of Mongolia, completed the acquisition of the Rincon lithium project in Argentina, and signed a framework agreement at the Simandou iron ore project in Guinea.

"These projects are all aligned with our strategy of growing in materials essential to a decarbonising world," Mr Stausholm said.

"Production in the first quarter was challenging as expected, re-emphasising a need to lift our operational performance. We launched seven more deployments of the Rio Tinto Safe Production System, building on the achievements from the previous rollouts.

"As we ramp up Gudai-Darri, our iron ore business will have greater production capacity and be better placed to produce additional tonnes of Pilbara Blend in the second half.

"We released an independent report on our workplace culture and are implementing all 26 recommendations to make positive and lasting changes. We also announced an agreement with the Yinhawangka Aboriginal Corporation on a new co-designed management plan to ensure the protection of significant social and cultural heritage values.

"These actions will ensure we continue to deliver attractive returns to shareholders, as we invest in sustaining and growing our portfolio, be a partner and employer of choice and progress our ambition to achieve net-zero carbon emissions."

Q1 2022 operational highlights

Mr Stausholm said the company experienced increased COVID-19 cases on-site in the Pilbara following the Western Australian border opening and spikes in cases across its other operations.

"We continue to monitor new variants and will remain vigilant."

- Pilbara operations had a challenging first quarter, as expected. Rio produced 71.7 million tonnes (100% basis), 6% lower than the first quarter of 2021. Pilbara shipments in the first quarter were 71.5 million tonnes (100% basis), 8% lower than the first quarter of 2021. The company expects increased production volumes and improved product mix in the second half with the commissioning and ramp up of Gudai-Darri, commissioning of the Robe Valley wet plant and improved mine pit health. Full year shipments guidance remains unchanged.

- Bauxite production of 13.6 million tonnes was in line with the first quarter of 2021 with similar wet weather disruptions as the corresponding period.

- Aluminium production of 0.7 million tonnes was 8% lower than the first quarter of 2021 due to reduced capacity at the Kitimat smelter in British Columbia following the strike which commenced in July 2021. Preparations continue for the Kitimat smelter to progressively restart from June 2022 with full ramp up expected by the end of the year. All of the company's other smelters continued to have stable performance, despite considerable challenges related to unplanned employee absences due to COVID-19.

- Mined copper production of 125 thousand tonnes was 4% higher than the first quarter of 2021 due to higher recoveries and grades at Kennecott, partly offset by lower grades at Oyu Tolgoi and lower throughput at Escondida. On April , Rio announced a new five-year Collective Bargaining Agreement had been reached with unions representing approximately 1,300 employees at the Kennecott operation.

- Titanium dioxide slag production of 273 thousand tonnes was 2% lower than the first quarter of 2021 as a result of equipment reliability issues at Rio Tinto Fer et Titane (RTFT), Canada, partly offset by continuing ramp up at Richards Bay Minerals (RBM) in South Africa. On March 18, Rio announced the lifting of force majeure on customer contracts at RBM, that had been in place since June 30, 2021.

- Production of pellets and concentrate at Iron Ore Company of Canada (IOC) was 3% higher than the first quarter of 2021, which was impacted by mine feed constraints. There is good progress on the initiation of Rio Tinto Safe Production System (RTSPS) at the concentrator.

- In the first quarter, Rio initiated seven more deployments of the RTSPS at five sites focusing on sustainably unlocking capacity across the Rio Tinto system. Mr Stausholm said the company is already seeing promising results for example at West Angelas achieving the best effective utilisation of its production drills across Pilbara iron ore. ***AMR***







KSB ANNOUNCES NEW, LARGER ADDITION TO GIW® MDX LINE:

MDX-850

KSB has announced a significant expansion of the GIW MDX product line, with the MDX-850.

KSB's line of GIW® slurry pumps is designed to ensure optimal wear performance in harsh conditions.

The GIW® Mill Duty Extra Heavy (MDX) product line is specially engineered to handle the extreme conditions found in hard rock mining applications.

Mining operators are seeing an increased demand for minerals and ores.

Operators must now consider the costs of pump maintenance and replacement as well as the cost benefit of utilising fewer larger pumps versus several smaller pumps to perform the same work.

The larger MDX-850 is the solution for operators who need to reach higher production levels while maintaining a lower total cost of ownership.

The MDX is widely considered the best cyclone feed pump available for the mining industry, so extending the MDX product line was a natural choice.

The MDX-850 is a major step up in size, with an 850 mm (34") discharge and 2,600 mm (102") impeller compared to 750 mm (30") / 2,350 mm (92") of the MDX-750, previously the largest MDX pump.

Design features of the MDX-850 also include a variety of improvements applied to the MDX range in recent years, such as an increased pump width to allow for improved diverter design, and a thickness increase in critical areas of the impeller to improve operation and wear life.

Thickened impeller vanes, cast in proprietary Gasite™ 28G and Endurasite™, improve wear life, so the lifecycles of wet-end parts match scheduled downtime.

The MDX-850 features an improved interface between the suction liner and the suction plate, which allows for the use of a wear ring and innovative hydraulic features at the pump inlet.

As with all GIW® MDX pump assemblies, the MDX-850 has an adjustable suction liner.

The MDX-850 is compatible with the GIW® RAMSL (Remotely Adjusted Mechanical Suction Liner).

RAMSL technology makes for faster and more accurate nose gap adjustments.

The MDX-850 is designed with high efficiency in mind.

According to Amy Lewis, KSB's MDX-850 Product Manager, "A significant amount of time and attention was devoted to the impeller hydraulics to ensure it would offer the best performance.

The MDX continues to be the top choice in mill circuit pumps and the 850 promises to shatter the barriers preventing customers from achieving maximum efficiency."

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LIVES FOR HARD ROCK.



MDX - Mill duty extra heavy pump for severe mill duty applications

The KSB GIW® MDX is equipped to tackle the most extreme slurry pumping duty conditions. With its patented wearing parts and material technology, the MDX matches operating cycle times with scheduled mill outages meaning fewer disruptions and increased operational efficiency.

Learn more at www.ksb.com.au or speak with a KSB representative 1300 073 887.

KSB MINING

KSB



CALIDUS POURS FIRST GOLD AT WARRAWOONA



Calidus Resources Limited (ASX:CAI) has poured the first gold at its 100 per cent owned Warrawoona Gold Project located in the Pilbara of Western Australia from the commissioning of the gravity circuit.

The project has now entered the ramp-up phase, with the elution circuit currently commissioning, paving the way for the first bar sourced from the leach circuit to be poured next week.

"Pouring our first gold on time and budget is the culmination of an incredible effort by all employees and contractors involved at Warrawoona," Managing Director, Dave Reeves, said.

"With production underway and revenue being generated, we have begun to lay the foundations for ongoing growth.

"Cashflow from Warrawoona will provide opportunities to increase production via the development of our Blue Spec deposit and help fund our highly promising gold and lithium exploration."

Calidus recently commenced continuous ore processing at the Warrawoona, with activities commencing with processing of low-grade ore before transitioning to run-of-mine ore as operations moved to steady state.
With the first gold pour completed, production is now ramping up to ~90,0000oz a year in Stage One.

"The start of continuous processing operations less than five years since our debut on the ASX is a major achievement in the life of Calidus and is the result of an outstanding performance by all our team and contractors," Calidus Managing Director Dave Reeves said.

"Despite the challenges faced in our industry during the Covid pandemic, we are pleased to have delivered Warrawoona on time and on budget.

"As Warrawoona completes successful commissioning and transitions into steady state operations, Calidus is well positioned for future growth and delivering strong shareholder returns.

"We look forward to becoming Western Australia's next gold producer."

In it latest Quarterly, Calidus reported that project construction was estimated to be 98% complete with no lost time injuries recorded to date. During the quarter, $20.4 million was incurred on the Warrawoona development with further development expenditure of $3.5 million remaining to first gold production.
Warrawoona is forecast to produce up to 105,000oz per annum. However, this has the potential to increase to 139,000oz per annum when the nearby Blue Spec deposit is developed.

Blue Spec has a JORC Resource of 415,000t at 16.3gpt for 219,000oz and is now the subject of a Definitive Feasibility Study (DFS) which is due in the June quarter of 2022.1

Project highlights for the quarter included:

- 9MW thermal power station commissioned and electrification of all switch rooms complete;
- Borefields for process water supply are operational and raw water and potable water services are commissioned in the plant;
- 4.5 MW SAG Mill is ready for ore commissioning;
- Tails thickener is water commissioned;
- Air services are commissioned;
- Major structural steel erection and mechanical installation complete;
- Piping and electrical installation complete, final testing underway;
- Tailings storage facility complete and ready for discharge;
- Operational workforce recruited and mobilised to site to assist with commissioning activities;
- All operational procedures, audits, inspections and maintenance management systems have all been implemented, Maintenance and Operational crews have been on site for some time and training is well advanced;
- All eight 777 (100t) trucks mobilised to site and operational;
- Main excavators now operating, targeting 450,000 BCM movement in May;
- 140,000t of ore on the ROM pad, targeting 200,000t on operational start-up;
- Additional 20,000 ozs hedged for delivery in 2022 at A$2,688/oz; and
- Zenith Pacific to construct a renewables microgrid comprising a 4MW Solar Farm with 3MW battery storage system at Warrawoona Gold Project under a Power Purchase Agreement (PPA):
- Construction of the solar farm is part of the PPA whereby Calidus purchases power from Zenith on a unit rate for power consumption; and
- The renewables microgrid will be constructed in H2 of CY2022 and will feed into the distribution line between the power station and accommodation village. ***AMR***



Integrated Project Solutions

GR Engineering Services Limited (GRES) is a leading process design and engineering company which supports mining developments from study to operation.

The ASX-listed company provides fixed price Engineering-Procurement-Construction (EPC) and Engineering, Procurement and Construction Management (EPCM) project delivery services to the mining and minerals processing industries internationally.

GRES successfully completed the suite of feasibility studies for the Warrawoona Gold Project and was selected as the EPC contractor for the 2 Mtpa conventional CIL processing plant and associated facilities in 2020.

Over the last two years, GRES has continued to work closely with Calidus as the funding and implementation pathway for the project has developed.

GRES is pleased to be working with Calidus on the EPC delivery of the Warrawoona Gold Project leading to Calidus becoming Australia's next Gold producer.

GRES has successfully completed feasibility studies, process and engineering designs and construction for projects of various scale covering a diverse range of metalliferous and mineral commodities.

The company has delivered mineral processing, hydrometallurgical facilities and infrastructure for a range of clients, both in Australia and internationally.

With extensive experience across a range of commodity types including gold, copper, lithium, graphite, iron ore, lead and nickel, the company is equipped to provide solutions for all types of mining projects.

The innovative engineering solutions developed by GRES enable its clients to confidently move into development with the knowledge that the outcomes from study work will be reproduced in the operation of their projects.

GRES has a proven track record of delivering integrated project solutions, having provided services in more than 20 countries and across a vast range of precious metals, bulk mineral concentrates and industrial commodities projects.

GRES has a presence in the Americas via its wholly owned subsidiary Hanlon Engineering & Associates, Inc. (Hanlon), based in Arizona, USA.

Hanlon is a single source, all-inclusive engineering and management firm that has a well-known brand along the US western states.

GRES also has a presence in the hydrocarbons industry via its wholly owned subsidiary, Upstream Production Solutions (Upstream).

Upstream is a leading provider of operations, maintenance and well management services to the oil and gas industry in Australia.

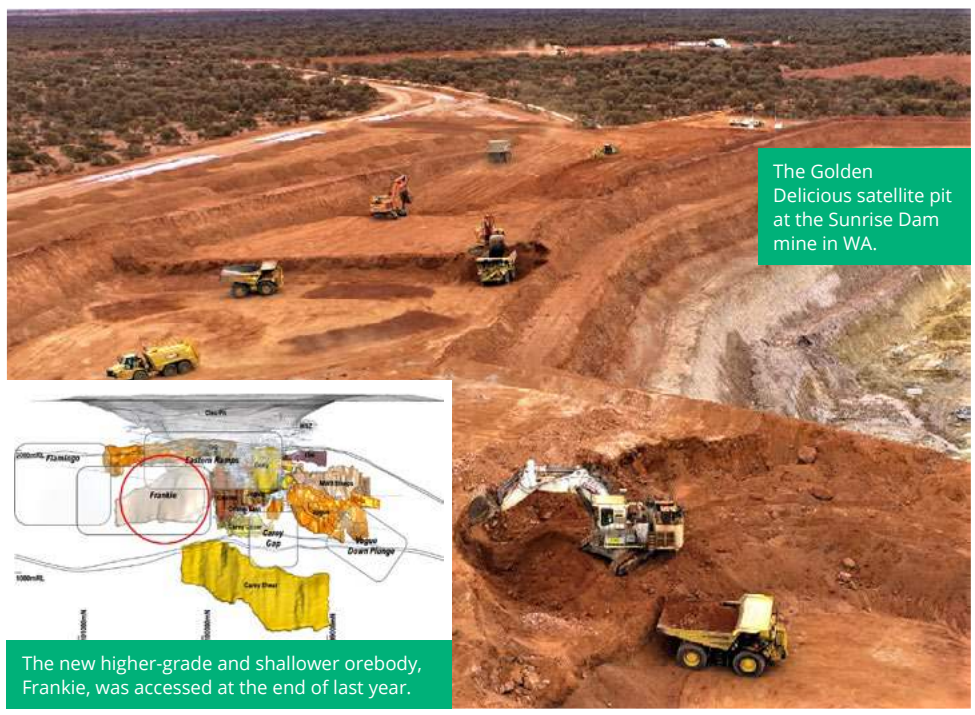
GRES has recently acquired MIPAC who were founded in 1997 and have operated for nearly 25 years on projects in Australia and internationally as a leading global provider of control systems engineering, automation and technology services.

AMR





HOUSE OF THE RISING SUN



The Golden Delicious satellite pit at the Sunrise Dam mine in WA.

The new higher-grade and shallower orebody, Frankie, was accessed at the end of last year.

AngloGold Ashanti continues to invest in the future of the Sunrise Dam mine after 25 years of operation.

A three-year accelerated underground exploration program was put in place in 2019 and, since then, new orebodies have consistently been found with the new discoveries being close to existing infrastructure.

Success Of Sunrise Dam
Sunrise Dam is one of two AngloGold Ashanti operations in the north-eastern goldfields of WA, with the other being the Tropicana gold mine.

Sunrise Dam produced 229Koz of gold in 2021 with an AISC of $1573/oz and is 100% owned by AngloGold Ashanti.

Open pit production began in 1997, with the main pit completed at a final depth of 500m below surface in 2014.

Underground mining began in 2003 with a number of different mining methods being applied, depending on the style of mineralisation and grade of the geological domain.

In the second half of 2018, a new fine grind and flotation circuit was completed and installed at Sunrise Dam.

Open cut mining methods started again in 2021 at the Golden Delicious satellite pit, with a new higher-grade and shallower orebody, Frankie, was accessed by year-end 2021.

Sunrise Dam also includes the Butcher Well project (at 70%).

Golden Delicious
Golden Delicious, a name synonymous with a variety of apple, is also the name of the small, productive open pit servicing the predominantly underground Sunrise Dam mine.

It is currently the only satellite pit from which Sunrise Dam draws material for stockpiling and blending with underground ore to optimise throughput and production.

Since mid-2021, ore from this pit has been displacing low-grade stockpile materials from the mill feed, making way for grade streaming to be applied through 2022.

Golden Delicious contributes about 1Mt of ore annually to the 2.7Mt Sunrise Dam gold mine.

This open pit is expected to deliver about 136Koz of gold over a 2.7-year mine life.

Frankie
Part of Sunrise Dam's accelerated exploration program includes a focus on drilling at Frankie to fast-track reserve conversion.

The substantial underground diamond-drilling program that began in 2019 resulted in the discovery of the Frankie orebody in 2020.

Frankie is close to existing underground structure with the potential to deliver more than 500Kt of ore annually over a five-year period from 2023.

At the end of 2021, the new higher-grade and shallower Frankie orebody was finally accessed, as part of AngloGold Ashanti's aggressive drilling strategy.

Sunrise Dam Strategy
The accelerated underground exploration program will support the mine site with building orebody knowledge, testing blue sky targets, adding to inventory, increasing the Mineral Resource base, converting Ore Reserves and identifying additional mining areas.

Improved mine flexibility remains a strong focus at Sunrise Dam where the investment in exploration added 0.7Moz to its Mineral Resource and 0.4Moz to Ore Reserve in 2021 (pre-depletion).

Exploration spend has also tripled in the last two years from almost a decade ago: a total of US$65m will be spent from 2020-2022, compared to US$22m from 2014-2016.

Apart from the focus on Frankie, the Sunrise Dam accelerated exploration is focused on the down plunge extensions of Vogue, bridging the gap between Carey Upper and Carey Shear and new targets at Flamingo and Eastern Ramps in the shallower regions of the mine.

This regional exploration continues to seek additional satellite ore sources within trucking distance of the Sunrise Dam processing plant.

AngloGold Ashanti's aim is to deliver annual ore production of 3Mtpa to displace lower grade surface stockpiles in mill feed.

Contractors And Infrastructure
Barminco carries out the underground mining under an alliance contract, while indigenous mining contractor Carey Mining, mines Golden Delicious.

Surface infrastructure in place includes the site's gas-fired power station, sealed airstrip, accommodation village, Central Tailings Discharge facility and workshops.

The 4.1Mtpa processing plant comprises conventional gravity and CIL circuits and a flotation/fine grind circuit.

A major multi-year underground exploration programme underway at the site has identified extensions to known mineralisation and several significant new ore zones.

Production Outlook
AngloGold Ashanti estimates that production will likely to be impacted in the next year or two due to lower stripping rates in 2021.

While gold production was 229Koz in 2021, it was higher in 2020 at 256Koz and also in 2019 at 254Koz.

As a result, a focus for the company in 2022 is the optimal sequencing of the pits and ensuring waste stripping is carried out on schedule.

Sunrise Dam's underground mining was also impacted by labour shortages.

AngloGold Ashanti will continue to build the pipeline of skilled personnel for its sites, including its successful graduate program and traineeships.

Australian Operations
AngloGold Ashanti has two operations in Australia: Sunrise Dam and Tropicana.

Both are located in the north-eastern goldfields of WA.

While Sunrise Dam is wholly-owned, AngloGold Ashanti has a 70% holding in, and manages, Tropicana, with its partner Regis Resources holding the balance.

Regis Resources acquired the share in Tropicana from IGO in March last year.

Together, these operations produced 494,000oz in 2021 (2020: 554,000oz), contributing about 20% to group production at AngloGold Ashanti.

At the end of 2021, the Australian operations accounted for about 10% of the group's total Ore Reserve and 8% of its total Mineral Resource.

The Australian operations also employed an average of 1,332 people, of whom 1,044 were contractors, last calendar year. ***AMR***



During its long partnership with AngloGold Ashanti's Sunrise Dam mine, **EDL** has consistently implemented ways to improve efficiency and lower the cost of power at the mine site.

Powering On

For 26 years, the Sunrise Dam Power Station has powered AngloGold Ashanti's Sunrise Dam mine in the Kalgoorlie-Goldfields region of WA.

Owned and operated by global sustainable energy producer EDL, the gas and diesel-fuelled station has a 43MW generating capacity and a track record exceeding 99.9% availability since commissioning in 1998.

History of continually improved efficiency

EDL's commitment to continually delivering the most effective energy solutions for customers is demonstrated at Sunrise Dam.

EDL has expanded the original Sunrise Dam Power Station several times over the years to support the mine's growing power needs.

In 2008, EDL worked with AngloGold Ashanti to transition to gas. EDL successfully delivered the new gas power station with minimal disruption to the existing power station and mining activities. In 2015, EDL converted the power station's gas supply from LNG to pipeline gas.

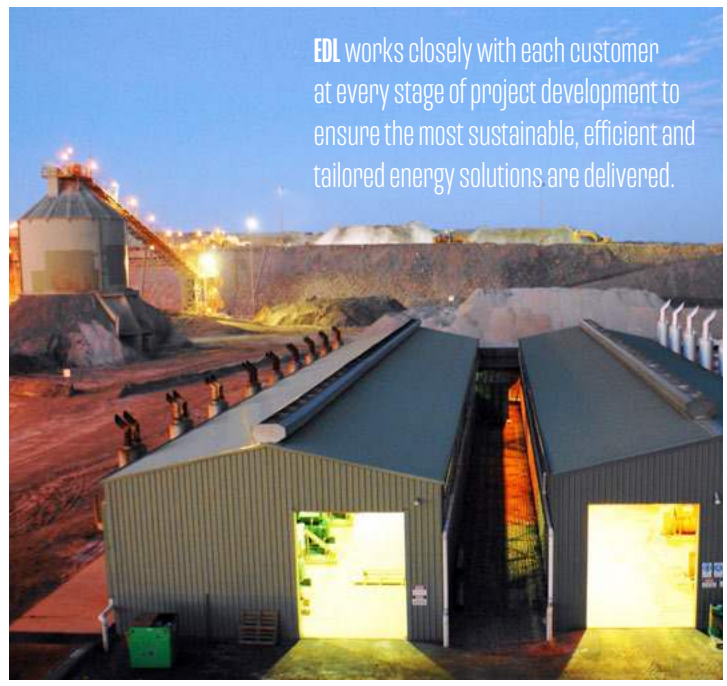
Leading global producer of sustainable distributed energy

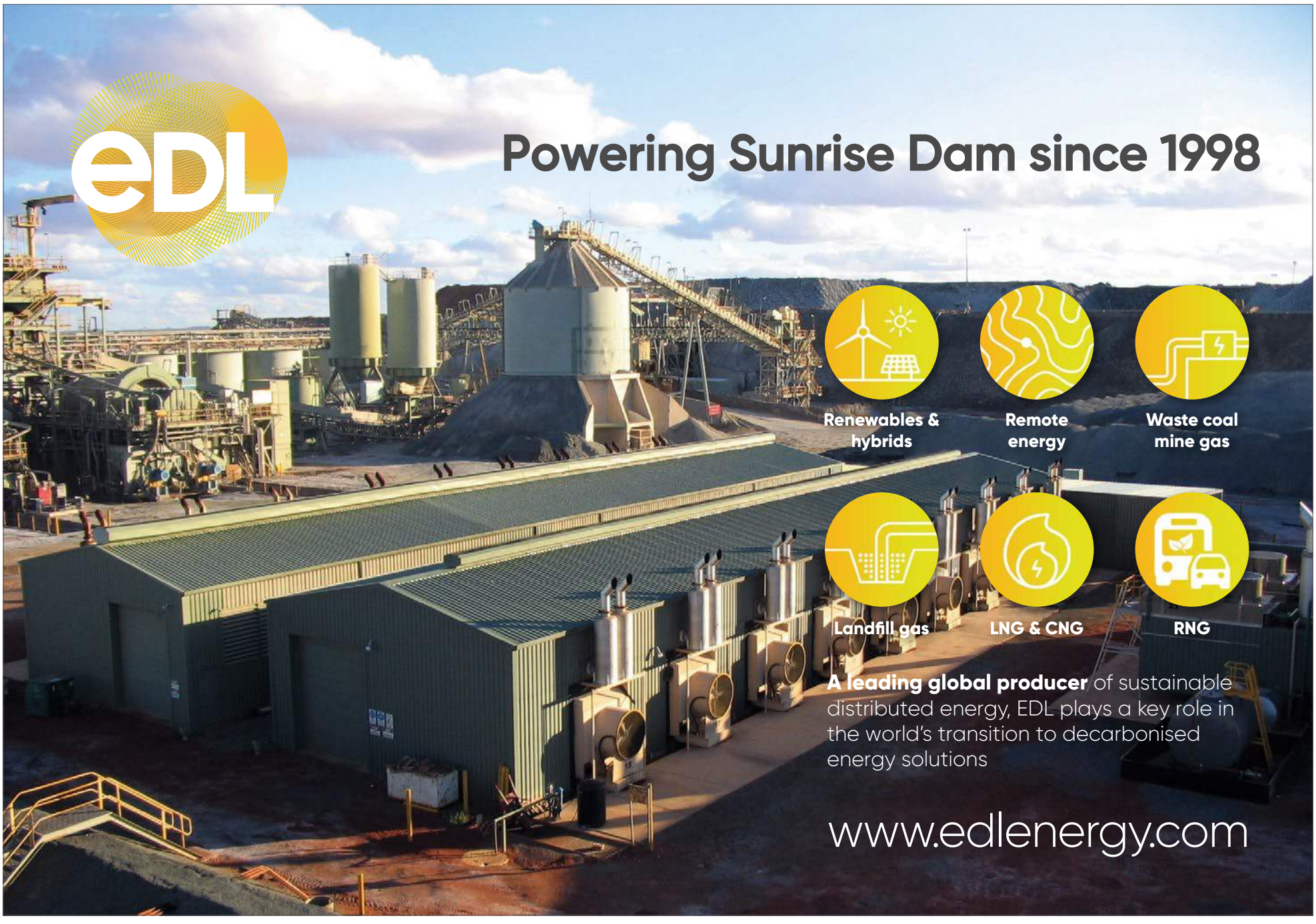
EDL is dedicated to a world of new energy for its customers, stakeholders and communities. EDL understands, and is prepared for, the complexities associated with the global energy transition.

Since 1988, EDL has successfully delivered more than 50 remotely located power stations and its collaborative approach has worked effectively to ensure that power is always supplied reliably and safely.

EDL currently operates 21 remote energy facilities across Australia, and is the country's leading independent provider of electricity to remote customers. It has more reciprocating generator and high penetration hybrid renewable generation experience than any other IPP in Australia. ***AMR***







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FMG REPORTS CONTINUED PROGRESS AT IRON BRIDGE PROJECT

Joint Venture partner Fortescue Metals Group Ltd (ASX:FMG) reports that the Iron Bridge Magnetite project in Western Australia achieved key milestones during the previous quarter.

The Iron Bridge Magnetite project will deliver 22mt per annum of high grade 67% Fe magnetite concentrate. Iron Bridge is a strategic investment that enables Fortescue to provide an enhanced product range and increase its production and shipping capacity.

Latest development highlights includes:

- Five module ships unloaded at Port Hedland, taking the total of the Project to date to 14 of 21 module ships
- Mechanical installation of Primary Crusher A is well advanced
- Continued progress on both the concentrate and return water pipeline installation as well as the raw water pipeline
- Completion of earthworks for the Concentrate Handling Facility (CHF) at Port Hedland
- Award of the mechanical and electrical works contract at the CHF.

FMG said the Project has made significant progress while managing the challenges associated with the impact of COVID-19, supply chain constraints and market inflation.

COVID-19 related labour constraints including isolation and absenteeism together with a tight labour market have contributed to workforce levels being significantly below the Project workforce plan for the March quarter.

Other factors include ongoing supply chain issues, higher installation and construction costs, as well as escalation in logistics and shipping costs, which have been further exacerbated by the recent lockdowns in China.

This has led to the capital estimate for the Project has been revised to US$3.6 - US$3.8 billion (previously US$3.3 - US$3.5 billion), subject to Iron Bridge Joint Venture approval. Fortescue's share of the capital estimate is revised to US$2.7 - US$2.9 billion (previously US$2.5 - US$2.7 billion).

The recent impacts have also led to as estimated delay for first production.

Fortescue said it continues to proactively manage COVID-19 and prioritise critical path work to minimise the impact on schedule. First production is now planned for the March 2023 quarter, from the previous guidance of December 2022.

FMG said that the Iron Bridge Magnetite project continues to represent a compelling investment for the Joint Venture partners given its low capital intensity and competitive operating cost structure.

The company said the strong demand for this high value in use product is expected to attract a premium to the Platts 65% CFR Index and will extend Fortescue's product range to the high-grade market segment.

The Iron Bridge Magnetite project will deliver 22mt per annum of high grade 67% Fe magnetite concentrate. Iron Bridge is a strategic investment that enables Fortescue to provide an enhanced product range and increase its production and shipping capacity.

The Iron Bridge magnetite project in Pilbara region of Western Australia is one of the biggest magnetite resources in Australia.

Iron Bridge is located 145km south of Port Hedland and incorporates the world class North Star and Glacier Valley Magnetite ore bodies.

The innovative process design, including the use of a dry crushing and grinding circuit, will deliver globally competitive capital intensity and operating costs.

The Iron Bridge project includes the installation of a 135km concentrate slurry pipeline to Port Hedland, together with a return water pipeline.

An unincorporated joint venture (UJV) between FMG Magnetite (69%) and Formosa Steel IB (31%) is developing the project in two phases.

Fortescue is responsible for the management and operation of the project.

FMG Magnetite is a subsidiary of FMG Iron Bridge, which is owned by Fortescue Metals Group (88%) and Baosteel Resources International Company (12%).

The first phase of the project was developed with a capital cost of $500m, while the second phase was initially estimated to cost approximately $2.6bn.

Final investment decision on the second phase of development was approved in April 2019. ***AMR***



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Proactivity
Thinking ahead

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NMT Projects is greasing the wheels of Australian trade with their popular turnkey transportation services.

The reputable logistics provider has a global footprint spanning multiple continents, helping companies move oversized cargoes and complex loads.

Providing nationwide coverage from Perth, NMT Projects arranges transport solutions for several critical industries, including supporting mining operators and engineering companies moving new and used equipment.

Their highly experienced team coordinates multimodal transport from place of manufacture through to mine site and engages with contractors to produce the most cost and time effective transport.

NMT Projects Business Development Manager Grant Bell said NMT are turnkey logistics, planning and design support specialists and this attention to detail elevated the company into a market leader for transport solutions.

He said whether operators required sea or land or air transportation, NMT Projects made sure product was delivered safely, cost-effectively, and as quickly as possible.

"In these industries time is literally money, so we are always prepared to source the best solutions," Mr Bell said.

"Here it's all about innovation, about finding better ways to move cargo.

"Through our continuously expanding network and highly skilled personnel, we support our clients through personal contact and assistance in all levels of shipment preparation and planning.

"It's about shortening timeframes, minimizing cost and safeguarding the equipment that needs to shipped."

Mr Bell said NMT Projects can move parts of equipment or complete plants and have a proven track record of delivering large scale projects into Australia, particularly into the Pilbara.

They provide total logistics management with a personal, hands-on approach, and are successfully delivering projects consisting of more than 1 million freight tons.

Meanwhile, the logistics provider works closely with engineering, procurement and construction companies, mining manufacturers and other entities to stay on top of industry requirements.

"We provide logistics management ranging from shipping, transport and installation on a turn-key basis, including route-survey's, technical assistance and supply of equipment and personnel," Mr Bell said.

"From comparatively small items to oversized and challenging loads, we have shipped them all.

"We have a wealth of experience shipping equipment and have the knowledge necessary to handle this equipment with care.

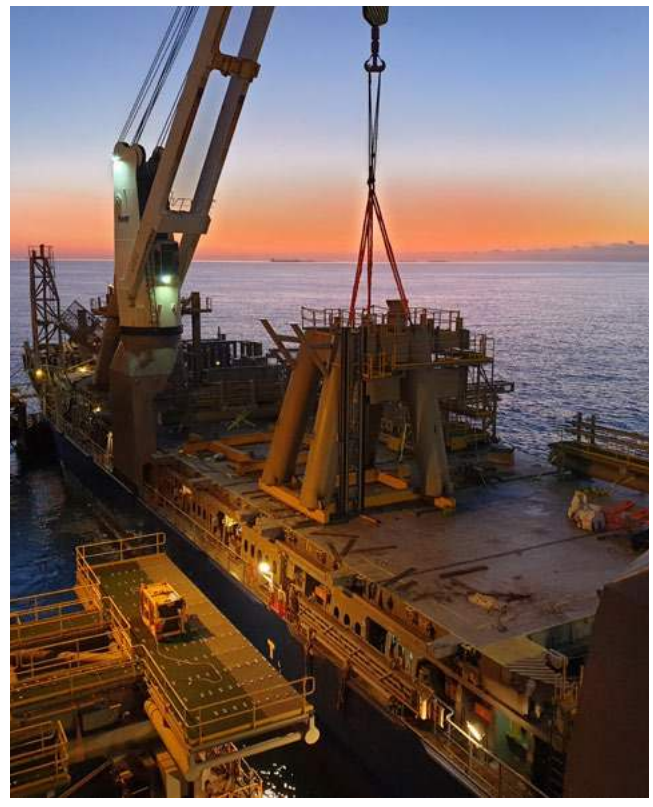
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A next-generation respirator half facepiece is taking the world by storm and helping the mining industry face these challenges head on with improved breathability, comfort and simplicity.

Revolutionary 3M™ Secure Click™ Platform

3M™ respiratory portfolio manager Timothy Khoo says the new Secure Click™ platform features the world's first quad-flow cartridge system which creates four air flow paths for easier breathing.



Introducing the 3M™ Secure Click™ Half Mask Reusable Respirator HF-800SD Series.

"Often time, users of negative pressure respirators feel discomfort in breathability when wearing respirators," Mr Khoo says.

"We also simplified the process of performing a negative pressure seal check by using an easy, one-touch button that helps provide increased worker confidence that their respirator fits properly."

Offering **ease of use** with its new Secure Click™ connection, workers can confidently connect filters and cartridges to the facepiece, as simply as a car seat belt.

Noisy surface or underground mining environments hamper verbal communications between workers but this is not an issue with the 3M™'s platform's first **speaking diaphragm**, designed to help provide easier communication while working with the respirator on.

Additionally, the low-profile facepiece design features a silicone faceseal with a flex-joint nose bridge for **greater comfort**, a wide field of view and **compatibility with other PPEs** (Personal Protective Equipment) such as certain welding and grinding shields.

Half Mask Reusable Respirator HF-800SD Series

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The HF-800SD respirator can be used with 3M™ Secure Click™ D8000 Series gas and vapour cartridges and D3000/D7000/D9000 Series particulate filters against a variety of gases, vapours and particulate hazards.

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- **Feel It.** Experience the greater breathability and comfort provided by the world's first quad-flow gas and vapour filter/combination filter system.
- **Say It.** Utilise the speaking diaphragm to help provide easier communication while working

See advertisement below by 3M™ for critical fit testing information. ***AMR***

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- **3M™ Cupped Particulate Respirator 8822**, for effective respiratory FFP2 protection against dust and mists)

SECURE A POWERED AIR PURIFYING RESPIRATOR (PAPR) DEMO



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- **3M™ Versaflo™ TR-300+ Powered Air Purifying Respirator**, the lightest Versaflo PAPR for particulate environments, for greater versatility, comfort and ease of use.

All offers above apply to workplaces with 10+ workers that require respiratory protection only. Scan the QR code for further terms and conditions.



POLYURETHANE PROTECTIVE COATINGS

EXTENDING ASSET LIFE

WORLD-CLASS TECHNOLOGIES

Pacific Urethanes specialises in the development and production of world-class polyurethane formulations. Their expertise enables them to translate new technologies into innovative products that increases asset life, which provides a competitive advantage.

The company has exclusive arrangements with Polycoat Products, one of the world leaders in polyurethane, polyurea, and polyaspartic coatings. This provides the benefit of bringing world-class products under one umbrella, rapidly offering new solutions to the market, and meeting the ever-changing industry performance requirements.

POLYCOAT PRODUCTS
A Division of American Polymers Corp.

Polyurethane coating formulations developed by Pacific Urethanes has gained the confidence of the market by providing high levels of corrosion and asset protection coupled with fast return to service. These coatings are commonly found as internal lining for mineral processing in leaching and thickener tanks, rail cars and wear protection on conveyors.

HIGH-PERFORMANCE COATINGS

The durability of Pacific Urethanes protective coating systems represents high economic value.

Developed through extensive research and testing procedures, high-performance polyurea and hybrid systems provide flexible, durable, unbroken membranes in the harsh conditions of mining and across an extensive range of water, chemical and abrasive environments.

END-TO-END SOLUTIONS

Pacific Urethanes is a distributor for Graco Equipment, worldwide specialists in fluid handling.

GRACO

The company has machinery specialists that have worked with polyurethanes equipment and chemistry for over 20 years, to provide tailor-made solutions for all machinery and service needs. This provides the market with assurance of product processing performance coupled with chemistry advances. From diagnosing, to upgrading and implementation, their team of experts provide workshops, on-site machine maintenance and services to a wide range of industrial and advanced manufacturing businesses.

SUSTAINABLE SOLUTIONS

Pacific Urethanes are committed to conserving natural resources for future generations by,

- Developing polyurethane materials that improve Energy Efficiency
- Moving to Carbon Negative through sustainable chemistry
- Working towards creating a Circular Economy

ISO CERTIFICATIONS

In line with environmental stewardship and ISO14001 initiatives, Pacific Urethanes utilises the latest technology in polyurethane foams with its low Global Warming Potential blowing agents. ***AMR***

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Polyeuro 5502F
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Polycoat Tuffshield II HAR
A revolutionary fast set, 100% solids, flexible two component spray elastomer that gives outstanding physical performance against abrasion tear and impact.

Polyeuro 1050H
Has AS NZS4020 approval for direct contact with potable water, and is recommended for use as a coating or lining on suitably primed carbon steel, non-ferrous metal and concrete.

Polyurethane Formulation Specialists - Mining Industry

Pacific Urethanes

Pacific Urethanes are the **'Polyurethane Formulation Specialists'** delivering tailored solutions, processes and applications based on the requirements of the mining and resources sector. Our team of highly dedicated individuals work closely with customers as specialists in their field, applying innovative technologies to achieve exceptional results.

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SUCCESS AT THE CHEMICAL LEVEL



Australian company Sigma Chemicals has become the partner of choice for mining, oil and gas companies needing to source and move dangerous products.

Backed by more than 50-years of experience, the chemical supply specialist is a market leader in hazardous materials' handling and sourcing product for a diverse range of applications.

Based in the premier mining region of Western Australia, Sigma Chemicals imports and exports products, is the preferred distributor for multiple suppliers and has the capacity to buy, repackage or blend almost any solution.

The company's water treatment options in particular are second to none, with the chemicals' provider able to support treating water for drinking or industrial purposes.

Leveraging expert advice, Sigma Chemicals provides a wide range of equipment and specialty chemicals to help operators efficiently manage, recycle and treat water, including test meters, test kits, consumables and reagents.

A Sigma Chemicals spokesperson said operators also partnered with the company for a range of specialty chemicals, precious metals and consumables suitable for laboratories.

She said glassware, magnetic shakers, dosing pumps and test meters were just some of the equipment the company could supply, repair or re-calibrate.

"As leading suppliers to the mining, oil and gas industry, Sigma Chemicals can coordinate the sale and transport of dangerous goods and other mining and process chemicals," the spokesperson said.

"We specialise in bulk and packaged chemicals for any company that requires it – supplying

Bulk Grade Chemicals, Pure Grade Analytical Chemicals and Reagents, with Certified Reference Standards.

"Our clients are domestic and international, meaning we have a large network for supply and distribution.

"We can source almost any product, but if we can't, we send the client in the right direction.

"Our quality solutions are backed by our knowledge and professionalism, which has earned us an unparalleled reputation in the global chemicals market."

The spokesperson said Sigma Chemicals also remained on top of modern legislation and compliance requirements, including Dangerous Goods Compliance and Chain of Responsibility.

The team can supply all necessary safety equipment, signage and chemical neutralization, in addition to their core, Australian-made product lines.

With their comprehensive products and services, Sigma Chemicals is the preferred supplier to several mining juggernauts, including Rio Tinto, BHP, Roy Hill, Sodexo and Compass Group.

Their continually growing client list spans dozens of Australia's critical sectors, with interest spanning hospitals, nurseries, timber mills, brewers and jewellers, to name a few.

The Sigma Chemicals spokesperson said the proudly Australian company was continuing to race ahead of the curve and lead the market in the safe moving and handling of chemicals.

"Whether you need a particular blend or a custom formulation, Sigma Chemicals can work with you," the spokesperson said.

"We are dedicated to making the purchasing of local and imported chemicals and raw materials simple for your business by offering a fully inclusive supply chain management system. Response times are as critical to your business as they are to our team.

"At Sigma Chemicals, we are all about turnkey solutions. ***AMR***

For more information, visit www.sigmachemicals.com.au

SIGMA - YOUR MINING PROCUREMENT TEAM

Sigma Chemicals is dedicated to making the purchasing of local and imported chemicals and raw materials simple for your business, to ensure you are getting the best quality product at highly competitive prices.

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- Sulphuric Acid
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- Calcium Chloride
- HD Premium Coolant
- Specialty Chemicals
- Toll Blending
- Industrial Cleaning Chemicals
- Leaching Chemicals



Water Treatment

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- Sodium Hydroxide
- Hydrochloric Acid
- Calcium Chloride
- Distilled Water
- Poly Aluminium Chloride
- Blubac Gold
- Citric Acid
- Ferric Sulphate
- NALCO 3268
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Earning an "A" in Finance

A Class Business Finance is an award-winning service that arranges equipment, vehicle, and property finance for Australian Industry.

Founded by father and son team Stuart and Chris Beath in 2007, the business has secured more than $1.25 billion in business funding and has organised more than 10,000 loans.

It's strong record supporting Australian businesses has earned the Queensland-based company more than 20 awards and has made it the partner of choice for operators across numerous sectors.

Co-founder and Managing Director Chris Beath said business loans for mining companies were particularly popular, as more and more operators were on the hunt for affordable finance solutions tailored to their needs.

'We take an active interest in Australia's mining and mining service industries," Mr Beath said.

"By regularly engaging our stakeholders and attending industry events and exhibitions, we stay up to date with the sector's needs and ensure that we remain across every piece of equipment we finance.

"Over the years, we've done it all.

"From helping companies secure mining trucks to trailers, forklifts, excavators, loaders, vehicles, and more."

Aside from equipment financing, A Class Business Finance facilitates a range of cashflow finance solutions for businesses to enable their growth.

The company supports businesses looking for invoice and trade finance, property finance, as well as providing business overdraft solutions.

Particularly popular is the A Class Business Finance Insurance Premium Funding service, which provides clients with a range of benefits.

Operators can unlock their cashflow, choose from flexible repayment options, and secure competitive interest rates.

Mr Beath said interest repayments may also be tax-deductible.

"A service like this really helps operators get ahead," Mr Beath said.

"We can fund most insurance policies, including General Insurance, Workers Compensation and Professional Indemnity.

"We arrange payment of policies to the insurer by the due date, meaning clients avoid overdue penalties."

A Class Business Finance has built a strong reputation over the last 15 years and has steadily grown to support hundreds of businesses with the expertise of their handpicked team of finance professionals.

The company holds an Australian Credit Licence and is a member of the Australian Financial Complaints Authority and the Commercial and Asset Finance Brokers Association.

While entirely independent, A Class Business Finance has partnered with a broad range of reputable lenders to provide a range of options for clients.

The fully accredited company's staff hold over 200 years' combined experience in industry finance and work to provide both long and short-term solutions.

"We take a partnership approach, and we are here to support clients for the long term," Mr Beath said.

"Our finance solutions are straightforward, quick and tailored to client needs.

"We make business finance easy." ***AMR***

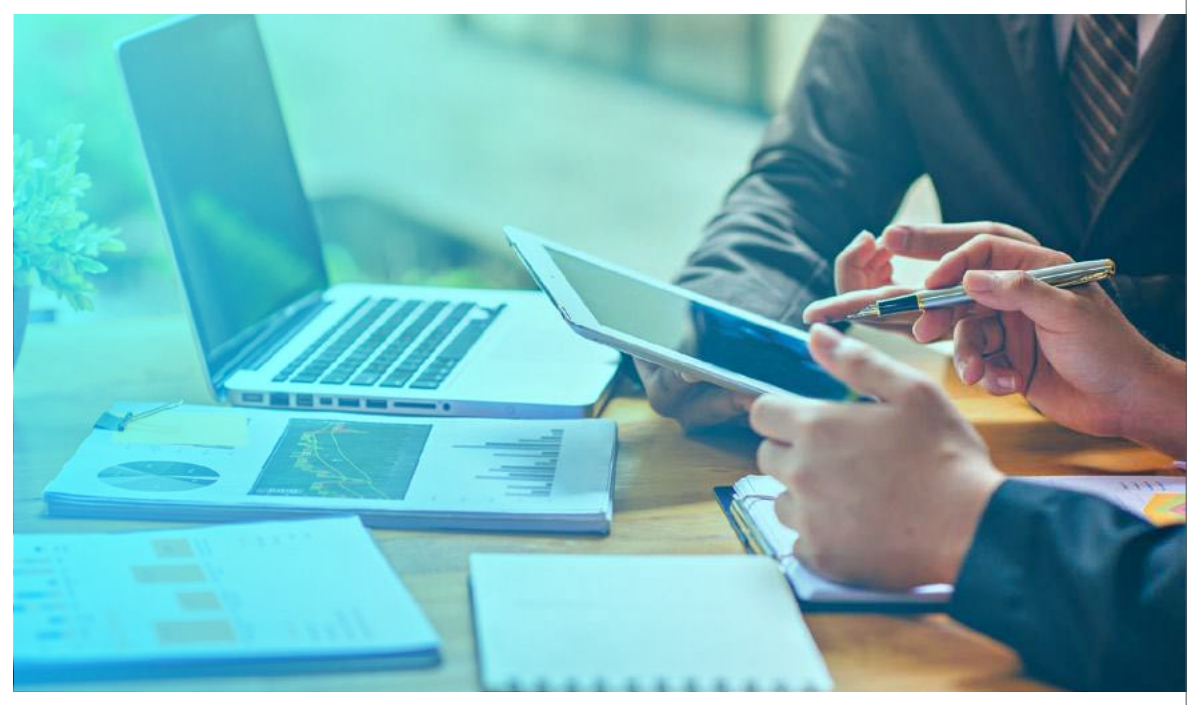
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Nelson Silos Expands to Keep Up With Booming Demand

As Australia moves out of a period of drought, the improved weather conditions have led to a boom in demand for agricultural silos. Eric Nelson, Managing Director of Nelson Silos, explains how his company is keeping pace.

Business is booming for silo manufacturer Nelson Silos, as farmers flock to increase their storage capacity.

Eric Nelson, the company's Managing Director says the demand is partly due excellent weather conditions across the country.

"On the east coast, many of these farmers have just come out of a drought into near perfect weather conditions for growing," he says.

"The price of grains and legume is also up significantly, which is improving profitability as well."

On farm storage allows farmers to wait until they have a stronger negotiating position before they sell Without storage, many farmers must sell their grain at harvest time when the price of grain is at its lowest.

Facing increasing demand, Nelson Silos has invested significantly into expanding its manufacturing facilities.

Part of this has been installing a new paint booth at its main Rochester facility.

Instead of now spraying individual silos, the booth can handle two to three silos at a time. In addition, temperature controls allow Nelson Silos to dry the paint at a consistent 20°c.

Nelson says the paint booth can also apply spray to the interior of silos with specialised coatings to act as corrosion inhibitors.

"These are mostly for our superphosphate silos, which use a steeper cone and have a more robust and larger outlet," he says.

"Superphosphate, depending on its type, is hydroscopic which means it can clump together. It can also be highly corrosive, which is why the internal coating is so important."

In addition, the company has installed four elevating towers, with another two planned. Nelson Silo's farm silos are built to handle up to 200 cubic metres in capacity. They are fully manufactured in the company's factories before being shipped out across Australia. The elevated towers allow easier access to bolt in wall sheets and place the roof section on the silo.

Additional gantry cranes have also been purchased to handle the growing sizes of silos. Nelson says the demand for taller silos has meant the business has had to adapt.

Transport plays a major role within the business. The company owns a fleet of eight prime movers and eight low-loader trailers, along with three heavy trailers. This allows the -:ompany to deliver silos to Darwin, Port Headland or Kalgoorlie itself, instead of through contractors.

"We don't use contractors because it gives us more control over the customer experience," Nelson says. "Our delivery team can also do the installation side of things, with staff in the pilot cars for heavy transport vehicles."

"That's one of our secrets for reducing time spent on site. The people handling the installation have done it literally 50 to 60 times before."

Nelson Silos is continuing further upgrade its manufacturing capacity. As part of this, the company is looking into building another assembly factory in northern New South Wales to streamline assembly." ***AMR***



Nelson Silos

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We have technical consultants based in Melbourne, Sydney, Brisbane and Auckland (NZ)

Nelson

Australia's largest manufacturer of transportable silos.



Viking Industrial's Name Synonymous With Major Australian Projects

What do Fortescue Metals Group (FMG) and Snowy Hydro have in common? They both trust their fixed speed diesel needs to Viking Industrial.

Renowned as Australia's largest fixed speed diesel specialists, Viking Industrial's inherent knowledge is being used on some of the largest projects nation-wide.

"We are always big enough to meet the strictest site requirements while small enough to remain flexible and find options to solve any problems swiftly," Viking Industrial Business Development Manager, Simon Luu, recently told the Australian Mining Review.

"Over the years we have developed a reputation for working very closely with projects to ensure the customer's needs are met.

Mr Luu says the Viking team prides itself on staying close to the project at hand, offering a seamless process from planning to installation.

"We are a young and hungry company and the advantages we provide is that we have proven to be agile enough to find solutions and fix problems, whereas some of the bigger hire and sale companies will be too big and busy to attend to the details."

Specialising in Fixed Speed Diesel Generators, Viking Industrial also offers a wide range of products ranging from power, air, water, lighting towers and fuel storage.

Mr Luu noted that recently, the demand for portable solar lighting towers has soared, and Viking Industrial has built a range to suit all sized projects and budgets.

With dedicated Rental, Sales and Service divisions, Viking Industrial can offer customised packages to suit individual project needs.

Notably, Viking Industrial's network is constantly expanding, with six dedicated branches currently operating Australia wide including Perth, Brisbane, Karratha, Gold Coast, Cooma and Sydney.

Mr Luu said the Viking team is getting behind some of Australia's biggest projects, and with their own 24/7 Service Team, the company is ensuring reliability and limiting potential downtime.

"When Viking began providing rental equipment for the Snowy 2.0 Hydro Project, we immediately set up a local branch to support the project in the best way possible.

"That's another example which highlights how Viking is one hundred percent involved in a client's project goals, and we will do whatever it takes to help them along the way. This on-the-ground approach also results in more job opportunities for locals."

The Viking team has a wealth of experience across a diverse range of trades, which means its customers will be dealing with someone that knows their job inside and out.

Another important element in dealing with Viking Industrial is the fact that the company is independent of engine manufacturers.

This means the company is not being tied down to any one particular engine manufacturer, allowing it to offer the most appropriate generator for the job, free from bias.

The company's quality engine partnerships include Volvo Penta, Kohler, Kubota, Cummins and Perkins.

Service Team

Viking Industrial's qualified and dedicated Service Department delivers 24/7 maintenance and support across most of Australia, with six branches nationwide.

The Viking Industrial Service Team have seen it all, and they come together to problem-solve and fix issues fast. They all know the effects of downtime, and Viking's technicians, trades people and experienced sales team work together to keep projects running.

Projects and Customers

Viking Industrial is helping power some of Australia's biggest projects from the mining, oil and gas, construction and utilities sectors. Some recent major projects include:

FMG Iron Bridge Magnetite Project
The US$3.3 – US$3.5 billion Iron Bridge Magnetite Project is under development and will deliver 22mtpa of high grade 67% Fe magnetite concentrate product.

Iron Bridge, located 145km south of Port Hedland and incorporating the world class North Star and Glacier Valley Magnetite ore bodies, is an unincorporated joint venture between Fortescue's subsidiary FMG Iron Bridge and Formosa Steel IB.

Viking Industrial installed over 50 machines on site, ranging from 25kVA to 1250kVA.

The service provided is a mix of rental and sale. Additionally, Viking's service team undertake a yearly power audit to make sure everything is running well.

Snowy 2.0
Viking's Rental Director, Luke Rennie, said the company is proud to work with Australia's largest committed renewable energy project, the Snowy 2.0.

"When we began providing rental equipment for Snowy 2.0, we immediately set up a branch in nearby Cooma to support the project in the best way possible. We are one hundred percent involved in your project goals, and we will do whatever it takes to help you along the way."

The company provided 16MW of power to support early works, with the plan to remain onsite into the future, providing portable power across a wide range of project areas.

Snowy 2.0 is the largest committed renewable energy project in Australia, set to deliver 2,000MW of on-demand energy and 350,000MWh of large-scale storage for the National Electricity Market.

Rio Tinto - West Angelas
The company was able to design, supply and install generators to power the main accommodation camp at West Angelas as part of the new upgrade to the project's mine site.

Mardie Salt
BCI Mineral's Mardie Salt and Potash Project is a large-scale, multi-generational solar evaporation operation on the Pilbara Coast of Western Australia.

A camp building contractor engaged Viking Industrial to provide a complete turn-key package to power the newly expanded 400-bed camp.

Queensland Urban Utilities
Viking Industrial's Service Team provides maintenance and 24/7 support for generators, compressors, and gas-fired equipment for a range of utilities such as pumping stations and treatment plants, water mains, sewer mains, and reservoirs.

Rozelle Interchange
The Viking Industrial Rental Team has supplied all of the construction power and standby power for the construction phase of the WestConnex M4-M5 Link Rozelle Interchange.

Tweed Water
Viking Industrial was proud to solidify its service contract with Tweed Water, extending the current five-year agreement with an extra three years. The company's Service Team will be providing 24/7 breakdown support plus preventative and corrective maintenance on Tweed Water's entire fleet of generators. ***AMR***







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INDUSTRY FOCUS

Alternative Cooling Option

Not all air conditioning units are built equally. Seifert Peltier units offer an alternative cooling option where conventional compressor/condenser systems are inappropriate.

Thermoelectric elements create a temperature differential between ambient and internal heat sinks.

This encourages an internal cool air circuit while fans help transfer convective heat to atmosphere.

Seifert Peltier cooling units' capacities range from 30W up to 800W and are available in Stainless Steel 304 or 316.

They are an ideal cooling solution for harsh environments especially where maintenance is limited.

They are resistant to extreme ambient conditions and operate well in dusty, oily environments where temperatures can vary from -20°C to +65°C. These units are available in 12V, 24V and 48V DC and 120 - 240V AC.

The external fans on these units are rated to IP68. However, the units as a whole are rated to IP66 and are suitable for indoor and outdoor applications.

Seifert Systems air condition, ventilate, dehumidify and heat control cabinets and enclosures for businesses in the telecommunications, defence, medical, traffic management, food, pharmaceutical and mining industries.

The company's design and manufacturing philosophy is underpinned by the international ISO9001 quality and ISO14001 environmental standards.

Multiple Peltier units can be installed in side-mount orientation, however top mounting is to be avoided as this can promote condensation.

These units are offered in either a recess format or with an external duct-fitted. The recess version means part of the Peltier will penetrate into the enclosure to be cooled, so use this option when there's minimal equipment to be cooled.

Equally, use the duct to keep the Peltier external to the enclosure, assuming the enclosure is crowded with equipment.

Seifert also offers a complete range of precision cooling products designed to support critical electronics infrastructure within enclosures.

For correct application, enclosures need to be a minimum IP54 rated: sealed from water and dust penetration.

Seifert offer IP54 rated cooling units for Indoor enclosures such as process control or telecommunications for example. For this application consider the Seifert Slim Line Series or the Seifert Compact range. Cooling capacities range from 320W to 4kW. Power supplies available from 120V, 230V to 400V 3phase.

Units are available in RAL7035 Powder Coat mild steel or Stainless Steel 304 or 316.

The Slim Line series is filterless technology. Compact units have filters available if necessary. ***AMR***



An MFB IP56 S280 enclosure fitted with Seifert IP54 Slim Line series KG-4269 500W 230V air conditioning unit.



A Peltier wall-mounted 200W, 24V cooling unit cabinet.



The TG 3050 with duct offers efficient cabinet cooling with Peltier technology. It is suitable for small enclosures and small control panels, for indoor and outdoor applications, and can be mounted in any position.



A Cut Above the Rest

HD Plasma and Laser Cutting Services provides an innovative and dynamic profile cutting service to all steel manufacturing industries within Australia.

The purpose-built, multi-function, steel processing business located in Bibra Lake, WA, is seen among the leaders in the steel cutting industry.

Laser Cutting
The technology of the HD Plasma and Laser Cutting Services machines delivers superior performance, giving the ability to provide clients with exceptional quality, together with 24-hour operations, shorter lead times compared with other conventional laser cutting machines.

- Cutting table size 4000 x 2000mm
- Capable of processing up to 20mm thickness mild steel
- Capable of processing up to 20mm thickness QT Material
- Capable of processing up to 32mm thickness aluminium
- Capable of processing up to 25mm thickness stainless steel

Plasma Cutting
HD Plasma and Laser Cutting Services operates three plasma machines - one Kinetic K4000 and two Kinetic K5000.
These state-of-the-art, heavy duty combination plasma/oxy/machine centres can process a wide variety of materials at an extremely fast rate.

The 62m plasma cutting bed, together with 24-hour operations, allows high volumes of cutting to be achieved with short lead times.

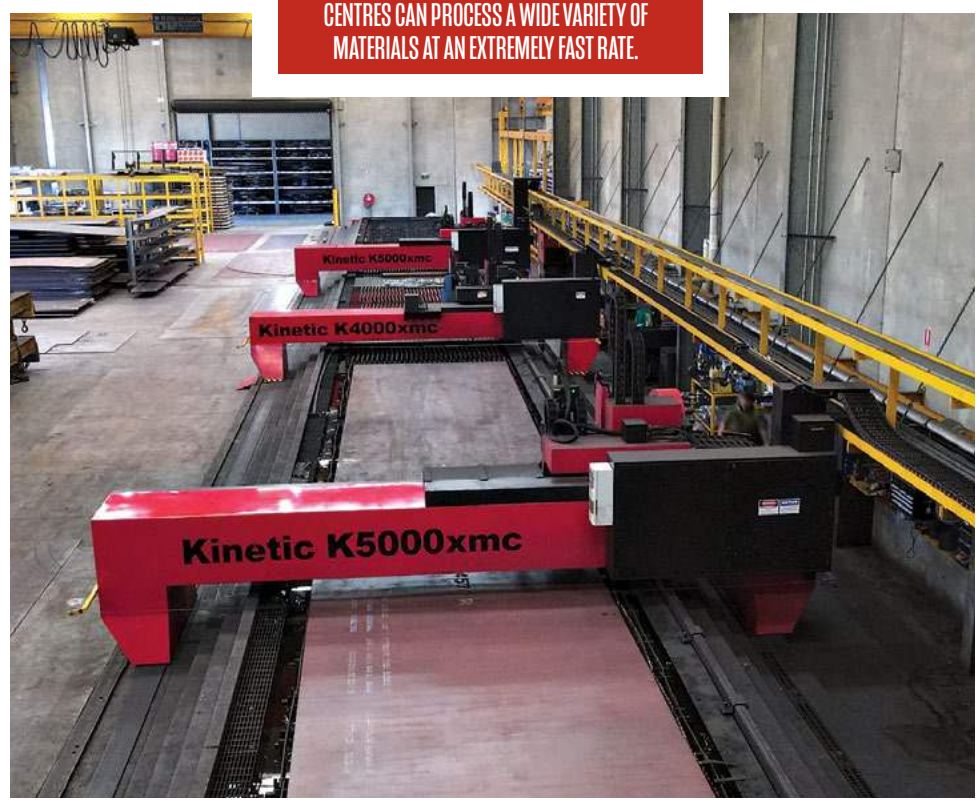
- Counter sink/counter bore
- Drilling – 3mm up to 60mm
- Plasma cutting – 3mm up to 50mm
- Oxy-cutting – 60mm up to 300mm
- Bevelling – up to 50mm with maximum of 45°

Steel Plates
HD Plasma and Laser Cutting Services holds steel plate in stock.

Plate is sourced from quality local and imported steel mills, to cut a wider range of materials at a greater thickness range than most of its competitors. ***AMR***



THE STATE-OF-THE-ART, HEAVY DUTY COMBINATION PLASMA/OXY/MACHINE CENTRES CAN PROCESS A WIDE VARIETY OF MATERIALS AT AN EXTREMELY FAST RATE.



GRADE	THICKNESS (mm)
AS 3678-250	UP TO AND INCLUDING 300mm
AS 3678-350	UP TO AND INCLUDING 300mm
FLOOR PLATE M/S	UP TO 10mm
BOILER PLATE - ALL GRADES	UP TO 80mm
QUENCHED AND TEMPERED	UP TO 80mm
CARBIDE OVERLAY	UP TO 40mm
ALUMINIUM PLATE	UP TO 32mm
PGI, ZINCANNEAL, GALVANISED & COLORBOND	UP TO 6mm
STAINLESS STEEL - ALL GRADES	UP TO 40mm

A cut above the rest

HD PLASMA & LASER CUTTING SERVICES





HD Plasma & Laser Cutting Services Pty Ltd is a purpose built, multi-function, steel processing business located in Bibra Lake, Western Australia.

We can deliver an innovative and dynamic profile cutting service to all steel manufacturing industries within Australia.

HD Plasma & Laser Cutting Services philosophy of progressive service to our customers is what is bringing us to the forefront of the steel cutting industry.

A continual process of system and service development and refinement is where our key advantage lies. We constantly find new ways to add value to the service we deliver to you.

Progressive service and quality is about staying one step ahead.

Services


LASER CUTTING

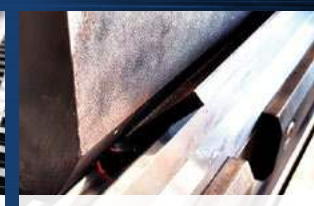


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Packed with the intelligence to handle every possible industrial application.

The new, improved VLT AutomationDrive is consistently awesome

Chosen for its versatility, respected for its reliability, the VLT AutomationDrive has been providing consistently awesome performance for almost half a century. But it is now tougher and more intelligent than it has ever been before.

ENGINEERING TOMORROW
Danfoss

Built to last

Modular and adaptable, the VLT AutomationDrive fits into any environment. Featuring the extremely compact new generation D- and E-enclosures and a wider operating temperature range – from -25°C to +50°C (-13°F to +122°F) – without derating, this robust drive operates effectively and reliably even with the most demanding applications and in the most challenging environments.

Additionally, a full range of 690V rated drives, options for ruggedisation and high environmental class enclosures means that even the more challenging applications found in the Chemical and Marine industries are well served with the robust VLT AutomationDrive.

Packed with innovation

The VLT AutomationDrive features both hardware and software enhancements that maximize performance and provide a level of application flexibility that truly boosts your business.

The Integrated motion controller (IMC) provides advanced functionality to perform high-precision positioning or synchronisation with asynchronous or PM motors with or without an encoder connection. Not only does the IMC save cost when your application doesn't require the dynamic performance of a servo drive – such as rotary tables, cutting machines and packaging machines – but it also saves time due to the commissioning process requiring no advanced programming.

Additionally, the Motion Control Options provide a way to replace mechanical controls with intelligent, energy-saving electronic solutions that result in reliable, high-quality processes that increase productivity and performance.

With these options, it's possible to add electronic cam control with the VLT Motion Control Option MCO 305, reducing system and maintenance costs, or increase the capacity of applications such as palletisers with the VLT Synchronising Controller MCO 350.

Regardless of your need, utilising these options with your VLT AutomationDrive can provide increased control and operational efficiency, providing a faster return on your investment.

When safety is your foremost concern, the VLT AutomationDrive also offers many options to tailor your drive to meet your functional safety needs. From the standard Safe Torque Off (PL d, SIL 2) to the VLT Safety Option MCB 150 and MCB 151 options that include several safe speed options, such as Safe Limited Speed (SLS) or the addition of PROFIsafe with the VLT Safety Option MCB 152, there are several ways to meet your functional safety needs.

The company has also have made safety commissioning easy using visual instructions within the VLT Motion Control Tool MCT 10 that ensures both fault-free wiring and that safety parameters are correctly transferred from the PC to the drive. MCT 10 also offers easy diagnosis and the creation of a dynamic commissioning report required for safety acceptance tests.

Seamlessly into the future

Smart factories are at the heart of Industry 4.0. The VLT AutomationDrive has been designed with the built-in intelligence to fit right into this new standard. It takes full advantage of all that the new digital age brings to offer:

- web-based configuration, EDI, transparent order management
- tailor-made documentation dependent on your application needs
- high-quality design and durability through embedded protective functions
- motor and system independence and adaptability
- embedded intelligence (for example, integrated motion controller, pump functions) and functional safety
- interface to cloud-based data (for example, Danfoss ecoSmart)

As with all Danfoss drives, you're free to equip the perfect combination of motor and fieldbus technologies with the VLT AutomationDrive. All common motor technologies – Asynchronous, Permanent Magnet (IPM and SPM), Synchronous Reluctance and Permanent Magnet assisted Synchronous Reluctance – are supported giving you the assurance that, no matter your application, it completely fulfills your requirements and optimises your processes throughout the entire lifecycle. ***AMR***



Versatile, reliable and consistently **awesome**

Chosen for its versatility, respected for its reliability, the VLT® AutomationDrive is now tougher and more intelligent than it has ever been before. Containing half a century of drives expertise, and built to last, this robust drive operates intelligently and effectively even with the most demanding applications and in the most challenging environments.

For more information call us on 1300 328 008 or
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ENGINEERING
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DKDD.PA.310.A1.02 – Mining – Australia

World-Class Bulk Material Handling Systems



Oreflow designs, manufactures and supplies quality conveyor and belting equipment systems to Australia and abroad. Pictured here is the Bald Hill mine.

For world-class conveyor, belt and apron feeder systems, look no further than Oreflow, the industry-leading choice for quality bulk material handling systems.

Oreflow supplies conveyor systems, chute and hopper skirting solutions, belt cleaning systems, air cannons and impact beds, to name just a few, and is renowned for their excellence in plant design, engineering and manufacturing.

As a global supplier of conveyor and belting equipment across a range of commodities, rest assured knowing that wherever you are in the world – Australia, Ghana, Senegal, Burkina Faso, Mali, Tanzania, Indonesia, Philippines and Zambia – Oreflow will deliver quality products, services and solutions for all your mineral processing and bulk material handling.

Rollers, Frames and Idlers
Oreflow offers fully-supported solutions with its conveyor and belting systems.

The company carries and supplies a range of rollers including trough, return, impact, as well as HDPE (poly) rollers on request.

The range of frames to go with these rollers include trough, transition, training frames for belt tracking, return roller brackets and retractable frames on request.

All frames and rollers are made to Australian specifications and are interchangeable to industry standard, originally set by Prok.

Along with delivering conventional steel idlers and idler frames (inline, offset, impact), Oreflow can also customise idlers for specific environments.

Example of these include the provision of extreme duty urethane sleeved idlers.

Since 2012, Oreflow has dealt directly with one factory in China to successfully deliver for all projects.

Oreflow's Australian workshop also has a well-stocked inventory of ready-to-go items, with the capability to ordered in or locally source through backup suppliers.

Conveyor Belting
Oreflow also sources its high-quality conveyor belting direct from one factory, which it has built up a great working relationship over the past five years.

The flow-on benefits to customers including faster lead times, with belting being manufactured and ready to be shipped in under two weeks from receipt of order.

Backup suppliers are also on-hand locally for emergency or much faster lead times.

Pulleys
Oreflow performs all aspects of pulley design, pulley manufacture, pulley repairs and refurbishments – within Australia.

Whether customers require head, tail, take-up or refurbished pulleys, including pulley lagging (cold bonded, hot vulcanised, diamond groove, to name just a few options), all are manufactured to the very best quality and exactly to spec.

Oreflow collaborates with customers to deliver fit-for-purpose materials handling solutions.

All aspects of conveyor design, manufacture and installation are included in the service by qualified installation and service personnel.

Replacement Parts
Oreflow saves customers time and energy by allowing them to source all replacement parts from one place.

With its large stock of idlers, frames and spillage control equipment always on-hand and in-stock, customers can obtain industry standard spare parts via walk-ins and pick-ups from its Welshpool warehouse in Perth, WA.

Walk-in stock include replacement rollers, belt scrapers, conveyor and feeder frames and brackets, rubber lining cold bonding adhesives.

Order and pick up items include: conveyor rollers and frames, new pulleys, pulley refurbishments, dust containment, belt tracking frames, scrapers ploughs and impact beds, as well as air cannons.

Brelko – Spillage Control
Oreflow is the Australian master distributor of Brelko conveyor products for spillage control, offering a premium range of belt scrapers and skirting systems.

Oreflow founder and technical expert Mel King says Brelko has been part of the company's business for 20 years, supplying customers with high quality products, backed by extensive research and development.

Oreflow delivers Brelko skirting, belt cleaners and impact beds right around Australia, Asia and Africa, servicing the mining industry in a whole range of commodities including iron ore, alumina, lithium, gold, copper, quarries and concrete batching plants, to name just a few applications.

As heavy-duty as they are, Brelko rubber skirting is currently being used by a large Australian company to stop spillage from their railway ballast track machines.

Belt Scrapers - E905 and E205
The E905 is a new head pulley belt scraper, ideal for wet and sticky materials and suitable for all types of conveyor belts and metal fastener systems.

Adjustable Brelko torsion twist tensioners allow the scraper to maintain a constant pressure on the belt while allowing it to deflect away from any obstruction, a significant safety feature.

Specially formulated polymeric blades maximise the life of the scraper while keeping the potential risk of damage to belt repairs, splices and metal fasteners to a minimum.
A V-base blade mounting makes blade changing quick and simple while a streamlined scraper construction prevents material build-up.

The E205 secondary belt scraper is the universal choice for all normal cleaning applications, bar direct mounting onto the pulley head.

This scraper is used in conjunction with torsion arm mountings to accommodate different belt thicknesses and excessive belt movement

Keyskirts – Sizes 2 and 3
Brelko offers different keyskirt sizes to accommodate different types of spillings.

The Keyskirt size 2 provides an effective chute sealing system designed to control spillage at conveyor load areas and is suitable for all belt conveyors carrying material with a particle size of less then 75mm.

The patented mounting track system results in simple installation and skirt rubber replacement while self-cleaning grooves trap spillage allowing it to be carried away by the belt.

The Keyskirt Size 3 is designed to cope with spillage of large lump material larger than 150mm.

Features include a robust and abrasion-resistant polyurethane sealing strip and a mounting system for easy strip replacement.

About Oreflow
Oreflow designs, manufactures and supplies quality mineral process equipment to Australia and abroad.

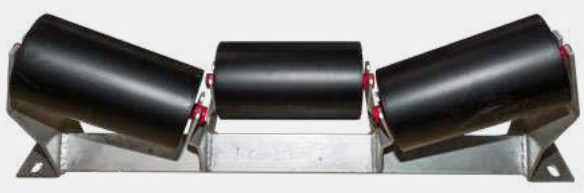
In 2000, founder Mel King and partners formed Minspec, a mining equipment manufacturer.

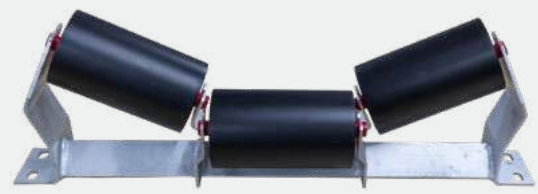
By the mid-2000s, King partnered with Brelko on the engineering of Encaplock and Keyliner dust sealing and chute lining systems.

In 2013, operations expanded to form OreFlow, supplying rubber products, belt conveyor glues and repair supplies.

Since then, Oreflow has evolved to service all areas of mineral processing systems and bulk materials handling, from design and installation to maintenance and repair.

With over 30 years mining experience, quality tradesmen and specialists are available seven days a week to support with design, engineering, 3D modelling, equipment and circuit application, including specially-trained Brelko scraper technicians. ***AMR***





Oreflow supplies a range of standard and customised roller and idler frames for a variety of mining applications.



The E905 poly head pulley belt scraper, suitable for all types of conveyor belts and metal fastener systems.









ONE OF AUSTRALIA'S LEADING MINING EQUIPMENT SUPPLIERS

CONVEYING FULLY SUPPORTED SOLUTIONS

Oreflow Australia specialise in designing conveyor and bulk material handling solutions capable of operating effectively in even the harshest processing conditions.

As the Australian distributor for Brelko Conveyor Products, Oreflow supplies conveyor systems, chute and hopper skirting solutions, belt cleaning systems and impact beds to Australia.

We supply quality capital equipment both in Australia and abroad, specialising in bulk materials handling and processing plant design and manufacture. We cover a huge range products from apron feeders, conveyors, vibrating pan feeders and much more.

Our products are designed to be fit for purpose, capable of operating effectively in even the harshest conditions and able to be integrated into new or existing plant.

The Oreflow range includes heavy duty Horizontal Linear Motion Screens (HLMS), excited by under and over Uras out of balance motors and available in single or multiple deck configurations.

Customised operating parameters ensure accurate sizing and high quantity processing of materials ranging from ores and rock to mineral sands.

Our screens are manufactured and fully assembled in Western Australia and are widely used in Australia and around the world due to their ease of installation, low maintenance requirements and exceptional performance.

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Crush Your Goals


MLG Oz is a one-stop-shop for all crushing and screening solutions.

MLG Oz is an ASX-Listed, vertically integrated mine site services company operating in Western Australia and the Northern Territory.

With a large Crushing and Screening division, MLG Oz provides crushing and screening services to the mining and civil contracting industries.

Over the past 15 years, MLG has delivered crushing and screening services to some of Australia's largest mining operations, servicing mining companies such as Fortescue Metals Group, Red 5, Gold Fields Australia, Northern Star Resources, Minjar Gold, Lithco and most recently awarded, Roy Hill where they assist with the ancillary crushing and screening requirements. Other current engagements include:

- **Bald Hill.** Lithco chose MLG Oz to crush and screen materials for their processing plant.
- **Agnew.** This Gold Fields' mine site uses MLG Oz for its road base materials and blast hole stemming.
- **King of the Hills (KOTH).** Red 5 contracts MLG Oz for its road base materials and blast hole stemming too.

Crushing and Screening
MLG Oz offers something its competitors do not – an integrated supply chain solution comprising of Bulk Haulage & Integrated Site Services, Aggregate & Sand Supply, and Export Logistics – which can support its Crushing & Screening division. This integrated offering is unmatched across the competitive landscape, and allows MLG Oz to offer a one-stop-shop solution for all crushing and screening, and site services and haulage requirements.

Equipment Fleet
MLG Oz own two five million tonnes per annum (5Mtpa) crushing plants in their fleet that are ready for immediate deployment.

These plants were designed around a philosophy of maximising both the operational delivery and efficiency of each mining client's project.

MLG Oz also offers a large selection of mobile tracked equipment that are all fit for purpose and for all types of minerals.

These include jaw crushers, cone crushers and screens.

All designs of crushing equipment and screening plants are highly customisable and dependant on each project.

About MLG Oz
Established in 2002, MLG Oz commenced as a Bulk Logistics company, then expanded to an integrated supply chain solution.

MLG Oz has been crushing and screening for 15 years and originally commenced to support their construction materials supply chain.

Despite current ongoing issues facing the mining industry including shortages in labour and spare parts, as well as global shipping delays, MLG Oz remains at the forefront of the sector, being trusted to service some of the largest mining companies in WA and across multiple commodities. ***AMR***

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for primary crushing plant. Handles 1000mm lumps, up to 1500TPH. Feeder operates continuously 24/7. Minimum maintenance.



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Linear motion handling high capacity at secondary crushing plant.



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at primary crushing plant. Rugged and robust construction. Handles high capacity.

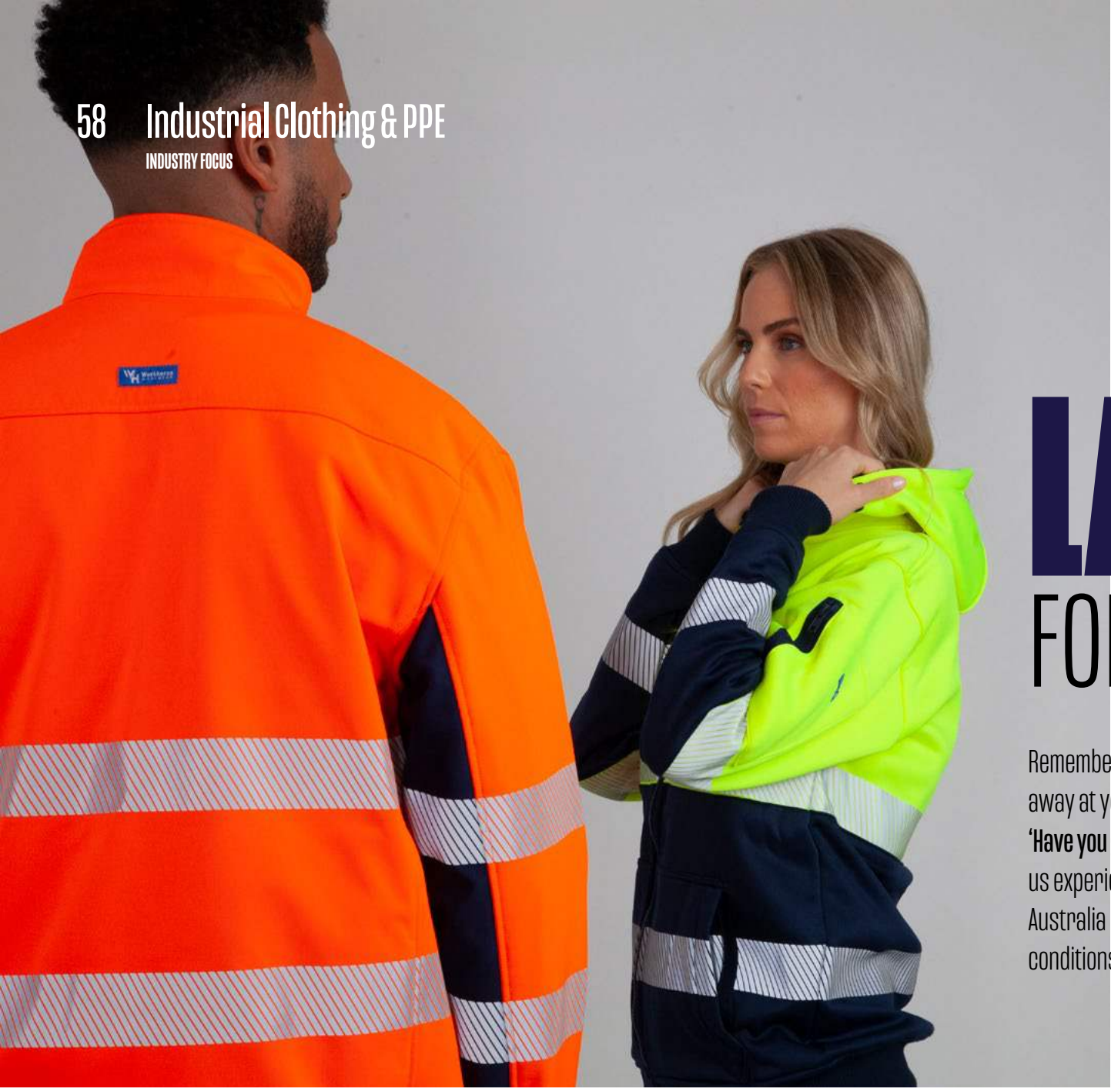


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HAWK EQUIPMENT FULLY DESIGNED AND MANUFACTURED IN MELBOURNE FOR OVER 35 YEARS



LAYERING FOR ALL SEASONS

Remember the days when your parents or other adults nagged away at you before you went outside? **'Where are your gloves?'; 'Have you got your hat?'; 'Do you have your jumper?'** Most of us experienced those types of questions for a good reason: Australia has a harsh, diverse climate with a vast range of conditions that need to be carefully assessed and prepared for.

In the workplace, wearing the appropriate clothes is not just about being comfortable.

If you're kitted with the correct workwear your comfort can improve your efficiency, and of course, safety.

We are now at the transition time between seasons, and that means whether you're an employer or a worker, it's time to ask an essential question: **Do you have the suitable workwear for the months ahead?**

The answer can be difficult because the clothing needs to protect you from the elements and workplace hazards.

Determining the appropriate workwear can be challenging but is essential in environments that can change significantly during a single shift of work.

For example, you may start your day before dawn where the darkness necessitates you wear night compliant hi-vis clothes.

The cold also means you must wear layers to keep warm, yet within a few hours the temperature rises to the extent that you shed all but one of these layers.

Each layer has its own role.

The base layer must provide compression and support of muscles and enable efficient blood circulation without the risk of clotting.

The mid layers must be breathable, warm, and at times when layers are stripped, they should also satisfy hi-vis requirements.

In addition to breathability and hi-vis elements, the outer layer should be waterproof and provide workplace relevant protection, including Ultra-Violet Protection (UVP).

Importantly, the air gap between each layer provides additional warmth and protection. So, as we approach winter, what are you thinking?

Remember, we can't control the weather, but we can apply flexible and suitable solutions for each workplace which improve comfort, efficiency and safety. ***AMR***



Winter Workwear for the Australian Construction Industry

Workhorse provides a full range of workwear designed to keep workers safe and comfortable through the Australian winter.

With over 2.5 million units sold, Workhorse is one of Australia's key workwear brands.
Scan the QR code to browse the range.

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Blackwoods and Bullivants have been keeping people and equipment safe for ***OVER 130 YEARS.*** We're trusted by Australia's leading miners for delivering specialist lifting and rigging solutions for both surface and underground applications. We also offer a range of recovery and height safety equipment, unique service expertise and access to training.

- Wire Rope NDT and testing
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- Eddy Current Testing
- Drill Rope Supply
- On-site inspections and repairs
- Height Safety Installation
- Online Asset Register (BEAM)
- Accredited & Non-Accredited Training Courses



For more information on how we can support your lifting and rigging requirements, contact our product specialists on **13 73 23**, or **1300 543 846** for inspection services, or visit **blackwoods.com.au/bullivants**

Blackwoods

FIT FOR PURPOSE





INDUSTREE GROUP PTY LTD IS AN AUSTRALIAN OWNED AND OPERATED, CARBON NEUTRAL, INNOVATOR, DESIGNER AND MANUFACTURER OF PREMIUM PERSONAL PROTECTIVE EQUIPMENT (PPE).

Industree's fit for purpose products deliver best in class certified protection, quality, comfort and value.

TRIDENT® Limited Life Protective Clothing and Disposable Respirator ranges were designed to meet the highest levels of certification, performance and comfort. ***AMR***

TRIDENT® COVERALLS

TRIDENT® coveralls provide unparalleled performance, comfort and value. The TRIDENT® body protection range is designed specifically for Australian conditions with Australian workers front of mind.

TRIDENT® SMS DISPOSABLE COVERALLS (DC300)

TRIDENT® breathable, anti-static SMS Coveralls provide proven protection to 99.9% of particles >3 microns. The patented permeable SMS fabric technology reduces the risk of heat stress while the optimised body fit and double panel crotch improves wearer comfort and safety. The 2 way zipper closure and sealable storm flap safe guard against Type 5 and 6 exposure. Ideal for a broad range of applications, TRIDENT® SMS Coveralls are available in White, Blue and Hi-Vis Orange colour options as well as Hi-Vis Orange + Reflective Tape (D320T).

TRIDENT® HST MICROPOROUS DISPOSABLE COVERALLS (DMP16)

TRIDENT® patented HST (Hybrid Substrate Technology) microporous fabric protects against low hazard liquid splash, sprays and fine particulates. Unsurpassed comfort, quality and performance at great value, TRIDENT® Microporous Coveralls are anti-static and silicone free. Available in an extensive size range (S – 4XL) and colour options including: White, White + Reflective Tape and Hi-Vis Orange + Reflective Tape, means we have all your workers and needs covered.

TRIDENT® CHEMICAL BARRIER PROTECTION DISPOSABLE COVERALLS (DC350)

The latest edition to the TRIDENT® Body Protection Range, these coveralls set a new benchmark for comfort and wearability in certified Type 3, 4, 5, 6 chemical barrier protection. Constructed with revolutionary multi-layer laminated substrates, TRIDENT® Chemical Barrier Protective Coveralls deliver the ultimate combination of chemical barrier protection with ergonomically designed lightweight comfort. True to the TRIDENT® ethos the new chemical resistant coveralls are designed specifically for Australian workers.

TRIDENT® RESPIRATORS

Since their launch, TRIDENT® have rapidly become the number one product of choice for P2 disposable respirators. TRIDENT® P2 Level 3 Surgical Disposable Respirators (RTCFFP2) and TRIDENT® P2 Valved Disposable Respirators (RTCFFP2V) provide optimal protection against mechanically and thermally generated particulates including: dusts, mists, fumes and smoke. The three panel design delivers improved comfort with a form fit facial seal. Supported by exceptional consistent PortaCount® fit testing results and unique proprietary design features, the growth in demand for TRIDENT® Respirators has been exceptional.

TRIDENT® Limited Life Protective Clothing and Disposable Respirator ranges are available nationally online and in-store through ATOM – The team behind the teams driving mining in Australia.

TRIDENT®
An Industree Group Brand

Industree Group - Protecting People Everywhere™



TRIDENT

An Industree Group Brand



Part No: **D300**

SMS DISPOSABLE COVERALLS

TYPE 5 / 6 CAT III

Designed for asbestos, mining, oil & gas industries.

- Highly breathable and water resistant
- Elasticised hood, wrists, waist & ankles
- Optimum strength and tear resistance
- 3 layer SMS fabric matrix
- 2 panel extended crotch
- 3 panel hood
- 2 way zipper
- Storm flap with a tape seal

Blue
White
Hi Vis Orange
Hi Vis Orange + Reflective Tape



Part No: **DMP16**

HST MICROPOROUS DISPOSABLE COVERALLS

TYPE 5 / 6 CAT III

Designed for asbestos, mining, oil & gas industries.

- Highly breathable and water resistant
- Elasticised hood, wrists, waist & ankles
- Optimum strength and tear resistance
- Lint free
- 3 panel hood
- 2 way zipper
- Storm flap with a tape seal

White
White + Reflective Tape
Hi Vis Orange + Reflective Tape



Part No: **DC350 - Available June, 2022**

CHEMICAL BARRIER PROTECTION DISPOSABLE COVERALLS

TYPE 3B / 4B / 5 / 6 CAT III

- Multi-layer barrier fabric for protection against numerous chemicals and biological substances
- Ultrasonically welded seams, safety zipper and storm flap
- Lightweight and durable
- Highly visible bright yellow colour for improved worker safety
- Anti-static, tested to EN 1149-5:2018

Yellow

Industree Product Safety Specialist: Paul Roberts National Business Development Manager - Body Protection
P 1800 276 872 M 0418 501 455 E PAULR@INDUSTREE.COM.AU

STANDARDS & CERTIFICATIONS

CATEGORY 3 PROTECTION LEVEL	HAZARDOUS SOLID PARTICULATES PROTECTION	SPLASH PROTECTION	ANTI-STATIC PROPERTIES	RADIOACTIVE PROTECTION	DMP16 ONLY: BIOLOGICAL PROTECTION	DC350 ONLY: LIQUID PROTECTION	DC350 ONLY: LIQUID PROTECTION
	T5	T6				T3B	T4B
	EN ISO 13982-1:04 + A1:10	EN 13034:05 + A1:09	EN 1149-5:2018	EN 1073-2:02 CLASS 2	EN 14126:03 + AC:04	EN 14605:05 + A1:09	EN 14605:05 + A1:09

EN ISO 13688:13

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INDUSTRIAL & SAFETY WALK THROUGH WAREHOUSE

Purchase the TRIDENT® range of coveralls from ATOM, online or in-store.





GENERAL FEATURES

- Lightweight 150mm (6') high laceup safety boot
- Water resistant leather upper
- Airport friendly
- uvex x-flow safety footwear range footbed is made from 87% recycled production waste foam and the top cover fabric is made from 100% recycled PET plastic.
- uvex x-flow range is certified to accommodate the uvex tune up foot-type specific footbed system
- uvex x-flow shoes have a seam free scuff cap and heel counter for durability

SAFETY FEATURES

- Electrically resistant (EH)
- Lightweight & insulative composite safety toecap
- 300°C heat resistant outsole
- Slip resistant (SRC)
- Fuel oil resistant
- Seam free scuff cap and heel counter for durability
- Water resistant leather upper
- Metal free design

COMFORT FEATURES

- High energy return uvex i-PUREnrj cushioning system designed to minimise worker fatigue compared to traditional polyurethane foam cushioning
- uvex bionomx uses biomechanics in design to harmonise the interaction of footwear with the ground and the body so that it performs as one system
- uvex climazone optimises breathability and internal air flow
- uvex multiple-fit system offers multiple widths in the same length in core sizes
- uvex x-flow range is certified to accommodate the uvex tune up foot-type specific footbed system

THESE BOOTS ARE MADE FOR WALKING

Safety equipment manufacturer uvex is seeking to combat workplace fatigue and heat stress with their biomechanically designed work boots – an innovative product cementing the company's foothold in Australia's mining sector.

Created for the demanding Australian environments, the uvex x-flow work boots comprise of a leather upper and heat resistant sole that safeguard the feet.

The electrical insulating sole and metal free design make it suitable to wear at airports and ideal for workers that could have accidental contact with electricity..

The sole is engineered to perform on both smooth and rough surfaces, making it perfect for environments that place extensive stress on workers and the footwear.

Head of Product Management at uvex Dr Caleb Wegener (PhD, biomechanics) said while the work boots had a wide variety of benefits, the design team particularly wanted to address the high levels of fatigue experienced by workers.

According to the biomechanics specialist, workplace fatigue poses a significant risk in industrial settings and footwear can be a major contributor to fatigue and play an important role in addressing the issue.

"Safety footwear is primarily worn to protect staff against traumatic foot injuries, but well-designed footwear can also minimise fatigue," Dr Wegener said.

"If footwear is poorly designed, the weight, rigidity and cushioning can contribute to fatigue and oftentimes, safety footwear designs ignore this because the footwear is developed on traditional concepts of what a work boot should look like".

"At uvex, we look to produce footwear that is both incredibly safe and harmonised to how the body moves.

"After four weeks of wearing the uvex x-flow footwear workers reported a 15% reduction in perceived leg fatigue compared to the workers existing footwear". Dr Wegener said the study also found that workers perceived uvex footwear to be 18% lighter, 12% smoother ride and to be more flexible than their existing footwear which all likely contribute to the reduction in workers perceived leg fatigue.

Heat stress is also major hazard to workers in the resource sector. "In parallel to developing the uvex x-flow range to try and reduce worker fatigue we also set out to try and improve the breathability of the footwear," said Dr Wegener. "The uvex 3 x-flow zip was tested as being 15% more breathable in laboratory tests than a comparable Australian market leading style. Workers testing the footwear in the hot Queensland climate rated it to be 38% more breathable than their existing footwear," explained Dr Wegener.

The innovative and unique design of the uvex x-flow range is making it fast-become a market-leading product for Australian workers looking to improve their quality of life. ***AMR***

For more information, visit https://www.uvex-safety.com.au/en/





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4 X 500kVA prime power generators were delivered and installed at a remote mine site. These generators will be running in some of Australia's harshest conditions. They have been fitted with a number of upgrades to meet the tailored application.



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Continental
The Future in Motion

The Petroleum Transfer Hose that Eclipses the Competition

Continental's Pilcord® ExtremeFlex™ Petroleum Transfer Hose, is the industry's leading innovation in the highly competitive petroleum fluid transfer application.

The specialist solutions provider is a world-leader in developing products and systems that support global industrial environments and improve operational safety, efficiency, and productivity.

The material and product development forms the core of innovation for Continental Industrial Fluid Solutions. The manufacturer has 20 standard types of elastomers and 150 compound recipes. Continental Corporation can transfer its know-how within the extended business areas to develop and incorporate smart and sustainable solutions beyond rubber.

Designed to be a new standard in hose technology, the ExtremeFlex™ Petroleum Transfer Hose is full of competitive advantages including increased flexibility, durability, lower force-to-bend and lighter in weight.

Continental's Industrial Fluid Solutions National Business Manager Scott Weston said "The ExtremeFlex™ hose range has an advanced formulation and construction making it the most flexible and easy to use fluid transfer hose on the market."

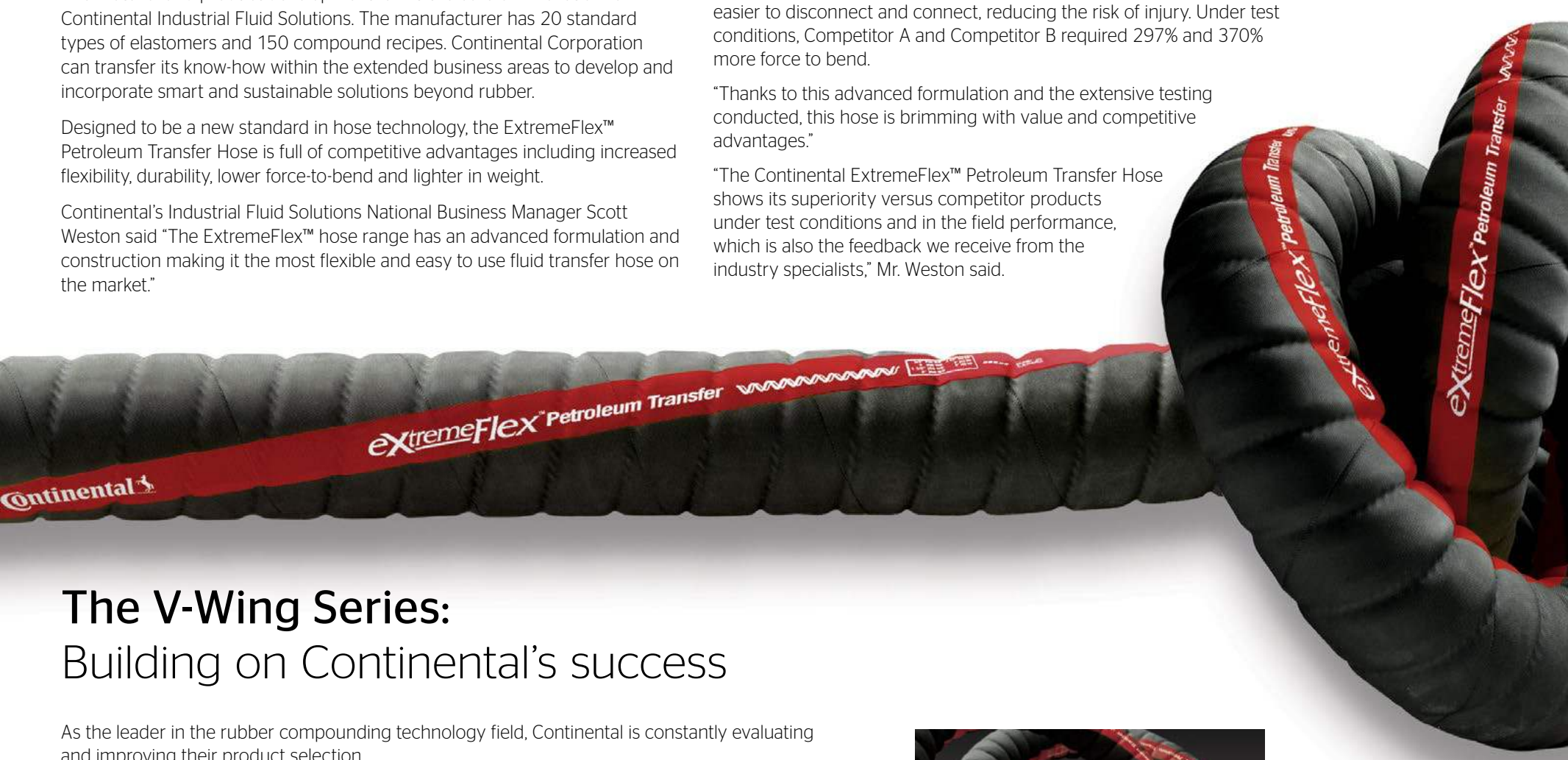
He said it was designed to be longer-lasting and fit-for-purpose, leaping past competitor products making it a new market benchmark. Testing conducted has identified that the ExtremeFlex™ Petroleum Transfer Hose is at least 8% lighter in weight than the competition.

"The lightweight product makes it easier to lift and carry, reducing the susceptibility to operator injury." Mr. Weston explains.

Having a lower force-to-bend makes a flexible hose product significantly easier to disconnect and connect, reducing the risk of injury. Under test conditions, Competitor A and Competitor B required 297% and 370% more force to bend.

"Thanks to this advanced formulation and the extensive testing conducted, this hose is brimming with value and competitive advantages."

"The Continental ExtremeFlex™ Petroleum Transfer Hose shows its superiority versus competitor products under test conditions and in the field performance, which is also the feedback we receive from the industry specialists," Mr. Weston said.



The V-Wing Series:
Building on Continental's success

As the leader in the rubber compounding technology field, Continental is constantly evaluating and improving their product selection.

Notably, the company has advanced their V-Wing Series of lightweight and flexible hose.

One recent innovation in the V-Wing family was the Chem One™ chemical transfer hose.

Boasting extreme flexibility, lightweight design and outstanding flex performance, Mr Weston said Chem One™ is sure to be the preferred choice for chemical plant applications.

"We took many of the cutting edge technologies from Chem One™ and applied them to ExtremeFlex™," Mr Weston said.

"This resulted in an advanced hose specifically designed to serve the petroleum industry."

The purpose-built product is just one example of the insights and technological advances project operators enjoy when they spec and purchase from Continental.

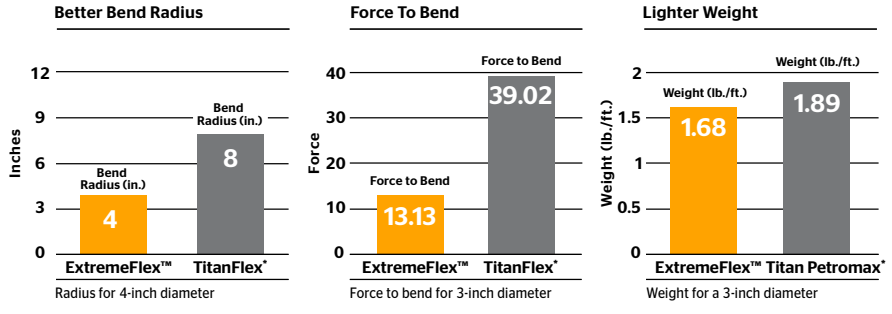


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THE RYCO24•7 TEAM SERVICING CENTRAL QUEENSLAND MINE SITES.

RYCO24•7 - HYDRAULIC SERVICE

EMERGENCY breakdowns and maintenance are a harsh reality for the mining industry.

For many projects that require 24/7 operations, any unplanned downtime can cause costly delays to production until repairers and the right equipment and parts are mobilised to site.

Set up with this key pain point in mind, RYCO24•7, a division of RYCO Hydraulics, offers fast mobile servicing across Australia for emergency breakdowns, programmed maintenance, Original Equipment Manufacturer (OEM) support, installation, and aftermarket businesses.

Our professionally trained and dedicated teams are on call 24 hours a day, seven days a week offering expert technical support for all types of hydraulic and industrial systems.

Our extensive national network of trained and certified Mobile Connector Specialists (MCS) supported by fully stocked Service Centres offering quick response time to reduce machine downtime no matter what the industry or application.

Whether it is mining, marine, agriculture, defence, construction, industrial or utilities, our team will be on hand; anywhere, anytime, to offer professional assistance.

RYCO24•7 EXPANDING IN CQ

Are you looking for mobile hydraulic hose repair services in Central Queensland?
If so, the team at RYCO24•7 Emerald and RYCO24•7 Blackwater have a full fleet of mobile service vehicles available to keep you running, no matter where you are within the Bowen Basin.

RYCO24•7 owned and operated branches in Emerald and Blackwater provide locals with premium services such as hydraulic hoses and fittings, 24•7 mobile breakdown repairs, workshop equipment, on-site workshop containers, hose tagging, hose assembly replacement, stock audits and MDG41 / RS23 compliance.

RYCO24•7 Emerald Branch Manager, Jason Fisher stated, "Service is our main priority. Our team of experienced technicians will go above and beyond to provide you with the right products at the right time; alleviating downtime to get you back on track.

Regardless of the industry, if your issue is hydraulic in nature then we have a solution."

RYCO24•7 Emerald
Service Centre & Mobile Service
Address: 8 Old Sheep Yard Place, Emerald
+61 07 4982 8600

RYCO24•7 Blackwater
Service Centre & Mobile Service
Address: 6 Jarrah Street, Blackwater
+61 07 3866 8851

GROWING THE RYCO24•7 CQ TEAM

This year marks a special occasion for RYCO24•7 — not one but two female Mobile Connector Specialists have joined the RYCO24•7 team!

RYCO24•7 is proud to support and foster employee diversity, equity, and inclusion (DEI).

We welcome our newest RYCO24•7 Mobile Connector Specialists and wish both Dennice and Zoe the best of luck.



MEET DENNICE FROM RYCO24•7 EMERALD

For Dennice, her new role as a RYCO24•7 MCS presents a challenge but one she is extremely excited about!

As Dennice mentioned, "I am looking forward to gaining as much knowledge as I can from the experienced RYCO24•7 staff. Currently, I am conducting on-the-job training by shadowing an experienced MCS on mine sites."



MEET ZOE FROM RYCO24•7 BLACKWATER

Zoe is very much excited about working with the trained and dedicated RYCO24•7 Blackwater team that are on call 24 hours a day, 7 days a week.

Transitioning from the RYCO24•7 Warehouse Assistant role to MCS Zoe stated, "I'm grateful for the opportunity to change career paths and can't wait to be on roster out on-site."

Zoe has a history of hydraulics in her family commenting, "my family is involved in hose and fittings, and I believe RYCO has the best products in the marketplace". ***AMR***

ON-SITE CONTAINER WORKSHOPS



RYCO24•7 On-Site Container Workshops reduce disturbances and stoppages associated with unpredicted hydraulic hose failure.

REDUCING DOWNTIME, INCREASING PRODUCTIVITY

Get your equipment back up and running on-site with our On-Site Container Workshops.

As part of the ongoing focus on customer service, RYCO24•7 has developed a new range of on-site hose assembly workshops and product storage containers.

The RYCO24•7 On-Site Container Workshops are an ideal solution for remote operational locations, including mining, construction, offshore and large manufacturing sites.

This on-site hose assembly workshop is cost effective and designed to reduce disturbances and stoppages associated with unpredicted hydraulic hose failure.

Join the RYCO24•7 Network

Do you have what it takes to be a hydraulic hose technician?

RYCO24•7 has plenty of opportunities to turn your dream job into a reality.

Join our professionally trained team, who are on call 24 hours a day, 7 days a week offering expert technical support for all types of hydraulic and industrial systems.

RYCO24•7 Franchise Opportunities

RYCO24•7 is offering motivated individuals, partners, or current business owners the opportunity to be in business for themselves, but not by themselves, utilising the successful RYCO24•7 business model.

Join the RYCO24•7 team today, visit www.RYCO247.com for more details.

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ON-SITE CONTAINER WORKSHOPS

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Turn Your Data Into Dollars

Gain the reputation for having the most reliable equipment on site and extend the economic and productive life of your assets (Optimal Replacement Time, or ORT).





Don't have your equipment sitting in a workshop for scheduled maintenance or unexpected breakdown and repairs. This equals dollars in lost production.

What you already know
No surprises here!

- You can control your maintenance costs.
- You can reduce the "costs" of lost production – the time your machines are down for maintenance and unexpected breakdowns.

Condition monitoring and advanced analytics control and reduce your maintenance costs. Mining companies and contractors have expensive machinery and equipment in the field.

Some of them come with technology that generates condition monitoring data to protect and maintain your assets.

What we know
The reality is not everyone has a skilled technician collecting and analysing their condition monitoring data, to set your maintenance intervals and control your maintenance costs.

The person entrusted with looking after this data holds a crucial role in taking care of your assets, equipment and machinery!

We know that some condition monitoring systems generate so much data that staff switch off from information overload.

Right now, it is possible that no one is using and analysing the data to take the best care of your equipment.

What you need to know
While your maintenance crew does a great job of fixing equipment, condition monitoring stops it from breaking down.

WT Hydraulics has a team dedicated to condition monitoring:

- We can install the technology into your existing assets.
- We monitor and take care of your equipment.
- We skilfully analyse the data, and support your maintenance personnel in their role.
- We show them what to look for and how to turn the data to dollars!

The WT Hydraulics' CM Team can identify failure patterns and intervene before a machine breaks down.

Condition monitoring is like doing maintenance checks whilst the machine is being used and still producing.

Artificial intelligence = Saving costs
AI sensors track machine changes and use machine-learning algorithms to identify data patterns that signal the need for corrective action.

WT Hydraulics managing director Kraige Cooper says the company is committed to using technology to drive innovation.

"The WT means Wise Technology and this has been our business mantra for over 20 years," Kraige said.

"What we are able to do now in mining with control systems, robotics and autonomous machinery is no longer beyond our wildest dreams.

"To lead in this space, we've added to our team of mechanical, electronic and mechatronics engineers based in Perth to drive innovation and change.

"Our customers that save costs with condition monitoring can use their added profits to finance their next steps into intelligent mining."

Key findings from research on the economic lifetime of drilling machines (Case Study: Model for Economic Lifetime of Drilling Machines in the Swedish Mining Industry) show that:

"of all costs associated with mining equipment, ***it is the reduction in maintenance cost that has the largest impact*** *on the ORT".*

THE ENGINEERING ECONOMIST, 60:2, P138-154

What you need to do
Turn your data into dollars!

The "choice" has always been a "no brainer" - reduce your maintenance costs. Turn your data into dollars!

Now you have the support of new technology and the WT Hydraulics' Condition Monitoring Team.

Call the CM Team at
WT Hydraulics, Kalgoorlie
Jim: (08) 9022 7220

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Continental
The Future in Motion

Industrial Fluid Solutions



The Petroleum Transfer Hose that Eclipses the Competition

Continental specialises in the engineering and distribution of innovative, reliable and high-performance industrial hose for a wide range of industrial, commercial and residential applications. Each Continental hose, fitting and accessory meets or exceeds the quality and performance standards you demand.

ExtremeFlex™ Technology

Our ExtremeFlex™ Hose is an advanced formulation and construction that creates an incredibly durable and flexible hose at a great value. ExtremeFlex™ is the standard in transfer hose and features technologically advanced rubber compounding that allows it to surpass the competition. **Among its many advantages, it is:**

More Flexible: Easier to move in and out **of tight spaces and around corners**
Lighter Weight: Easier to lift and carry, **resulting in fewer workplace injuries**
Lower Force to Bend: Easier to connect and **disconnect for increased productivity**
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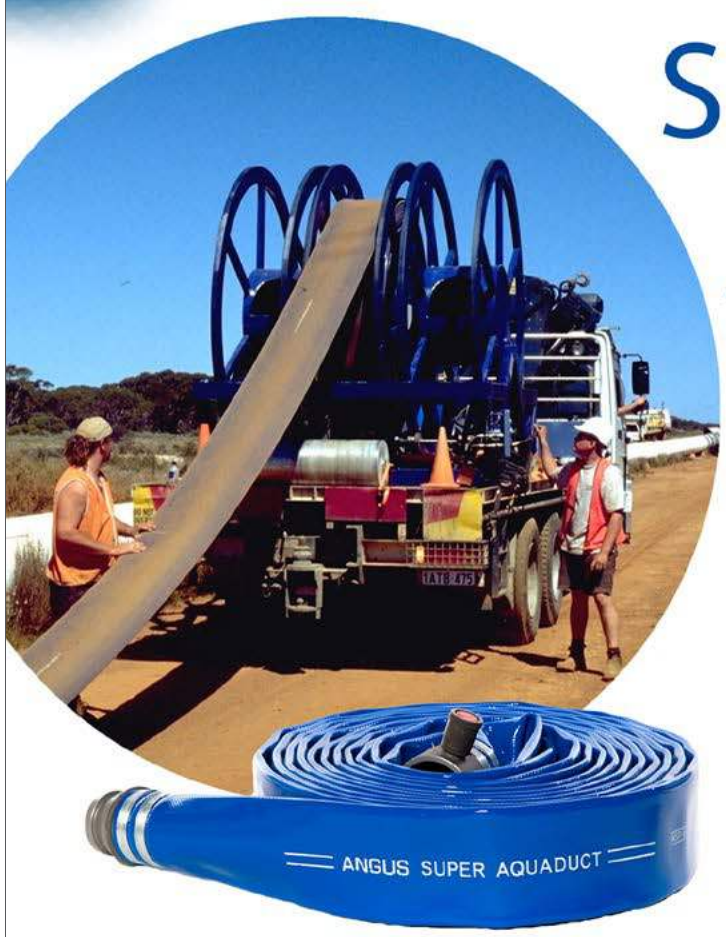
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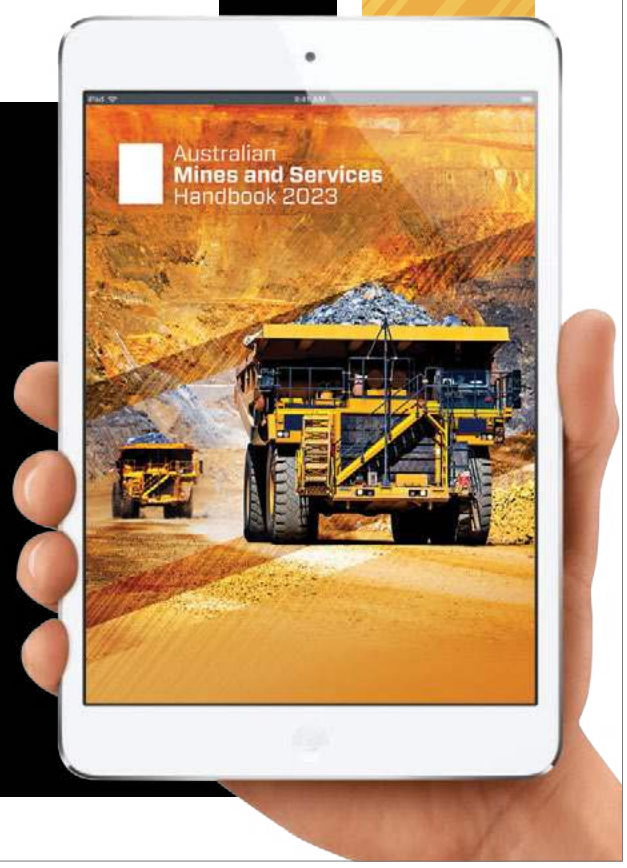
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Kelair Pumps specialises in pumps for mineral processing plants and hard rock mining such as copper, lithium, gold and nickel.

SELECTION THE KEY TO EFFICIENCY

Pumps play an integral role in mineral processing plants, essential in moving material from one point to another. In the world of hard rock mining, this is done with the aid of water or other solutions. Simply put, without water, mines cannot function.

Mines are typically located in remote areas where water is scarce meaning water supply, treatment and removal can be costly.

Environmental concerns, government regulations and the need to reduce costs has placed a heavy emphasis on water management in the mining industry. Pump selection, optimising pump efficiency as well as wastewater treatment have proven essential as a response.

Pumps in Mining
Kelair Pumps specialises in pumps for mineral processing plants and hard rock mining such as copper, lithium, gold and nickel.

"Kelair is heavily involved in gold processing plants where we design systems involving suction pumps, multistage pumps, dosing pumps, acid pumps and all other types of chemical pumps," said Michael Charnley, Kelair Pumps Australia Regional Sales Manager.

"With the dewatering process, we offer self-priming pumps sets, borehole pump sets and line shaft vertical turbine pumps to move large amounts of water."

Reliability, Efficiency and Durability
The speed, efficiency and reliability of pumps are paramount to the smooth running of multiple, interconnected systems at an operation. A whole host of factors determine pump selection and system design at a mine site, including client preferences, site applications, nature of the solids and fluids, distance, height, and gradient, to name but a few.

Efficiency is about getting the most work done for the least possible power. An efficient pump is usually a reliable pump.

All pumps have a "best efficiency point" and it is imperative to get the unit to operate at the point where it should operate to create a more efficient product and reduce costs.

"An in-depth look at the application of the pump and its uses requires careful consideration of what the pump will have to do, where will the pump spend its time, how can we manage external factors and environment," Charnley said.

"When a pump runs efficiently, you have a system that is running the right way with everything balanced, so almost by default, you'll have a more reliable system. Reliability in many ways is more important than efficiency. Usually when you achieve efficiency, you achieve reliability," Michael said.

Maintenance, Repairs and Responsibility
In mining operations, pumps often need to handle abrasive and corrosive products so ensuring you're using the right pump with the right materials is crucial to preventing corrosion and minimising unnecessary maintenance costs.

Unreliable pumps are expensive. Breakdowns and repair time will impact operational performance, operational time and costs.

According to Michael, when Kelair sees pumps that are damaged onsite, quite often it prefers to repair them because it may take less time than supplying a new pump, and secondly the repaired pump is as good as or better than the pump originally was.

"Kelair can make improvements to the mechanical seals, and diagnose problems so it can go to the customer with something which is much more reliable, which is typically below the cost of a new pump," he said.

Kelair Pumps
Since 1975, Kelair Pumps has specialised in providing pumps and pump packages for the diverse needs of mining operations across Australia. When pump knowledge matters, you can rely on Kelair.

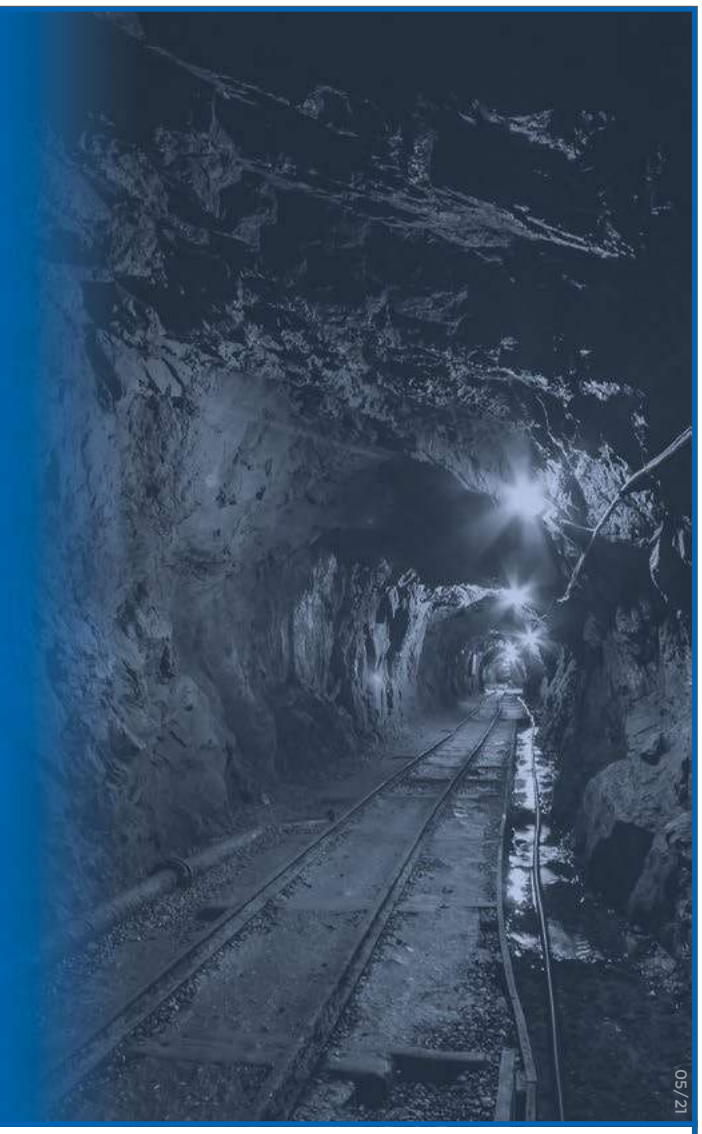
Fluids transfer including oils and lubricants.
Refining, smelting and milling process.
Water treatment. Dewatering.

Looking for the pump experts?

You've just found them.

We are Kelair Pumps.

We know the importance of choosing the right equipment. With our extensive range of pumps, first class customer service and ongoing comprehensive support, Kelair Pumps Australia are second to none when it comes to your pumping requirements.



05/21

KelairPumps

WHEN PUMP KNOWLEDGE MATTERS
Rely on Kelair

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Dewatering at large iron ore mine using Waterlord®.

THE CAT-AND-MOUSE GAME OF MINE DEWATERING

A cat-and-mouse game is a situation where the advantage constantly shifts between the competitors.

With mine dewatering in the Pilbara region, the game is played between the water table and expanding open-cut pits.

Crusader Hose offers the Hamersley Mine Dewatering system so mine engineers can maintain the advantage in the game with the right equipment.



Hamersley reel system deploying 200 m of 305 mm Waterlord®.



Large pit mine dewatering with Flexibore®.

Situations where actions involve constant pursuit, near captures and repeated escapes, are known as cat-and-mouse games.

The competitors are vying for an advantage by taking action to outsmart their opponent, only to find themselves back where they started.

Mine dewatering in the Pilbara region has been quoted as a game such as this.

As the open-cut mine pits are expanded, the high water table slowly seeps through and needs to be pumped out, with more water seeping through with the following expansion.

Managing the dewatering process can be costly and time-consuming.

Fortunately, Crusader Hose offers a dewatering solution to keep costs down and reduce time.

The water table in the Pilbara region is relatively high, and open-cut pits are prone to filling with water.

Keeping the water out of the pit is integral to mine water management.

The typical strategy is to have in-pit bores with submersible pumps, which keep the standing water level down.

From the top of the bore, the pipework connects to a large poly pipeline that can go for many kilometres to flow out to another unused pit or lower depression.

"It is a cat and mouse game," said one dewatering operator to Francois Steverlynck, the MD of Crusader Hose, during his visit to a large iron ore mine in Western Australia.

It was further explained how the water would re-enter the aquifer from the pipe outlet and make its way back to the mine pit, hence the cat-and-mouse analogy.

Mine dewatering is a two-pronged approach; first, extraction of water from the open-cut mine pits, then second, transferring the extracted water to another area.

Removing the water from the open-cut pit is first facilitated with submersible pumps.

Apart from the in-pit bores, many of the large iron ore mines also have permanent dewatering bores located around the perimeter of the large pit.

These peripheral bores help keep the water table below the seams of the iron ore.

Removing the water enables the iron ore to be extracted in the essential dry form.

After a time, however, with continuous excavation and expansion of the open-cut mines, the in-pit bores need regular relocation.

Secondly, conventional bore water transfer systems are set up with poly pipe.

Although very functional, once the mine expands and these pipelines need to be relocated to the next in-pit bore, it can be a time-consuming and costly exercise.

Cutting and dragging long lengths of poly pipe across the mine requires additional equipment, time and a large workforce.

Flexibore®, the flexible rising pipe manufactured by Crusader Hose, is a trusted name in bore water pumping and has converted many engineers from using rigid pipe.

Flexibore® can be deployed in much less time than conventional poly rigid pipe, increasing dewatering efficiency.

It comes in a wide range of diameters to support bore depths of up to 400 metres.

Skid-mounted generators and a flexible riser pipe make retrieving submersible pumps quick and easy, thereby increasing the proficiency of bore relocation.

Crusader Hose has also increased efficiencies regarding bore water transfer in consultation with industry.

Crusader Hose, a company specialising in manufacturing high pressure and quality layflat hose, has had personnel visit mines across Australia and, therefore, understands the requirements for efficient dewatering systems.

"At the foothills of the Hamersley Ranges, where Lang Hancock discovered some of the largest iron ore deposits in the world, we are proud to have developed a new concept making mine dewatering less complicated - the Hamersley Mine Dewatering System using Waterlord® layflat hose," said Francois.

The Hamersley system was developed from experiences gained elsewhere.

"In 2002, we supplied the Australian Army with over 30 km of 152 mm diameter layflat hose to move fuel easily to frontline troops or aircraft," said Francois.

"The Army is constantly moving, so they cannot use cumbersome rigid pipes."

Having developed a layflat hose and reeling system for the Australian Army, Crusader Hose was then able to supply similar systems for large dewatering projects, including mine sites.

Layflat hose can be easily wound up and redeployed when using the Hamersley system.

A large reel mounted on a drive-unit can take up to 200 m of hose and then be driven over to the next bore.

With this system, multiple reels can be used, allowing many kilometres of hose to be connected quickly and easily without having to dangerously drag or reweld pipe in the mine with trucks constantly driving by.

A recent success was supplying a brine transport system for Salt Lake Potash in outback WA.

Over 15km of 300mm diameter layflat hose was used with the Hamersley system to pump the brine from evaporation ponds across the mine.

"We were able to deploy 1.2 km per day with only three operators," said Trevor Freight, the dewatering manager.

"We also were able to take a longer and windier route across the environmentally sensitive ground without soil disturbance or disruption."

The benefits of long-length layflat hose have not yet been fully appreciated by the mining industry due to its inherent handling challenges.

Innovative businesses like Crusader Hose are solutions-driven and are helping the mining industry overcome the challenges of using layflat hose.

"Crusader Hose is fully committed to supplying complete systems," concluded Francois.

With the Hamersley reeling system, Crusader Hose is pioneering a new concept in mine dewatering in Australia, giving mines the advantage in the cat-and-mouse game.

AMR



Quality Ice Machines & Food Service Equipment

Reliable ice machines and food service equipment are critical for catering purposes in remote mining regions where extreme temperatures are the norm.

AJ Baker & Sons are the exclusive importer of the Manitowoc Ice range of ice machines and dispensers Australia-wide commencing in Western Australia over 40 years ago.

Since its inception in 1964, Manitowoc Ice has been on the cutting edge of ice-making technology.

Manitowoc's range of ice machines are available in a variety of sizes, from smaller machines with an ice production capacity of 31kg, up-to large, industrial high-capacity machines which can produce up to 950kg of ice.

Paired with the industrial machines the large capacity dispensers are equipped with an auger that rotates to lift the ice and push it through the chute automatically.

This eliminates the need for staff to lean into an ice storage bin and scoop the ice out, reducing the risk of contamination.

Compact machines for site cafeterias and catering stations feature a hinged door and a sealed food zone to prevent contamination of ice as well as food.

AJ Baker & Sons also provide a range of cold and hot food bain-maries manufactured by the Tecfrigo Italy. These are available with an overhead motorised perspex canopy with available castors.

AMR







Premium Quality Seating for Breakout Areas

Felton Industries specialise in outdoor furniture for mining and industry breakout areas and and have been supplying seating solutions across Australia for more than 20 years.

An Australian-owned and operated business, Felton are known for their premium products, innovation and commitment to delivering quality workmanship and outstanding customer service.

National Sales Manager, Gus White, has been working with the mining industry for a number of years and knows the importance of comfortable breakout areas for staff.

"Creating a place for employees to meet, eat, relax and rejuvenate, helps them to get ready for the tasks ahead and do a good job," he said.

Felton Industries manufacture durable, low maintenance outdoor tables and chairs and sheltered seating, perfect for breakout areas."

Felton's outdoor furniture is made from premium aluminium with a marine grade anodised coating. that won't rust or warp whatever the weather.

It is 100% Australian made and built for Australian conditions.

Durable, practical, comfortable, and low maintenance, Felton's outdoor range is made for industry.

Although Felton provide a wide selection of outdoor settings to choose from, the Advanced Park Settings remain a favourite with industry and can be found at Glencore in Mount Isa and Margaret River.

The Settings feature spacious, hardwearing tabletops and sturdy bench seating with a slightly higher finish, making them are a great option for lunch and breakout areas.

Felton also offer a selection of sheltered park settings that are all-in-one units combining bench seating, table tops and practical shelter for added protection from the elements.

The Deluxe Sheltered Park Settings and Deluxe Broad Roof Sheltered Park Settings have been valuable additions for Rio Tinto and Evolution Mining in Mount Carlton.

Both sheltered settings seat up to 8, feature a Colorbond roof, and bolt down lugs for maximum stability and safety.

In addition to outdoor settings and shelters, Felton provide a versatile range of customisable bench seating from free standing stackable benches to inground bench seats.

All seating is made from premium aluminium, will not crack, rust, or stain.

Available with or without backrests and armrests, Felton bench seating comes with patented safety endcaps as standard.

Felton Industries are ISO 9001:2015 accredited, Approved LGP Suppliers, offer fast turnarounds and deliver nationwide.

To find out more about Felton outdoor furniture visit **felton.net.au** or get in touch on **1800 834 016** and mention code **AMR2022** for special offers on outdoor furniture for mining. ***AMR***







PREMIUM QUALITY SEATING FOR BREAKOUT AREAS

Add quality seating to your breakout areas. Create a place for employees to meet, eat, relax and rejuvenate, ready for the tasks ahead.

Felton Industries Australian made premium quality aluminium outdoor furniture is durable, practical, comfortable and low maintenance. Ideal for mining environments.

Call today on **1800 834 016** and mention code **AMR2022** for specials on outdoor furniture.

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GOOD VIBRATIONS

OLI Vibrators is keeping the mining sector's screens, centrifuges, grizzles, bins, silos and chutes running smoothly with their market-leading industrial vibrators.

Based in Victoria, the top-selling manufacturer works with clients to assist in the design and engineering of bespoke screening, separation, and materials handling solutions.

Clients can access a range of products to suit each individual application and material stream, with vibratory motors purpose-built to prevent breakdowns and reduce downtime at mine sites.
Oli's range of industrial vibrators are built using heavy duty ductile cast iron with superior bearings and windings, giving them long life spans and strengthening product performance and reliability.

OLI Vibrators General Manager Mark Thompson said manufacturing high-quality products was the main priority for the Australian team – part of an international family creating cutting edge vibrating technology.

"We are part of OLI Group, an international leader in industrial vibrators, electric vibrators, concrete consolidation, frequency converters and a wide range of other products designed specifically for industrial applications," Mr Thompson said.

"Our focus is on manufacturing high quality products and delivering the best solutions to meet the customer's specific needs.

"Product performance and reliability — whether out on site or in the processing plant — is of paramount importance, especially when it comes to mining and quarrying.

"There's a limited timeframe to work in, and our customers need to know that the equipment will be working as it should be."

Mr Thompson said mining, quarrying and other mineral processing facilities put equipment under extraordinary pressure to perform for extended periods of time, so it's crucial that the appropriate specialist vibratory motors are used.

He said because of this, Australian equipment specialists and manufacturers partnered with OLI Vibrators for both standard and bespoke vibrating materials handling, sorting, and processing solutions.

From loading pits and conveyers through to dewatering, separation, processing equipment and even the heavy haul vehicles themselves, OLI Vibrators designs and manufacturers specialist vibratory motors for the extractive industries across Australia and the world.

The company has a comprehensive range of products and spare parts available locally, supported by staff with extensive product knowledge and Australian industry expertise.
It offers a "Greased for Life" option and extra heavy-duty range, along with pneumatic and flow aids solutions of every application.

Mr Thompson said the global brand was backed by a strong reputation for high-performing products, supporting the sector's screens, feeders, separators, bins, silos, and chutes.

He said as a global leader in vibration technology, the name OLI has been synonymous with expertise and reliability in brute force vibration for more than 60 years and is known for its price to performance ratio being second to none.

"While it may seem a straightforward solution to place a vibrating unit on a vehicle or piece of equipment to separate materials and/or get them moving, nothing could be further from the truth," Mr Thompson said.

"Selecting the right vibratory solution is definitely not a "one size fits all" process.

"Specific materials respond differently to different amplitudes and different frequencies and vibration strengths have different ranges of influence on different materials.

"It's important to partner with a provider who knows this.

"That's why operators choose OLI." ***AMR***

For more information, visit www.olivibra.com.au



A Portable Valve Actuator for the Mining Sector



By definition, open-pit mines are often located in remote areas, and can be large or even gigantic (some mines are much larger than large cities).

The process of operating a mine is complex and involves many industries.

The infrastructure (electricity, clean water, wastewater, roads, etc.) is comparable to that of a large city, not to mention the industrial infrastructure itself.

Water is a resource that is used extensively in all areas and its supply is critical. It often comes from far away and is transported by large pipelines.

Whether in the water pumping stations at the ocean's edge, on the route of the pipelines or, above all, in the mine itself, the water networks are complex, with enormous flows and consequently large valves.

Often, these valves are manual and, given their size and the torque required, require several thousand turns of the hand wheel to open or close them, which represents a very long operating time.

Modec Portable Valve Actuators are Used for Preventive Maintenance

- Drastic reduction in operating time.
- Reduced fatigue, risk of accidents and occupational illness.
- Protection of the valve itself with our power, speed and torque control systems.
- Increased valve service life due to shorter, easier and therefore more regular maintenance operations.
- The valves are of course located in remote and sometimes very isolated locations.

This is where the Modec range is of particular interest due to the possibility of using portable battery-powered actuators (with a continuous autonomy of up to 90 minutes), or actuators with combustion engine (in this case the autonomy is limited only by the size of the petrol canister taken by the operator).

For the numerous valves located in pumping stations or water treatment complexes (most often equipped with a compressed air network), a particularly powerful and light pneumatic compressed portable actuator can also be used.

It is also possible to use one of the battery-powered actuators directly connected to the mains for total autonomy.

- **Simple installation:** The portable actuator and flying adapter can be installed in seconds.

- **Ease of use:** The device is intuitive, safe, lightweight and can be used safely by anyone. Robustness: Portable actuators do not require any special maintenance and are particularly suitable for demanding environments.

- **Versatility:** With only 5 models (2 pneumatic, 2 battery, 1 gas) and a few adapters, any valve can be handled in any environment. Whether the need is to save time by going faster or to gain strength for difficult valves, our devices are there for you.

- **Associated gains:** It is not necessary to look far to see the gains brought by these portable actuators – saving time (and therefore money), reduction of accidents, sick leave and occupational illness which cost the company a lot of money, reduction of drudgery (operator satisfaction and improved productivity), drastic improvement of equipment maintenance and consequently its lifespan.

AMR



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MOMA SOLAR

Continuing to Light up the Resources Sector with New Innovations

Western Australian company MOMA Solar is continuing to introduce innovative ideas and add some exciting new products that will assist mining companies in creating safer and more environmentally friendly work sites.

The company began in 2017 with a drive to help improve the environment through technology and since then it has evolved with the times and engineered new lighting technology to better improve Australia's emission output and reduce its overall power consumption.

The company's Solar range of products has progressed technically and at reasonable cost to the end user, making it viable to use Solar as an alternative to electricity.

MOMA Solar is also collaborating closely with its manufacturers to ensure improvements and the latest technology is incorporated into solar solutions.

About MOMA Solar
MOMA Solar is an Australian manufacturer who is a national provider of renewable lighting solutions, specialising in Solar LED lighting products.

Some of their key achievements include:

- Members of the Western Australian Local Government Association.
- Member of Lighting Council Australia.
- Patented the Australian Made MOMA Pop-Up Bases.
- Partnered with Carbon Neutral's Plant-a-Tree Program.
- MOMA Pop Ups available to hire through Coates Nation-wide
- Certified Australian Owned and Manufactured through AusOwned.

Published RAP on the Reconciliation Australia Website https://reconciliation.secure.force.com/application/services/apexrest/File?Id=0686F00000kUIu2QAG

Why Solar?
Australia has some of the best sunshine in the world and there are growing opportunities and technologies which can help industry make better use of this valuable and renewable resource?

Solar lighting has taken leaps and bounds from its first years of introduction. Technology has advanced and with it so has our ability to better provide sustainable alternatives to traditional energy solutions.

The products MOMA Solar provides will surprise with their reliability and innovation, making users soon forget their worries set in old solar power ideals. Many of MOMA Solar's products are IP65 which means they meet Australian standards of being fully protected against dust and other particulates, including a vacuum seal, and have been tested against continuous airflow as well as being protected against low pressure jets (6.3mm) of directed water from any angle with no harmful effects.

MOMA Solar lights are also Category A and B wind tested making them reliably strong and durable against anything harsh Australian weather can throw at them.

The company's lights promote the latest in battery technology with modes that conserve energy and output it when it needs it most.

The company's lighting journey is an investment into society's future. By using less finite energy resources and cutting back on our carbon footprint we strive to fight climate change and work on creating a more reliable sustainable future for all.

Environmental Awareness And Innovation
MOMA Solar's range is in a constant state of review as the company works hard towards ensuring it is always providing quality, updated products that meet sustainability standards.

The company's goal is to reduce waste by proving long-term lighting solutions or, in the case or our pop-up lighting range, long-term reusable lighting solutions.

In this regard, MOMA Solar continues to introduce exciting new technology. This includes:

The MOSLX Series - Australia's most advanced solar light on the market today
The MOSLX Solar Street Light Series is ideal for a wide variety of installations, including:

- Mining
- Large Commercial Sites
- Road works
- Construction
- Councils
- Carparks
- Many More



A highly versatile product, the MOSLX Series comes with four modes of operation, giving users the ability to tune their light to their need.

MOSLX SERIES Benefits:
- Built To Perform
- MOMA uses the best components for the highest level of performance and durability
- Permanent pole options available through MOMA Solar
- Save energy with the PIR motion sensor
- All night lighting even on cloudy or rainy days
- Anti Blackout
- Optimal component calibration and intelligent management system
- Selection of the latest and highest component technology
- Handles Extreme Temperatures - Resistant from -10°C to +60°C
- Worldwide Warranty - MOMA Solar offers a three-year warranty on all MOSLX components

The MOSLX SERIES comes in an enhanced version as well, which includes a larger battery and solar panel with a smaller LED output.

This allows the battery to last longer in cases where there is reduced sunlight that can affect charging ability.

Include information regarding the Conveyor Lighting in this section

M2 Swivelpole™
- Swiveljoint allows for easy access to lights for maintenance
- Made from Steel with a Zinc Aluminium Coating
- Various Handrail mounting options available
- Anti-Vibration protection

MOMA Vandal-Proof LED Bollards - MOVPB SERIES
This smart, solar powered lighting solution is ideal for:
- Mine Sites and Camps
- Rural Properties
- Commercial Properties
- Community parks and pathways
- Carparks
- Storage Units

The MOVPB SERIES is all in one system with solar panel, battery and controller all built inside the light. This provides:
- Great appearance.
- Quick and easy installation.
- Surface mount or direct buried.
- IK10 vandal resistance.
- Energy saving – 100% generated from solar.

The system includes a LIFEPO4 Lithium Battery. The Eco-friendly and safe LiFePO4 battery improves the cyclic charge and discharge over 2000 times and has a life span of more than 10 years.

MOMA Solar Pop-up Base
One of the most popular and widely used MOMA Solar products is its Pop-up base, a unique Australian invention that allows the company to offer amazing temporary Solar lighting solutions anywhere from the Perth CBD and Council Zones to tier one mining companies.

The Patented MOMA Solar water-filled base is an ideal alternative to other temporary lighting systems as it provides low environmental impact with zero emissions. Notably it is Australian designed and manufactured.

Key features include;
- Made of durable MDPE (UV20 Rated).
- Lightweight (37kg when empty) and fitted with easy lift handles.
- Stackable for easy bulk transport.
- Compatible with all MOMA Solar fittings.
- No specialised equipment needed for set up.
- 637KG~ when filled with water.
- Fitted with forklift slots for ease of mobility on site when full.
- A and B wind region certified
- No need for height work when fitted with our G5-Giraffe Pole.
- Height - 1125mm, Length - 1150mm, UV20 rated

The base's colour is a standard Orange however, colour customisation is available upon request.

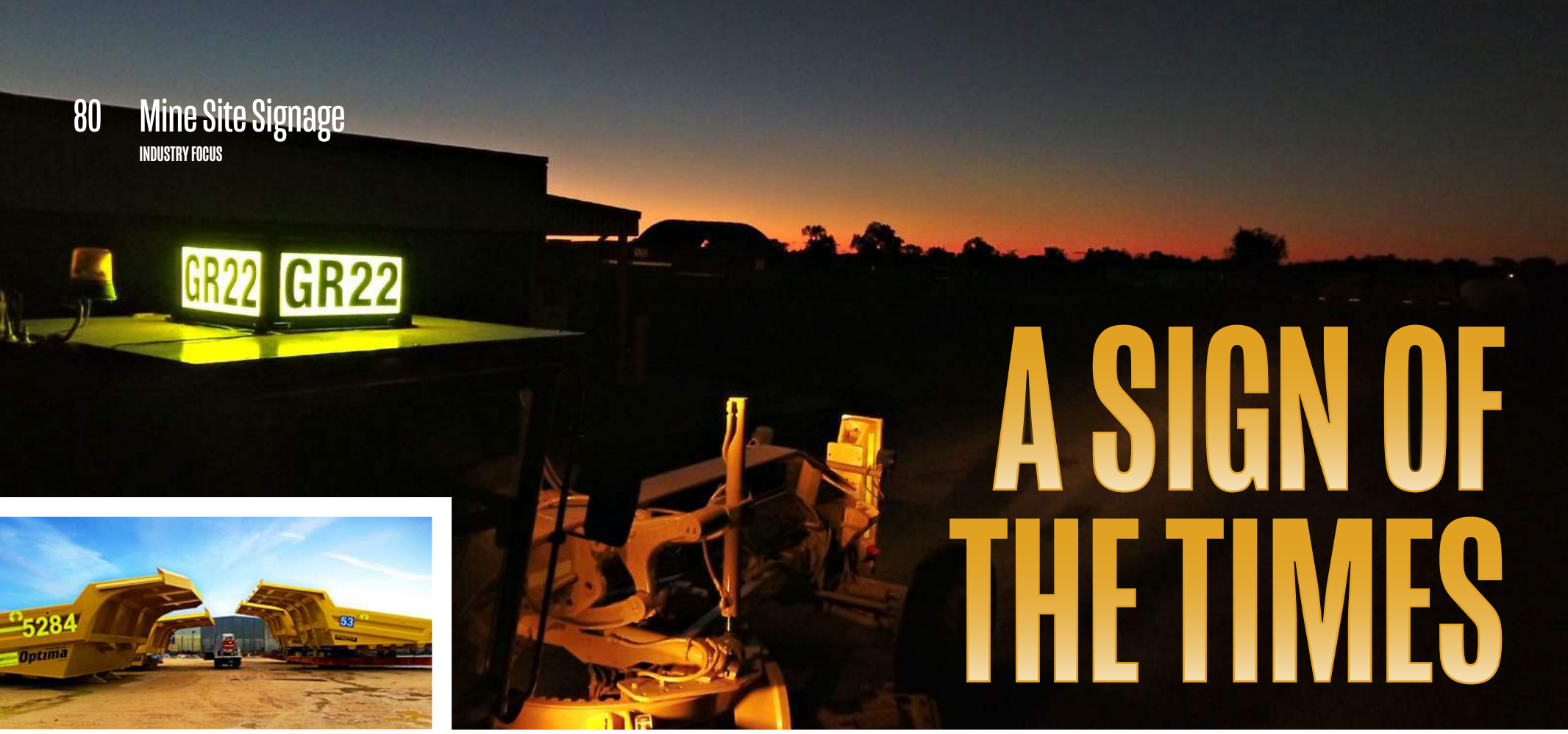
One of the significant benefits of the MOMA Solar water-filled base is its ease of installation – allowing it to be able to be set-up in minutes.

Initially developed in 2019, MOMA manufactures the Pop-up base in Western Australia and its recently opened Victorian facilities.

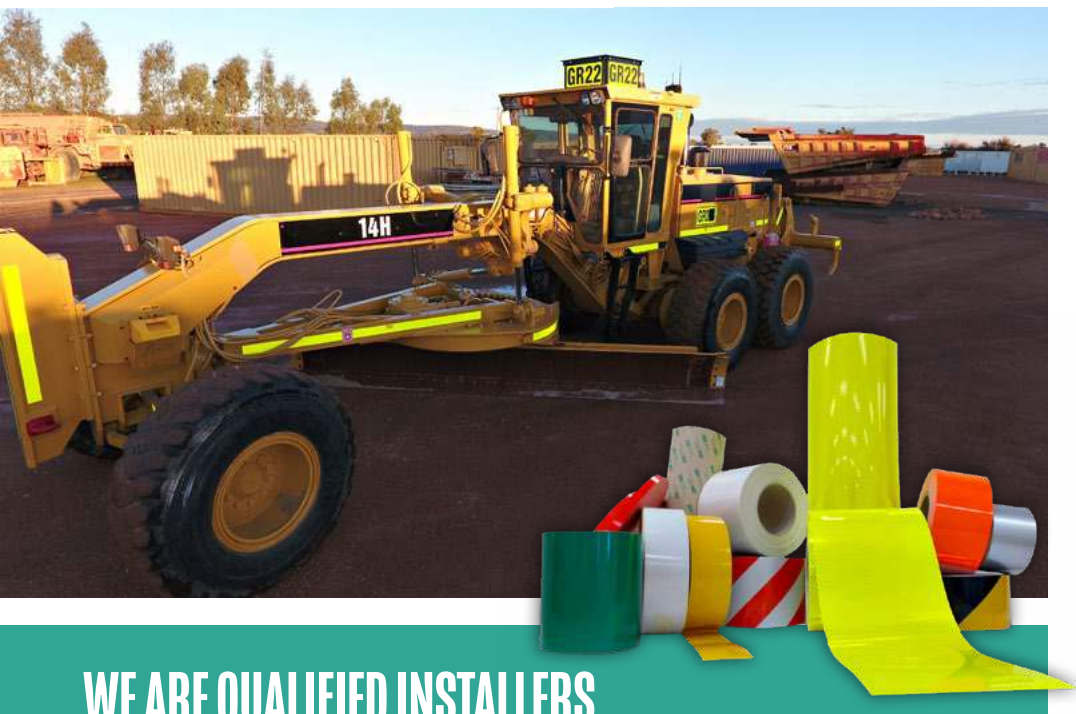
When a company is considering its environmental responsibilities, its bottom-line, ease of installation or a reliable power supply, it is time to make the change to Solar and MOMA Solar are the experts in the field.
AMR







A SIGN OF THE TIMES



WE ARE QUALIFIED INSTALLERS

- Site inducted to large manufacturers, such as WesTrac and Komatsu.
- Trained with Working at Heights and Elevated Work Platform licences.
- Equipped with the right tools for the job, including all access equipment.
- Experienced working on all kinds of machinery and sites – from skid-steers to large dump trucks and excavators.
- OHS trained and compliant at all times.
- Committed to quality installation practices.
- Efficient, professional and respectful..

OUR SIGN CAPABILITIES INCLUDE

- Signage for machinery and equipment – custom signwriting for construction, mining, and industrial machinery. We draw on our extensive catalogue of factory decals and kits to develop signage to accurate specs.
- Halo IDTM – signage for broadcasting fleet numbers, includes a range of 24V internally lit panels, powder coated black frames and panels suited to heavy earth moving machinery and equipment.
- Safety decals – including reflective safety decals, asset numbers and 3M high visibility striping to ensure machines and vehicles are appropriately up to spec and looking professional.
- OHS signage – order site-ready signs online that comply with Australian safety regulations, or have custom signs made to order.
- Fleet branding – for vehicles of any shape or size, with quality laser cut vinyl wraps manufactured to withstand tough WA conditions using digital print technology.
- SQDC boards – and other tools for Lean Manufacturing and Six Sigma methodologies that transform workflows by minimising waste and improving productivity.

Western Australian company Sign Here Signs has cut timeframes and costs for mining, construction and industrial operations with their recently launched web portals.

Founded more than 30 years ago, the sign designer and manufacturer has developed over the years into Perth's go-to mining signage company.

It has a dedicated mining department offering unparalleled industry knowledge and experience, with industry leading production times and same day despatch on a number of custom made products.

With over 45 staff, the company is also one of Perth's largest signs providers and has full-service capabilities, spanning from design, manufacturing and installation.

Sign Here Signs Mining Manager Tom Davies said the company was the preferred signage contractor for the largest machine dealers in Perth - WesTrac and Komatsu.

He also said the company was the partner of choice for large miners such as Rio Tinto, Macmahon and MACA.

"We ship many orders daily and directly to sites across Western Australia and across the country," Mr Davies said.

"We understand the pressures on the mining sector and how quickly they need equipment, so this year we have begun rolling out phase two of our new web portal.

"We upload and catalogue all signage aspects for our clients, from the simple things like general site and safety signage, through to particular machine based kits for large haul trucks and excavators down to light vehicles and ancillary equipment.

"The portal is able to be customised to each client's requirements, with companies such as Westrac, Aggreko, UON and MACA already utilising the system for both sales efforts and functional ordering.

"In phase one we successfully rolled out the portal system to other market segments including RAC Park and Resorts as well as Transperth bus service operators Path Transit and Swan Transit."

Mr Davies said larger companies enjoyed the portal because it offered them greater control and certainty over their branding and machine kits.

For UON, Sign Here Signs was able to define and create controlled documentation for their dewatering trailer product.

Previously, there was large variation in delivered product and limited control over what was produced when the kits were ordered.

Using the portal, UON are now able to select the specific model of trailer they're building, see exactly what is included in the kit and can order through the portal, or generate a quote for them to raise a purchase order through their own systems.

For WesTrac, the portal has been an opportunity for their Operational Support team to build their own signage quotes for machines.

Staff have been able to select how many logos, asset numbers, high visibility striping and safety kits they require across the entire CAT machine range.

The portal allows WesTrac to see and lock in live pricing for their tenders and active builds.

The process simplifies administration on both sides and allows Sign Here Signs the ability to focus on delivering the finished product.

According to Mr Davies, brand control was becoming an important factor for mining clients, as well as asset number visibility and safety decal marking.

He said combining these elements into a single easy to use system was a game changer and Sign Here Signs was already looking to expand this system and introduce new and existing clients to the ease of fleet brand control and kit ordering.

"The portal system essentially acts as a customised online store, updating to the individual clients' requirements," Mr Davies said.

"As a company we're continually seeking to build out technologies and processes to deliver increased services and offerings to our clients while reducing unnecessary administration.

"There are many online only suppliers of safety signage and off shelf products – what we're doing differently with the portal is taking all these customised and detailed client specific decal packs and individual signage elements and building these into a user friendly system.

"Our clients are now able to order a new brand kit to suit the HD785-7 Dump Truck, or a Safety kit specifically for their 980M Loader, all with the click of a button – all priced, laid out to review, ready for you now." ***AMR***

For more information, visit https://www.signheresigns.com.au/

signhere
bringing your brand to life



Signage for the Mining & Transport Industries

Affordable and quality made mining and construction signs for operations across the State.







Sign Here Signs specialises in manufacturing construction signs, vehicle wraps, OHS signs, Halo ID fleet solutions and SQDC boards for construction, mining and industrial operations in Western Australia.

We are backed by decades of hands-on experience, developing signage solutions that make your site safety compliant, while also streamlining workflows and improving efficiencies

All of our work is completed in-house, at our fully equipped facility in Malaga, which allows us to keep costs low for our clients, while ensuring high quality signage and fast turnarounds.

(08) 9248 1184 info@signheresigns.com.au www.signheresigns.com.au



COMMAND SOLUTIONS:

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- Digital Notice Boards
- Internal Communications
- OH&S Messaging
- Interactive Signage
- Wayfinding

COMMAND SERVICES:

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- Fabrication
- Hosting
- Installations Nationwide
- Project Management
- Support and Maintenance
- Training

COMMAND PRODUCTS:

- Navori Digital Signage Software
- 22Miles Wayfinding and Interactive Software
- LCD and LED Indoor and Outdoor Screens and Kiosks
- GlassVu, TransVu and MirrorVu On-Glass Projection Films
- Touch-Glass and Interactive Foils
- Nexcom, iBase Mini and Industrial Computers

HERE'S YOUR SIGN!

Command Digital Signage is improving Australian mine site safety with a bevy of communication solutions.

With offices located in New South Wales and Queensland and servicing Australia and New Zealand, the company is a leading digital signage supplier, with a range of products and services for clients across multiple industries.

Backed by more than 20 years' experience, Command Digital Signage provides project management and installation services and is a technical partner to many companies requiring specific expertise.

Director Rod Alderton said one of their most popular markets was the mineral resources sector, which he said was full of operators looking for modern safety solutions.

"We know there is a lot of emphasis on safety in the Australian mining industry," Mr Alderton said.

"At Command Digital Signage, we support an operation's safety goals with our wide range of simple digital signs and comprehensive solutions using LCDs, LEDs and touch screens.

"Our Digital Signage and Internal Communication products support the dissemination of information to all staff at any given mine site.

"These solutions can be installed inside and outdoors in locations such as Administration areas, Meeting Rooms, General Access Areas, Training Rooms, Security, Crib and Camp areas.

"These systems are also very easy to use and can be conveniently managed by a single person or department or spread across multiple departments for the purpose of updating information to various sites."

Mr Alderton said digital signage was the ideal platform for internal communications, Occupational Health and Safety training and security messaging.

He said project operators also engaged the business to digitise their production messaging, alert messaging, and other general information.

Harnessing years of IT, graphics and advertising experience, Command Digital Signage has put together a range of industry-leading products and services.

Mr Alderton said their installation and support capabilities are unmatched, making Command Digital Signage the partner of choice for Australia's mining industry.

"We have market-leading products and the expertise needed to fit them into client systems," he said.

"These products are easy to use, they're affordable and they provide obvious value to mining operations.

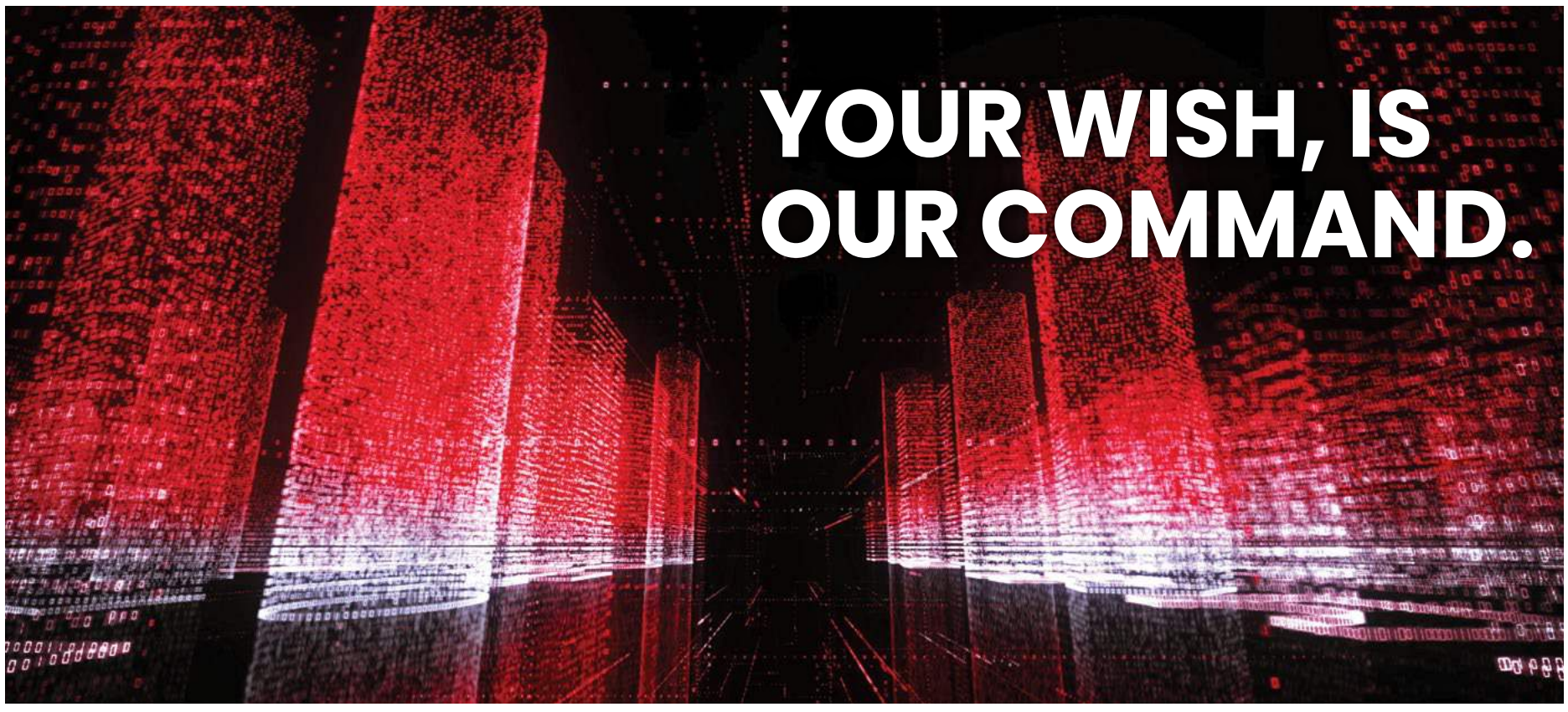
"Enjoy convenient features such as remote management, operate multiple display zones, include a news ticker or use one of our on-glass projection systems.

"When it comes to safety, digital signage is the ideal way to inform your staff of the things they need to be aware of.

"Get in touch with us today." ***AMR***

For more information, visit www.digitalsignage.com.au

CommandDigitalSignage



Find your communication and safety solutions with Command Digital Signage.

1300 780 204

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Command are celebrating 20 years as Australia's leading digital signage supplier.

We have a range of innovative products and solutions for clients in the corporate, government, mining, manufacturing and retail industries.

We provide a range of interactive and wayfinding solutions including kiosks, screens, and interactive foils.

Our project management and installation services are second to none and we are a technical partner to many companies requiring specific expertise.

FIT FOR THE JOB



Mining companies are getting new employees onto worksites sooner and keeping them healthier with Jobfit Health Group's MediManager – an advanced online platform for booking medical assessments and managing workforce health.

Supporting more than 5000 clients, Jobfit Health Group is Australia's leading occupational health provider and the mining industry's partner for pre-employment and periodic medical assessments, health surveillance, injury management and prevention, and drug and alcohol screening.

Jobfit CEO Vikas Dogra said the company's platform, MediManager, was the industry's most efficient solution for end-to-end workforce health management – from onboarding new staff with pre-employment medicals to exit medicals when employees resign.

He said clients only waited one day for medical results, significantly speeding up the recruitment and onboarding process.

"MediManager is the only platform that is fully automated and self-servicing and can be tailored to include specific company medical requirements," Mr Dogra said.

"The user experience is enhanced because you can manage everything online, including booking appointments and answering digital questionnaires.

"With this platform, candidates are spending less time in the clinics and getting medically approved faster for work.

"The system is flexible, its seamless, and it's a proven way to help mining companies get new employees onto worksites sooner."

As well as supporting mining companies through the onboarding process, Jobfit Health Group also provides periodic medical assessments for the mining sector's workforce to help keep staff healthy and fit.

The regular heath checks have demonstrably reduced downtime, created safer working environments and minimised workplace injury incidents as well as improved how operators match employees with suitable roles.

Leveraging a national footprint of clinical expertise, Jobfit can also accommodate companies that have unique or specialised safety needs with complex and tailored medical assessments.

Jobfit's platform has a fully automated reminder function for periodic medicals, vaccinations and health surveillance assessments.

"We also offer medical assessments upon exit which help reduce the number of WorkCover claims and insurance costs," Mr Dogra said.

"By July, Jobfit will be the first provider to go 100% paper free and digital – removing unnecessary administration and streamlining the clients' experience.

"We will also have 50 wholly owned and operated occupational health clinics by mid-year, which is the largest footprint of any provider in the country. This is in addition to more than 450 associated clinics that we work with to make our services the most accessible for our clients across Australia and New Zealand.

"With us, the benefits are extensive. We are cost-effective, proactive, we make the recruitment journey of our client's workers quick, we reduce downtime, and all of this has a trickle down and positive impact on workplace culture."

Founded in 1996, Jobfit Health Group currently has 43 wholly owned and operated centres across Australia, employing more than 300 staff.

Find out more about Jobfit and its industry-leading services by emailing info@jobfit.com.au, visiting www.jobfit.com.au or by phoning 1300 61 61 65.

AMR

MEDIMANAGER BENEFITS

- Booking and managing medical assessments online 24 hours a day, 7 days a week
- Checking appointment availability at Jobfit centres around Australia
- Seamless integration to any business' HR software
- Keeps track of each booking from the initial request through to receiving the medical report
- Provides automated periodic reminders to industries that require periodic health assessments, such as coal mining
- Retention of all past medical information so businesses can search and retrieve previous reports
- Vaccination screening and reporting to verify vaccination records (and any medical exemptions) to ensure relevant industry requirements are met, including COVID-19 vaccinations
- Can be used on any computer or mobile device

JOBFIT

Australia's leading occupational health provider

We partner with mining companies to keep their workforce fit, safe and healthy

We deliver a broad range of specialist occupational health care services including:

- Pre-employment medicals
- Work fitness assessments
- Injury management and prevention
- Periodic & exit medical assessments
- Onsite medical services
- Drug and alcohol testing
- Health surveillance and monitoring

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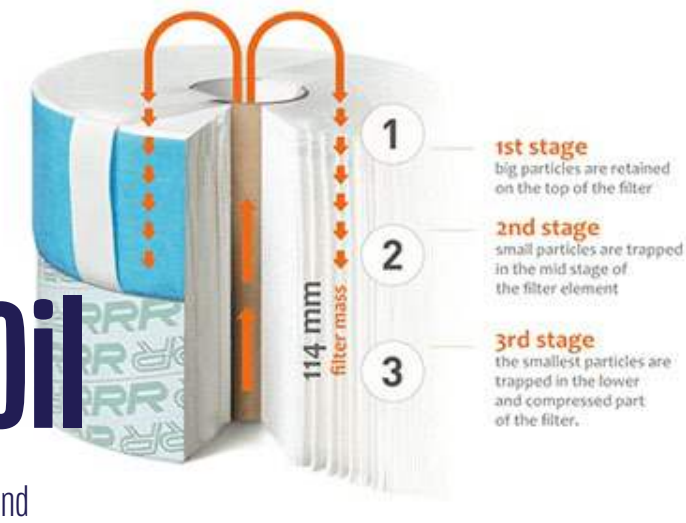


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Perfectly Clean Oil

Triple R Filtration Australia is the leading provider of Triple R Filters and Tan-Delta oil condition sensors in the Australian market.

Engine oil filtration
Increased demands to extend oil change-out intervals on engines has resulted in the use of synthetic oils being used on modern engines. These synthetic oils have resulted in oil change-out intervals being significantly increased, thereby reducing costs associated with oil changes. Extended oil change-out intervals have also impacted the filter used on the engine. Change-out of the filter element is in most cases associated with a change-out of the oil and the filter element has therefore had to be adapted to meet this requirement.

Filter elements have also had to adapt to other aspects of modern engines.
- Improving fuel economy
- Improving power
- Reducing emissions

Clean oil improves fuel economy and power output by reducing friction and wear on moving parts of the engine. Increased wear causes oil to enter the combustion chamber, burns with the fuel and is exhausted into atmosphere as particles and hydrocarbons.

Full flow and by-pass filters
Filters usually installed and supplied with the engine are referred to as full flow filters.

A variety of housings makes the Triple R filter solution **suitable for any size engine**.



The total flow rate of the lubrication pump is directed through this filter to lubricate the engine. By-pass filters are an addition to the full flow filter. A flow of oil is directed from the main oil supply into this filter to enhance filtration capability. Filter media used in by-pass filters is specifically designed to capture small particles which the full flow filter cannot.

Soot
Soot and sludges in engine oil are formed as a by-product of incomplete combustion. When the air and fuel mixture fails to ignite completely, there is leftover particles. These particles find ways into the lubricating oil and is reflected as soot. It is very rare that the engine combusts completely, so most engines will produce soot.

Extended oil change-out intervals increase the risk of high soot build ups in the engine oil. Full flow filters installed on engine have limited ability to remove this soot as particles are too small for the filter to remove. By-pass filter however have the ability to remove this soot and sludges in oil.

Oil change out intervals
Oil change-out intervals are almost always dictated by the engine manufacturer. These intervals are based on distance or operational hours of the engine. There is an increasing trend to further extend these intervals.

Testing of oil samples has shown that this can happen after the recommended interval has elapsed.

Triple R by-pass filters
Triple R filter elements have unique features which make the element suitable for by-pass filters used on engine. No other filter element on market displays these unique features.

1. Engine oil enters the filter media in a radial direction. This ensures that oil is directed into the thick 114mm of depth media.

2. A 1st stage of filtration ensures that larger particles are trapped in the least compressed filter media. By doing this, element lifetime is extended.

3. In the 2nd stage, the filter media, which is now more compressed, ensures that smaller particles are being filtered out of the oil. This again ensure maximum filter lifetime.

4. In the 3rd stage of filtration, the filter media is compressed at maximum by means of the outer wrap, which traps all small particles in the oil.

The filter element has a very large volume of cellulose filter media contained within. This volume or area of media ensures that the element is effective at removing contamination as well as ensuring extended lifetime of the element A selection of housings makes the Triple R filter solution suitable for any size engine.

Selection of the type of filter housing is carried out quite simply by the sump size of the engine. Housings are typically available in aluminium, steel and stainless steel and range from single element housings to multiple element housings.

Housings are supplied with integrated valves needed for functioning of the filter as a by-pass filter fitted onto the engine. This makes installation hassle free with no other control valves to be installed.

Oil condition sensors fitted on-engine
Our expertise extends into providing solutions for on-line oil condition sensor solutions. These sensors are installed on-board engine and provide feedback to the user on condition of the oil. Use of continuous real time on-line oil condition sensors reduces risks associated with infrequent oil sampling and gives the user transparent information on oil condition to make more informed decisions on oil change outs.



Plug and play solutions for logging and retrieving data.

Tan-Delta
Triple R Filtration Australia is proud to represent Tan-Delta oil condition sensors in the Australian market. We are the leading provider of Tan-Delta sensors into Australian market. The Tan-Delta sensor outputs the condition of the oil as an easy to understand value. Installation of the sensor is trouble free and the outputs from the sensor can be integrated with ease.



The **Tan-Delta** sensor is packaged into a mobile kit format.

Features
- Unique sensor technology measuring remaining useful life of oil
- Analyses the electro-chemical properties of oil with unrivalled accuracy
- This accuracy allows the sensor to also measure other contamination in the engine oil such as fuel dilution, wear metals and water in oil.
- Easy to understand output values
- The sensor also outputs the rate of change of the oil. This is a very useful value as it indicates the rate of oil degradation
- Plug and play solutions for logging and retrieving data
- Data communicated to a Cloud based platform if required

The sensor is also packaged into a mobile kit format. This allows the sensor to be used to measure condition of the oil on multiple compartments without the need of permanently installing one. ***AMR***



A zero-emission loader for large scale mining operations



United. Inspired.

Scooptram ST14 Battery

A fully battery electric loader is a 100% emission-free loader with 14-tonne capacity built for demanding underground applications. With a design for higher lifting, a proven powertrain and traction control, the Scooptram ST14 Battery is designed to optimise every stage of the loading operation. With the electric drive, this battery loader will outperform diesel equivalents, especially on grade. So why not go electric today?

Epiroc

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An Iron-Clad Partnership

Minova and Split Set Mining Systems have created a new benchmark for the ground support and geotechnical solutions market through the expansion of their successful partnership.

With a global footprint spanning 25 countries, Minova has a 140-year history of delivering high-quality products, technical expertise and creative problem-solving to the mineral resources sector.

In 2019, the international producer partnered with Australian company Split Mining Systems to distribute specialty products, including resin capsules, grouts and ventilation systems into the Western Australia mining market.

Split Set Mining Systems is a leading manufacturer of ground support products and the partnership with Minova has seen enhanced success for both companies.

The partnership has increased the already wide range of locally manufactured steel products supplied by Split Set Mining Systems in the Western Australian market and allowed domestic operators to access a greater supply of high-performance ground support products.

To accommodate thriving market interest, Split Set Mining Systems has opened a fully stocked warehouse facility in Orange to closer service the New South Wales metalliferous mining industry. Building on the successful partnership in Western Australia, Minova are supporting Split Set Mining Systems in the opening of this warehouse.

Newly opened in March, the Orange warehouse enhances the ability of New South Wales operators to access premium ground support products at competitive prices at a central location to all customers.

A Minova spokesperson said the two businesses had put forward a competitive range of bolts, steel products, resin capsules, logistics and manpower, while working to create safer and more productive work sites.

“Our products are engineered to be safe, efficient and reliable,” the spokesperson said.

“We provide tailored solutions to suit every simple or complex need.

“We help clients increase project performance, overcome application challenges and work safely no matter the conditions.

“Our partnership with Split Set Mining Systems has only enhanced this.”

Bolts and Resin

Leveraging Minova and Split Set Mining Systems’ resources, the companies offer innovative bolting technology that increase the safety and quickness of rock bolting.

The innovative range has options to replace cable bolts, a simplified supplier interface and will result in reduced project costs.

The Minova spokesperson said their solutions suited individual mine requirements, worked with unique surface support methods, and could be deployed in a dynamic or static capacity.

“Our range includes Secura® Bolts, which are specifically designed with a solid reinforcing bar for use in strata reinforcement with resin capsules. The Secura® range provides enhanced performance, as shown through independent testing, as well as improved resin mixing and installation performance.

“Additionally, our Lokset® Advance Resin Capsules, are a reinforced, thixotropic polyester resin mastic in one compartment and an organic peroxide catalyst separated by a physical barrier in the other. Lokset® Advance has been developed to be a true 12-month long life resin capsule, with an enhanced formulation allowing easier installation underground. Reduced wastage and improved stock handling are reducing site costs.

Split Set Mining Services range includes the original IR Split Set® Stabiliser, the industry benchmark for high performing ground support at competitive prices. With millions used around Australia, Split Set Mining Services are the supplier of choice for this critical ground support product.

With a goal of increasing the safety and productivity of underground environments without compromising the ease of installation of Split Set® Stabilisers, Split Set Mining Services developed the Stiff Split Set® Stabiliser. A unique product, Stiff Split Set®’s utilise an internal grout sausage which locks the shape of the Split Set® to the borehole, enhancing its performance.

Optimised Ore Recovery

The Minova and Split Set Mining Systems partnership has also strengthened solutions for ore recovery in hard rock mines.

Often these sites contain ore rich reserves in unmined areas that can be difficult to obtain, leading Minova on an journey to find the best way to maximise extraction.

After developing best practice methods, Minova has spent more than 18 years’ optimising ore recovery, increasing company profits and support mine life extensions.

The proven applications have helped operators’ better control mineral dilution, get cost effective usage of “run of mine” waste rock material and see improved management of health and safety risks.

Since 2001, Minova has invested technology and resources into developing the correct methodology and optimal product design to consolidate material to form artificial rockfill pillars.

FB200 was developed as a low viscosity, flowable, high yield cement grout with complete void penetration, easy pumpability and dimensional stability.

The industry leader’s technical team conduct site analysis and work closely with clients to determine optimal consolidation thickness and test the rockfill permeability prior to commencement of the operation.

Clients include Round Oak Minerals, Newcrest Mining, Castlemaine Goldfields, Newmont, Goldfields, Evolution Mining, South 32 and Glencore.

Freshen Your Air Supply

With a strong history building underground mine ventilation structures, Minova is now leading the market in the design and installation of Ventilation Control Devices.

The company’s extensive product range enhances air quality in underground mines and allows workers to re-enter an area quicker after blasting.

The Minova spokesperson said the devices and services were born from the company’s strong capabilities in engineering, design, product manufacture, fabrication and contract installation.

“We have successfully developed and implemented many specific devices for individual customer requirements,” the spokesperson said.

“We offer trusted designs and engineering certification, products that are safe and convenient to use with protective coatings for harsh environments and customised options.”

Included in the Ventilation Control Devices range is Blastflow® louvre regulators, a product designed to maximise time available to underground operators by allowing them to work in a controlled ventilation environment right up to the time of the blast.

Minova’s QBC blind is an easy to install ventilation device that stops airflow to or from the area of a mine that may need to be accessed at a later stage.

Split Set Mining Services and Minova products are available around the world. To learn more, visit **https://www.splitset.com.au/** and **https://minovaglobal.com/apac/**

AMR





Minova is an industry leader in ground support and geotechnical solutions with a 140-year history of supporting mining, tunnelling and surface ground engineering projects.

Split Set Mining Systems (SSMS) is a leading manufacturer of ground support products, including the original IR Split Set friction rock stabilisers.

Minova have partnered with SSMS to distribute Minova's specialty products.

The alliance has expanded to new regions with the opening of a new warehouse in Orange, New South Wales.

WE ARE THERE WHEN YOU NEED US | GET IN TOUCH TODAY

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Orange, New South Wales
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F: (02) 9832 0733
E: SSMS.NSW@phoenixmetal.com.au

Brisbane, Queensland
T: (07) 4774 6464
F: (07) 4774 6939
E: Townsville@phoenixmetal.com.au



Engineered Blasting Systems

Small Blast Chamber with sound deadening added.

Protoblast Company has been designing and building abrasive blast equipment for all industries since its establishment in 1975.

The third-generation family business is Australian owned and operated with all equipment designed, engineered and fabricated in Picton, NSW.

Over the last 45 years, Protoblast has become an industry leader in the design and construction of full and partial recovery blast chambers, automatic blast machines and ancillary equipment.

There isn't much the company can't build—machines for blasting ingot moulds, surfboards, kitchen sinks, 44 gallon drums, automatic blast machines in aluminium smelters, large sheds for earthmoving and mining equipment refurbishment—the list goes on.

Protoblast equipment can be found in all corners of the country and the world, including New Zealand, USA, Southeast Asia and the United Arab Emirates, servicing companies such as the Australian Defence Force (Navy, Army and Air Force), BHP, Rheem, Hitachi, Caterpillar and Outotec, to name a few.

The experienced Protoblast team have a very strong focus on getting to know its customers, their product and their processes.

This gives customers assurance that what is supplied by Protoblast will outperform expectations and provide a superior return on investment.

The proof in the pudding is the end-to-end solution.

Protoblast offers the full service—the consultations, engineering and design, fabrication and factory testing, delivery, installation, commissioning, followed up by ongoing maintenance.

This gives the customer absolute confidence that they can rely on the product all the way.

The flexibility and customisation that Protoblast can offer further spotlights the superior advantage customers get when working with the company.

A recent example of Protoblast providing their extensive knowledge and experience is shown in a machine it built for a company in New Zealand for blasting barbecue gas bottles.

These bottles were depressurized but not purged, presenting a real danger for blasting as the friction from blasting causes sparks, which would lead to an explosion.

The customer had been given all sorts of conflicting advice from: 'It's not possible' to 'It will be OK but you will have to use a different blast media that won't produce sparks'.

The customer sought advice from Protoblast, which immediately carried out testing and found the media they were being encouraged to use still produced sparks.

Following more testing and consultation with local authorities, it was discovered that balancing the airflow through the machine during the blasting would lower the potential gas level to below the lower explosive limit, where it is no longer a danger.

The machine was to be installed in the bottle filling hall, which was classified as a Zone 1 Hazardous Zone.

Protoblast took on all of these challenges head on, and successfully completed all necessary testing and installation.

Within four months of installation and commissioning, the machine had blasted more than 10,000 9kg gas bottles.

The Protoblast installations are built to last with many of the original systems still in operation today.

One example is a machine built in 1976 for blasting water heater tanks, which is still going strong today and being serviced by Protoblast.

The heart of the Protoblast system is the bucket elevator with abrasive classifier and oscillating conveyor.

It has proven to have a far lower operating cost when compared with other reclaiming methods.

Then, considering the long life of the equipment, it is not hard to see how the Protoblast system is known for its superior ROI, benefiting the customer's bottom line. ***AMR***



Sectional Steel Blast Machine.



Blast Chamber with a side and front entry using Heavy Duty Rubber Roller Doors.



Protoblast's Blast Chamber made from a shipping container.

PROTOBLAST™
ENGINEERED BLASTING SYSTEMS

A leading Australian manufacturer of

ABRASIVE BLAST EQUIPMENT















Protoblast has been designing and manufacturing to suit customers' individuals needs since 1975.

ABRASIVE RECOVERY SYSTEM

AIRLESS BLAST MACHINES

SECTION BLAST MACHINES

DUST COLLECTORS

The best way to prepare a surface for a coating is by using the abrasive blasting process. Whether you need to blast earthmoving equipment, turbines, structural steel or railway lines...

We have successfully completed projects for Bechtel, BHP Billiton, ThyssenKrupp and BAE Systems just to mention a few.

Protoblast has the experience to design and supply equipment that is fast, efficient, improves your product and saves you money ... year after year

PLEASE VISIT OUR NEW AND UPDATED WEBSITE:

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FORTESCUE: AT THE FOREFRONT OF WATER MANAGEMENT

MINING IS THIRSTY WORK, MORE SO FOR FORTESCUE METALS GROUP (ASX: FMG)WHICH JUST ANNOUNCED RECORD THIRD QUARTER OPERATING PERFORMANCE FOR FY22.

FORTESCUE OWNS MULTIPLE OPERATIONS IN THE NORTHWEST OF WA AND IS ONE OF THE LARGEST PRODUCERS OF IRON ORE GLOBALLY.

IRON ORE SHIPMENTS OF 46.5MT FOR Q3 FY22 WAS 10% HIGHER THAN THIS SAME TIME LAST YEAR, CONTRIBUTING TO RECORD SHIPMENTS FOR THE NINE MONTHS TO 31 MARCH 2022 OF 139.5MT.

BASED ON THIS STRONG OPERATING PERFORMANCE, GUIDANCE FOR FY22 SHIPMENTS HAS NOW BEEN UPGRADED TO 185-188MT (PREVIOUSLY 180-185MT).

Strong Performance

Fortescue chief executive Elizabeth Gaines says the company's excellent operating performance continues to drive strong results.

"This strong performance is underpinned by the successful delivery and ramp up of the Eliwana project, and execution of our integrated operations and marketing strategy," she said.

"Fortescue's transition to a vertically integrated green energy and resources company continues to gain momentum.

"During the quarter, Fortescue completed the acquisition of Williams Advanced Engineering (WAE), providing Fortescue with critical technology and expertise in high-performance battery systems and electrification, with key integration activities well advanced.

"Together with Fortescue Future Industries, WAE will develop the Infinity Train, the world's first regenerating battery electric iron ore train, eliminating diesel and the associated CO2 emissions from Fortescue's iron ore trains.

"Building on our commitment to integrate sustainability into all aspects of our operations, Fortescue successfully completed its inaugural green financing offering in April 2022, with proceeds to be applied to decarbonisation initiatives as we deliver on achieving carbon neutrality by 2030.

"Against the backdrop of a record performance in our iron ore business and our focus on decarbonisation and green energy, Fortescue is well placed to finish the financial year strongly, as we continue to meet demand from our customers and deliver on our strategic priorities."

Fortescue's wholly-owned and integrated operations in the Pilbara, WA, include the Chichester, Solomon and Western Mining hubs.

Its mining infrastructure is connected to the five berth Herb Elliott Port and Judith Street Harbour towage facility in Port Hedland via the fastest heavy haul railway in the world.

Safeguarding The Environment

Supporting the success of Fortescue's mine sites is the company's commitment to sustainability, stakeholders and the local communities and environments in which it operates.

One of its three sustainability pillars, "Safeguarding the environment", focuses on climate change action and disclosure, protecting biodiversity and water resources and tailings management.

Mine sites are responsible for maintaining water supply for the operations and the staff, mitigating risks to the environment and managing water resources sustainably to minimise potential impacts to neighbouring water users.

Ms Gaines says water-related challenges vary for each of its operations but the company is committed to safeguarding the environment for future generations.

"Fortescue manages a considerable amount of water to maintain efficient mining conditions, supply water for mine site uses and satisfy environmental conditions," she said.

"Water management is prominent through many parts of the organisation and requires ongoing planning, infrastructure design and construction, operation, and monitoring.

"Our evaluation of water-related risks and opportunities, including those related to climate change, are integrated into multidisciplinary, company-wide risk management processes and are considered as part of our overall business strategy.

"Facility level risk assessments are undertaken regularly as part of mine planning processes, including operational and environmental risks, constraints, and challenges."

Sustainable Water Management

Fortescue's responsible water and environmental management includes assessing potential impacts to surface water bodies, ecological receptors, and other water users including pastoralists.

The company mitigates the impacts by complying with all regulatory requirements at the absolute minimum and implements sustainable water management practices across all sites.

"This includes designing appropriate water management infrastructure using integrated hydrogeological numerical and water system models, conducting annual risk assessments and implementing wet season preparedness plans, as well as undertaking ongoing groundwater monitoring and managing groundwater drawdown," Ms Gaines said.

Water-related risks are assessed and addressed on an ongoing basis, with assessments considering all operational risks at a site level and the actions required to address them.

Fortescue operates in some areas that are adjacent to sensitive ecological habitats such as national parks, significant wetlands, permanent pools and groundwater dependant vegetation.

As a result, supplementation and ongoing monitoring are conducted to maintain water levels and mitigate the potential impacts of its operations in these areas.

The company is also subject to several environmental protection obligations and implement voluntary monitoring programs to minimise impacts to these ecosystems.

Water Sources And Specialist Team

Fortescue's operations use water for ore processing, dust control and for village requirements including the supply of drinking water.

This water is primarily sourced from local groundwater resources, with minor quantities of water purchased from municipal suppliers.

Its Port Operations also use seawater, which is treated using desalination.

Surface water is not used to supply water to any of its operations.

There is a dedicated Water Management team providing technical support across the business during all stages of operation, including planning and approvals.

Specialist advice is provided on a wide range of issues including flood management, water supply, climate change impacts and dewatering.

Mine Dewatering

Mine dewatering is conducted at several of Fortescue's operations to access ore which sits below the natural groundwater level.

This water is reused wherever possible and forms a key water source at our Cloudbreak, Christmas Creek and Solomon mine sites.

The reuse of water is subject to a water quality hierarchy, ensuring that reused water is of a suitable quality for each purpose.





Solomon.



Cloudbreak.



Port Hedland.

At the Christmas Creek and Cloudbreak mine sites, mine dewatering volumes exceed the operational and environmental water requirements, with excess water returned to the environment by reinjection.

Fortescue does not discharge water to surface water bodies, with the exception of its regulated surface water supplementation requirements.

The Papa Waringka MAR Scheme

Dewatering associated with accessing mining areas accounts for the majority of water abstracted at Fortescue's operations.

The company's Managed Aquifer Recharge (MAR) programs minimise environmental impacts and maintain water balance by ensuring as much water as possible is returned to the natural environment through reinjection to the local groundwater systems.

The Papa Waringka MAR scheme has been operating at Cloudbreak and Christmas Creek mine sites since 2009.

Named after the traditional Nyiyaparli word for water of the ground, this scheme has progressively expanded to its current scale of 288 abstraction bores, 139 injection bores and 12 transfer ponds.

The scheme currently returns nearly 100 gigalitres (GL) per annum of abstracted groundwater and involves the reinjection of water to form a hydraulic barrier between dewatering operations and the internationally significant Fortescue Marsh ecosystem.

The scheme is one of the largest in Australia and the first to be operated in a variable density groundwater environment.
The scheme is a temporary water management system which will be dismantled and rehabilitated on completion of mining, allowing for the return of the natural groundwater regime.

During FY21, 127GL of groundwater was abstracted under the scheme, with 32GL reused for ore processing, dust suppression and camp supply and 95GL reinjected into local aquifers.

Minimising Impact On Water Resources

Fortescue minimises its impact on water resources by applying adaptive responses to water management.

It assesses the overall water risk of our operations against several risk measures including the BETA Aqueduct Water Risk Atlas, which provides both overall water risk and water stress ratings.

The Cloudbreak, Christmas Creek, Solomon and Eliwana mine sites are located in low or low-medium water risk areas.

Both the Port Hedland operations and Iron Bridge development are located in an extremely high water risk area.

To manage this risk, water from the Iron Bridge mine will be sourced from a lower risk area and transported via a pipeline to the site and water for its Port Hedland operations is sourced primarily from desalinated seawater.

Existing mine, port and rail operations are not located within areas defined as water stressed by the BETA Aqueduct Water Risk Atlas.

The water source area for the Iron Bridge development, currently under construction, falls within an area defined as highly water stressed.

Fortescue does not have operations or developments located in areas defined as 'extremely high water stressed' by the BETA Aqueduct Water Risk Atlas.

Water Stewardship

Ms Gaines says Fortescue recognises the importance of water resources in the Pilbara and is committed to sustainably managing water resources to avoid impacts to the environment and other users.

"We strategically manage water resources at a catchment level across our operations," she said.

Fortescue monitors water quality and quantity at its operations, along with the health of key local ecosystems and habitats.

This monitoring allows the company to ensure impacts are minimised and that they are operating in compliance with regulatory requirements.

Along with direct operational requirements, Fortescue also manages key environmental water requirements including the maintenance of groundwater levels at the boundary of the Fortescue Marsh, the boundary of Karijini National Park and within some permanent pools in the Kangeenarina and Weelumurra Creek systems at its Solomon mine site.

Site-specific water balances are used to quantify supply and demand and identify opportunities to improve water use efficiency.

Losses through evaporation is minimised by the avoidance of surface water discharge and the use of evaporation ponds.

Water management activities at each of its sites, including allocation, are undertaken in accordance with a combination of regulatory and voluntary requirements.

Water allocation is regulated by the WA Department of Water and Environmental Regulation, under the *Rights in Water and Irrigation Act 1914.*

Water Performance And Targets

Fortescue will report against the following targets in its FY22 Sustainability Report:

- Overarching water targets:
  - Initiate, host and coordinate a series of Mine Water Management Forums about the Pilbara region to encourage the sharing of learnings for practitioners and regulators
  - Set public, site-specific water management targets for each of our operating mine sites by FY23
- Site-specific water targets:
  - Annually ensure at least 80% of water abstracted for mine pit dewatering at the Cloudbreak and Christmas Creek mine sites is used for operational requirements or beneficial environmental purposes.

The forums were postponed in FY21 due to the COVID-19 pandemic but Fortescue achieved a total of 98% of dewatered water from Cloudbreak and Christmas Creek being used for beneficial purposes or reinjection.

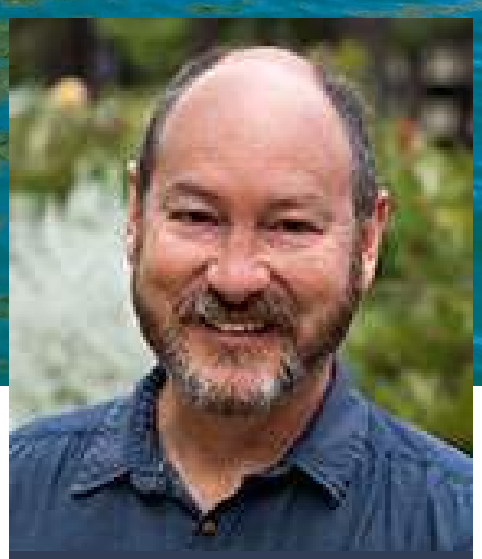
Ms Gaines says the effective management of water as a critical resource is fundamental to the sustainability of Fortescue's operations and the ecosystems and communities in which it operates.

"It is vital that every industry takes steps to use water responsibly by improving water use efficiency and minimising water loss through surface water discharge and evaporation," she said.

"With the impacts of climate change expected to increase, the implementation of appropriate water management practices must be a focus." ***AMR***

Highwalls and steep sides typical of many coal pit lakes in Queensland.

SUSTAINABLE PIT LAKES: SOLUTIONS POST MINING



Associate Professor Mark Lund, Principal, Mine Water and Environment Research Centre (MiWER), Edith Cowan University.

Pit lakes are a common feature of open cut mining sites, and they can be found on every continent except Antarctica.

These lakes form as a result of the large gaps or voids left in the ground after mining operations have been completed.

In many cases, these pits are filled with tailings, waste rock or overburden from other mining activities on-site.

While the practice of backfilling these pits is often favoured by regulators and the public alike, there are certain instances when this may not be feasible.

For example, if the cost of filling a pit is prohibitively high, or if there is not enough suitable material to use for fill, it may not be possible to fully rehabilitate these spaces due to the fill negatively impacting groundwater.

Where the void is deep enough, it can become a lake, filled by a combination of groundwater, surface runoff and rainfall.

While most pit lakes in Australia tend towards being saline, mainly due to high evaporation rates, water quality can range from excellent to extremely poor (extreme pH and/or high concentration of toxic metals and metalloids).

Kathleen Southway spoke to **Associate Professor Mark Lund, Principal, Mine Water and Environment Research Centre (MiWER), Edith Cowan University, Perth, WA**, about the impact of water in pit lakes on the environment, local community and broader sustainability goals of the mining industry.

MiWER research has centred around pit lakes from coal mining, which to-date, have had relatively few water quality issues.

Once a pit lake is created, it is essentially there forever and it becomes incumbent on all stakeholders to ensure that the lake is a net benefit and not a future liability.

Despite these challenges, however, it is clear that pit lakes play an important role in post-mining land reclamation efforts and should continue to be monitored and regulated to ensure their long-term sustainability.

AMR: What is an aquatic ecosystem and how could this be defined by regulators?

ML: A simple definition of an aquatic ecosystem is a wet area with a community of organisms that interact with their physical and chemical environment.

For example, when we forget to put chlorine in our swimming pools for a couple of months we create an aquatic ecosystem, where a range of algae, microbes, macroinvertebrates, for example, insects, move in and set up home.

Across the bottom, dead leaves and other organisms start to create a sediment.

If this swimming pool was a pit lake, the types of questions regulators may ask include: If we leave the pool for longer does the number of species present increase? When will aquatic plants around the edge or under the water become established? When will birds and fish call the pool home? How long, if ever, would it take before we could say that the pool was the equivalent of a natural lake in terms of biodiversity?

They illustrate the challenges regulators face in defining what aquatic ecosystem they would consider acceptable when a pit lake is closed.

Unlike swimming pools, pit lakes have no concrete or fibreglass walls separating them from the soil and potentially groundwater.

They also have a typically small catchment, which allows surface water, nutrients, and organic matter to enter the lake.

Lakes are essentially products of their catchments. So, the aquatic ecosystems within pit lakes need to be considered not in isolation but in conjunction with their catchments.

AMR: What is the ideal endpoint or outcome with pit lakes – and how does this impact Australian mine sites?

ML: Unlike terrestrial mined lands where in most cases the ecosystem that existed prior to mining can be reasonably determined, pit lakes are completely new ecosystems that never existed there before.

Pit lakes due to their shape, depth and human-made catchment are difficult to compare to natural systems that might co-occur in the area.

As we have no exact reference sites to guide what an aquatic ecosystem in a pit lake should be like within that mining region, defining an end point is difficult.

Thinking about this problem in another way, the region around the pit lakes contains a limited number of aquatic species, of these only some will be suited to the water quality of the lake, be able to get to the lake and will be able to find sufficient food and habitat within the lake.

Therefore, we can only expect a pit lake to contain a smaller subset of the aquatic species that occur in the region.

Questions to ask include: What percentage of the region's aquatic biota can you reasonably expect in a pit lake? What time frame is it reasonable for a pit lake to achieve this percentage of taxa? Can we realistically determine what the region's aquatic biota richness is, especially as other human impacts might have already reduced it?

Perhaps the simplest solution is to engineer the lake the best we can for biodiversity and then let nature do its thing.

Also known as the "Field of Dreams" approach, based on the Kevin Costner movie of the same name, the idea is that if you create a suitable environment for organisms to live in then nature will do the rest.

To do this we need to determine what interventions can be made to improve biodiversity – such as adding more habitat.

Our scientific understanding of aquatic ecology means that we can reasonably guess some of interventions that might be needed although that it is best to test these ideas experimentally.

These experiments will not only provide confidence that these interventions work but guide regulators on how much of the intervention is needed to produce the desirable increase in biodiversity.

For example, adding fringing vegetation is likely to aid biodiversity in many ways – but, how much do we add to get the best result while minimising the cost?

I am currently leading a large project funded by the Australian Coal Association Research Program (ACARP).

MiWER is also investigating how different forms of rehabilitation might alter the nature or trajectory of that pit lake ecosystem.

Understanding the trajectory that a lake ecosystem is on, is one of the key things that MiWER is grappling with in our research as lake ecosystems evolve over time.



Giant water bug (Family Belostomatidae): Australia's largest bug caught at a Queensland coal pit lake.



Assoc Prof Mark Lund collecting samples from an experiment running in an acidic pit lake in Collie, WA.



Highly acidic (pH <2.5) pit lake in Collie, WA, is now re-mined.



A small rehabilitated saline pit lake in the Hunter Valley, NSW.



An unrehabilitated saline pit lake in Central Queensland that is still filling up with water.

Our research is aiming to understand positive versus undesirable development, or trajectory, of the lake so we can ensure that our interventions are pushing the lake in a desired direction and hopefully at a much faster rate than if we let nature take its course.

Aside from creating pit lakes and ensuring that they meet an acceptable standard, it is also important to engage with local communities that will have the lake as part of their environment.

What do local communities want from the lake and how that be achieved without creating a long-term burden on the State?

For example, if a lake is to be used for aquaculture, who is responsible for rehabilitating the lake when the business moves on?

Many mines have pit lakes on the lease that are used as water storages, with a view that they will be prepared for closure when the time comes.

Sometimes, these lakes are backfilled as other areas are mined.

For the project that I am currently working on, these pit lakes offer a valuable insight into aquatic ecosystems that develop without rehabilitation.

For miners, these lakes offer interesting testing grounds for interventions that could form part of their closure planning.

Results could provide a unique opportunity for mine sites to demonstrate to regulators that what they are proposing works.

AMR: What do the public and local communities gain, and why do they benefit, from pit lakes as aquatic ecosystems?

ML: Creating lakes where there were none before is challenging but does create the opportunity to add something to the local community and environment post-mining.

Pit lakes are considered to the greatest potential legacy of open cut mining and transforming them into aquatic ecosystems in one way to reduce that legacy and provide an asset for local communities.

Pit lakes are typically large enough for a range of future uses such as energy production (pumped hydro or solar), aquaculture, cattle watering, irrigation and recreation (swimming, boating, diving).

Creating an aquatic ecosystem makes the lake suitable for most of these future uses, although salinity might limit some options.

Aquatic ecosystems can still be a valuable addition to the natural environment even at high salinities, as Australia has more naturally saline wetlands than freshwater.

How saline a lake will become is dependent on many factors, but where there is pathway to lose salt from the lake then high salinities are inevitable.

Natural loss pathways for salt are largely limited to some uptake by sediments and plants, loss into groundwater leaving the lake or surface discharge.



The fringing and riparian vegetation typical of natural lakes are often absent from pit lakes, limiting their development.

Current practices aim to retain all water in contact with mining onsite to prevent possible contamination issues off site.

Where water qualities in the pit lake are good and the value of the lake is high to the local community, there may be a case for allowing some of the water to leave the lake.

If this lake discharge occurs at times of high flooding in the area, then it is less likely that there will be any detrimental impacts downstream due to the release.

Any release from a pit lake or connection of a pit lake to a river such as what occurs at Lake Kepwari in Collie, WA, needs to be carefully considered as there are important risks to be considered to downstream areas.

Lake Kepwari is permanently connected to the intermittently flowing Collie River South Branch.

Connection to the river has brought numerous benefits to the lake, improving pH and water quality allowing for recreational activities to occur.

Water skiing and other related activities such as camping have turned Lake Kepwari into an important regional tourist attraction.

My group has monitored changes in the lake and in the river downstream over many years.

The river has been impacted by the connection to the lake, but the impacts at this stage appear to be trade-offs for the improvement to the lake.

AMR: In an era of climate change, explain the considerations surrounding pit lakes and the environment?

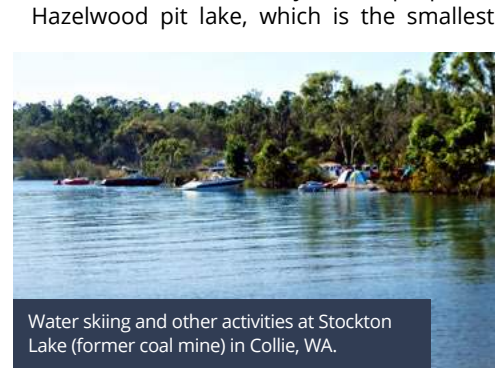
ML: Creating an aquatic ecosystem is a great option for closing pit lakes as it creates a lake that should be safe and sustainable into the future.

Unlike most other future uses for pit lakes, an aquatic ecosystem should require no more management than any other lake, keeping community costs to a minimum.

Climate change poses at least two challenges for pit lakes as aquatic ecosystems or even as viable closure options.

The first challenge is the volume of water required to fill some of these pits.

In the LaTrobe Valley, the proposed Hazelwood pit lake, which is the smallest of the three pits in the valley, would hold an estimated 640GL of water which is approximately the same volume as Sydney harbour.



Water skiing and other activities at Stockton Lake (former coal mine) in Collie, WA.

There are concerns that the filling of Hazelwood pit would detrimentally impact on other aquatic environments in the region.

In areas where climate change may reduce rainfall then the challenge of filling becomes more difficult, and the lake may take centuries to fill naturally.

The positive outcome seen for the closure of Lake Kepwari is based on MiWER research dependent on continued inflows from the Collie River South Branch.

These flows have been declining over the last 20 years due to a drying climate in WA.

The possibility of exceptionally low flows in the river in successive years could undo some of the positive improvements seen in the lake's water quality.

Low rainfall and high evaporation rates are also likely to speed up salinisation in some of these pit lakes.

The second challenge is more extreme weather that could result in flooding and discharge of pit lakes.

Careful design following modelling and engineering can reduce these occurrences, the recent flooding across parts of Eastern Australia show that these events can be challenging to completely design for.

Any pit lake that is going to remain after mining needs to be sustainable – or does it?

What this effectively means is that the water quantity and quality and associated biodiversity are essentially maintained within certain ranges into the future.

As pit lakes age, we can reasonably expect them to become more saline through evaporation, until they reach equilibrium.

This process is not likely to be linear with years of high rain reducing salinity temporarily thorough dilution.

Salinity increases will alter biodiversity and water quality, as species have different salinity tolerances.

It may take many decades for salinity to reach equilibrium.

As the climate changes, this is likely reflected in the aquatic ecosystem.

Determining what makes a sustainable aquatic ecosystem is therefore difficult.

MiWER aims to develop practical solutions to these challenging questions and ensure that pit lakes closed as aquatic ecosystems are a positive contribution to the environment and local community. ***AMR***

AUSSIE TAKES THE LONG VIEW



Mood Ellahi,
Senior Product Manager at Australian Pump Industries.

Aussie GMP hydraulic drive mud pumps equipped with 316 stainless steel impeller built to handle abrasive and corrosive liquids.

Australian Pump Industries' Mood Ellahi put together these headlines from recent Financial Review columns, dated 26th and 27th April editions. It's not exactly encouraging or stimulating but, Mood has a different view that is much more positive.

Here he takes us through Australian Pump Industries and its specialist mining product lines that will face down those negative headlines!

When we put this story together, we wanted to talk about how encouraged we were about the tremendous results Australia's mining industry produces for this wonderful country. To see that we're heading for what could be a $450 B export of minerals record for 2022 should be stimulating and exciting for all Australians.

At Australian Pump, we keep working on developing new and improved products for mining, knowing not only the importance of the industry but, the very difficult environments Australia's miners have to work in. It's incredible that only 250,000 industry participants are the backbone of Australia's economy.

AUSSIE PUMPS PRODUCTS

Australian Pump Industries is first and foremost innovative. Every month we go through a process with key executives and engineers working through an agenda of new product development ideas.

Those ideas sometimes never make it past initial sketches and surveys but, many of them have become major successes, not just in Australia, but in the mining industry around the world.

The process is simple. First, we talk to users on the ground to find out what it is they like about the current equipment they're using in pumps or pressure cleaners and what they don't like. Sometimes comments about our own products can be quite negative and that is a great learning experience for us.

Often, those negative experiences are based on a failure of our company to document what we do and how we do it, and for that matter, even how to operate the equipment. We learn from that!



Aussie's Fire Chief in Mine Boss configuration… essential plant protection.



Aussie's big 4" trash pumps ready to take the mining challenge.

THE NEW PRODCUT DEVELOPMENT PROCESS

Once the idea has been tabled, we canvas the concept amongst potential users to verify its validity. After that "pub test" we start looking at how we can adapt, improve or even develop a new product. If we can base it on an existing Aussie Pump, that's a bonus and gives us a leg up to start with!

Over the past five years, we've seen an amazing array of new product developments coming out of Aussie's committee based decision making process that have made a big difference in mine sites not just in Australia but around the world.

FOLLOW THE PROCESS… THE FIRE CHIEF GOES MINING

A good example is our Mine boss high pressure fire pump. We investigated the requirements for fire pumps on mine sites, after we had some enquiries from some of Australia's biggest mining companies. We learned that fires on mine sites are not only common but can be very damaging and costly.

Apart from that, they can also be extremely dangerous to operators and even deadly. Turning our petrol drive Aussie Fire Chief into a diesel drive Mine Spec machine entailed a major rethink of the roll frames that the machines are built into it and their standard equipment requirements.

The Aussie Fire Chief is a mighty self priming centrifugal fire pump that in its Honda petrol engine powered configuration, weighs in at only 26 kilos. Regarded as the world's best lightweight portable fire pump, it's ideal for firefighting authorities, farmers, even home owners to protect their properties from bushfires. It's not suitable for mine sites where flammable liquids are never far.

The ideal solution was a diesel powered machine but built tough for rugged environments. The first thing we did was redesign the frame out of heavy duty stainless steel 38 mm tube and added an integrated lifting bar.



The frame had to be big enough to accommodate a Yanmar diesel engine with electric start, battery, battery isolation kit and the mandatory E-stop.

We also fitted a compact, high quality fire extinguisher. The response to the launch was immediate with manufacturers of mobile firefighting appliances aimed at mining being the first to pick up the product line.

We see many production runs of this high performance pump, with 25% more performance than it's competitors, and applaud it for its unique mine site suitability. The Aussie Fire Chief is famous for producing up to 100 psi (75m head) in terms of pressure and offers flows up to 450 lpm.

That makes it ideal for a ute installation with 400 or 600 litre water tank, hose reel and firefighting hose kits. It can accommodate two 1" hoses or one 1 ½ " hose, depending on the operator's needs and the necessity imposed by "damage control" requirements.

Today we're pleased to see these Fire Chief Mine Boss units, with a unique Aussie "We're for a Australia" flag insignia operating in Africa, Central Asia and all over Australia.

CONTINUOUS IMPROVEMENT… MORE CAPACITY

When we designed and built single impeller pumps with 4.8hp diesel engine drive units, we soon saw a requirement for a higher capacity fire pump and moved to building twin impeller jobs with 10hp Yanmar diesel. More performance, more horsepower, and to some extent a necessarily enlarged footprint and frame resulted in the 2" and now more recently a 3" version.

That machine can save a large crawler dozer, dump truck or even a reclaimer if action is taken promptly to contain the blaze. More recently, the Aussie engineers have redesigned the Aussie Mr T so it operates with 3" ports (both inlet and outlet), providing flows up to 200 lpm at 75 m head.

Throwing loads of water the fire at pressure is the secret of fire containment. The Mr T twin impeller 3" does that job immaculately but, needs a suitable water source.

TRASH PUMPS TOO

The Aussie trash pump range went through much the same process of evaluation and development. Pumps that were used on construction sites powered by Honda petrol engines in 2", 3" and even 4" were turned into Mine Boss configuration!

We didn't understand that trash pumps can be damaged easily by being moved on site by an excavator or picked up with the teeth of a front end loader, transported to where they needed to be and just dropped. We realised conventional frames designed for normal applications simply wouldn't cut it.

The result was a 38 mm hot dipped galvanised frame with integrated lifting bar to a design requirement that even the boys in Peoria would be proud of. The machine was then equipped with all the standard Mine Boss accessories including E-stop, battery isolation and fire extinguisher. Today those trash pumps are being used all over the world and do good service on mine sites and quarries in Kenya to Kazakhstan and right through the Australian mining industry.

BIG TRASH PUMPS

We learnt that mining needs water. We found that during the drought, mining operators were forced to compete for water with farmers and regional towns in what turned out to be the worst drought in decades. The need to move water fast and build storage became mandatory with the mining industry investing heavily in areas where it was appropriate to do so.

Today, the amazing job the government has done in financing a $5.4B dam at Hells Gate on the Burdekin in Queensland, is justified not just by the agricultural industry's requirement but also by the additional advantage it provides to the coal mining industry, so essential for Queensland's economy.

FLOOD CONTAINMENT… AUSSIE MINE BOSS DOES IT

The other side of the coin is what happens when there's too much rain, rather than not enough. Recent floods have filled quarries and mines around the country stopping production at huge cost.

Batteries of big 6" Aussie model MQ600TD pumps can move huge amounts of water fast. This pump can pull 6,000 lpm. A row of six can move up to 36,000 lpm! These big heavy duty cast iron pumps can self prime. By that we mean no priming devices required. No need for compressor systems or vacuum pumps!

Our big boys consist of one huge cast iron body casting with an integrated tank that helps the pump to prime itself fast. The priming process is so simple. The pump has an integrated check valve on the suction port. The pump body is filled through the priming port in the top of the pump near the discharge.

The operator or installer has to pay particular attention to make sure the suction hose, joining into the entry point on the pump body is absolutely air leak free. That may mean taking a close look at the Camlocks or Bauer couplings being used to ensure the rubber seals are absolutely first rate, not worn or twisted. With a perfect seal, the priming process can begin.

Step 1: With the pump bowl filled, start the 80 hp Detuz diesel engine.

Step 2: The water in the pump bowl is expelled through the discharge port, creating a vacuum inside the pump body.

Step 3: That vacuum allows the pump to literally 'suck' the water up through the inlet hose, into the pump and the rest just happens!

Trouble free, there's no wrestling with hoses and the simplicity of the process often amazes those operators who have only had experience with dry prime pumps!

MUD PUMP DEVELOPMENT

Our experiences as mud pump suppliers started with drilling contractors using our standard diesel engine drive self priming pumps for this important job. They worked well but if misapplied, showed problems of premature wear and the inconvenience of having to refuel 5hp to10hp diesel engine pump sets was not considered desirable.

Working with some of Australia's most experienced exploration drilling companies, we started playing with the idea of going hydraulic and developing self priming centrifugal pumps, with big open impellers and silicon carbide seals to carry out the mud pump function.

We knew it was going to be abrasive and we also knew that sometimes the liquids could be particularly corrosive as well. The first experiences we had were with 2" cast iron semi trash pumps. We noticed that the drilling companies using them were replacing impellers more frequently than expected.

The resulting research showed that the standard high SG cast iron impellers weren't up to the wear factor required and we quickly replaced them with 316 stainless steel. **The results were excellent.**

MORE FLOW PLEASE

We then found that the higher flows were required than the 400 -600 lpm in a 2" pump and started supplying big 3" pumps on, some of them with high head. The Aussie GMP semi trash pumps with big front opening ports enable easy clean out were a big hit. Some are supplied in NiAl bronze with stainless steel impellers. That's what we regard as being the ideal specification based on our feedback from the market. The hydraulic drive, mounted on the output shaft of the pump, provides loads of power from either a power pack or often from the rig's hydraulics.

That makes for a neat package and no small engines to have to worry about servicing, fuelling or even checking the oil on a daily basis. We also found that the hydraulics, often being driven itself by a big diesel engine, provided loads of power!

We are now moving on to a wide range of different size exploration drill rig pumps in what we call "drillers" configuration. Next we will be looking at blast hole drills, particularly where we can use hydraulic drive to a good effect!

HYDRAULIC CLEANING POWER

We started out building hydraulic drive versions of 'Big Berty' Bertolini 4,000 and 5,000 psi pumps used in our engine drive pressure cleaners. The initial market was concrete pumps where there is a hydraulic system already installed and a cleaning function necessary after every job.

After that, it was easy to see other applications from vac trucks, to exploration drill rigs, and for that matter also blast hole rigs and even water well drilling equipment. Now we're seeing more opportunities as mining companies see the benefit of building cleaning equipment into plants that include reclaimers, conveyers and processing plants like pugmills and crushers.

AUSSIE'S RAPTOR 500 BAR BLASTERS

Although the Raptor is not available as a hydraulic drive at this stage, the development of the product continues to grow as we're asked for more and different flow/pressure requirements. Although the present range is limited to 500 bar and flows as high as 24 lpm, a very respectful performance range, the quality of the heavy duty Mine Boss machines we make and their low prices, bring us a consistent flow of requests for even bigger and sometimes more complicated systems.

A BRIGHT FUTURE

Working with the mining industry is a great privilege. We know we're working with the most important industry in the country and one that is the greatest contributor to our export income.

Many city people have never understood the importance of mining. At Aussie Pumps, we get it! In spite of those frightening headlines running in the papers, we know that the world's recovery from Covid, the war in the Ukraine, and the return to a normal supply and demand will provide stability, prosperity and opportunity. All Australians will benefit from the mining industry, including the 50 very motivated folk here at Australian Pump Industries in Sydney.

Got questions or comments? We'd love to hear them. Mood Ellahi. ***AMR***

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McLANAHAN ROTARY SCRUBBERS.



McLANAHAN HYDROSIZERS.



McLANAHAN ROTARY SCRUBBERS.

McLANAHAN

READY TO MEET CHANGING DEMANDS OF GLOBAL MINING SECTOR

The providers of mineral processing solutions are constantly being called upon to adapt to the changing demands of the mining sector, and that is even more so currently with a "boom" in battery metals exploration and development and a growing push for miners and service and equipment providers to meet ESG measures.

The Australian Mining Review recently caught up with Richard Williams, Director of Global Business Development at McLanahan, to obtain his expert insight into the changing dynamics of providing dewatering solutions.

AMR: McLanahan is well recognised as a leader in mineral processing solutions and provides a range of specialist equipment to the mining sector and I have been told there is growing demand for your Hydrosizers and Fine Material Screw Washer equipment.

RW: There is a growing interest in our ability to process a lot of fine clay particles associated with ore. We provide equipment to effectively wash that ore and separate out the fine clay from the useful ore and then manage the fine tailings in terms of dewatering so the ore can be suitably stacked or processed. The demand for Hydrosizers and Screw Washers is a response to effectively classify this fine material.

AMR: So McLanahan has an important role at the upstream end of ore processing?

RW: In certain scenarios we are suppliers at both the very front end in the ore preparation area and then also right at the tail end when dealing with the tailings. The early part of this process is separating the components, the latter part managing them.

AMR: I have heard that McLanahan has had a lot of recent success in supplying key equipment to a range of Australian miners.

RW: Yes, we have been quite successful in supplying rotary scrubbers for ore washing in the iron ore sector, classifiers and crushers in the precious metals and battery mineral sector and thickeners for managing tailings. We have recently completed a number of large projects across Australia, South America, Indonesia and even Mongolia.

The classification equipment ranges from physical separation on trommels and screens to hydraulic classifiers such as Hydrosizers™ and screw washers.

The McLanahan Hydrosizer™ has an efficiency of separation comparable to Sizing Screens but at a fraction of the footprint and cost. They are used when extremely sharp classification is needed to separate <5mm (4 mesh) granular material by size or specific gravity.

A producer who needs tight control over classification or who wishes to separate minerals of two different specific gravities or remove lightweight contaminants would be an ideal candidate for a Hydrosizer™.

Fine Material Screw Washers wash, classify and dewater -10mm solids material in one machine.

AMR: What commodity producers are McLanahan receiving increasing interest from currently?

RW: A global trend is a declining quality of ore be that iron ore, lithium, vanadium or nickel So, the miners are forced to increase beneficiation to improve the quality of the ore to the grade that is required for the downstream processes.

In Western Australia the industry is heavily influenced by the big iron ore producers and interestingly there is the global push into what they call "green steel". In producing green steel, the steel makers need generally higher quality iron ore.

Company shareholders and governments are all behind this drive and the demand is going to keep growing. McLanahan recognises that customers are all trying to squeeze more out of what they have to minimise their footprint, minimise their waste, and to get better utilisation of water or power, as all of those issues are of increasing importance.

AMR: Have you had to come up with something unique to meet these new demands, or is it something you're improving on?

RW: It is using proven techniques that are well known. We are constantly refining equipment for improved serviceability and improved lifetime. These incremental improvements in design for better operability are learnt from real-life experiences. The equipment is supported by our service agreements, service arrangements, staffed with our own experienced people with specific skills.

McLanahan is continually investing in more people and better facilities to provide better service for our customers to improve their uptime and efficiency.

These improvements allow the customer to be more efficient with well proven technologies.

AMR: Are there any new areas that you guys are working in?

RW: From a company-wide perspective, we've always been very strong in coal. With the increasing interest in battery minerals we are getting a lot of inquiries on how to apply our technologies to slightly modified process routes for things like lithium, vanadium, nickel or copper. The requirements are slightly different, but we have the proven technology and expertise to deal with it.

AMR: If you were to meet somebody new in a coffee shop, how would you describe why say, a lithium company, would want to use your services?

RW: McLanahan has been providing mineral processing equipment over a long period of time – the company has been around for over 185 years.

So, we are applying well-proven techniques that we have had a lot of experience with, that we know how they work, and we are supporting our customers with our local expertise and support.

We are cautious about using the word customise, but to a degree we are trying to create a fit around our knowledge and customer needs which add value for the end-user.

We are not a one size fits all company but in areas that match our skill set we look to create lasting relationships that deliver mutually beneficial long-term outcomes.

McLanahan has a strong reputation and expertise in the oxide crushing and washing space, in the provision of classification technologies, and in tailings management solutions. ***AMR***

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4 x 300mm mild steel pipe freezes on main-line to allow "T" junction for secondary chillers.

Save Time, Money And Valuable Water With Pipefreezing

Servicing all areas in Australia and New Zealand, Adelaide headquartered Pipefreezer is offering a specialist service that is providing major savings for mining companies in reducing costly downtime and improving water management.

The Australian Mining Review recently spoke to pipefreezing specialist Richard Griffin about what makes the company's services so valuable for companies with a pipe issue?
AMR: How would you talk a potential client into using pipe freezing?

RG: The main advantage of pipe freezing is that we can maintain a system's uptime and the client doesn't have to shut that critical pipeline down.

Essentially, if people need to work on a pipeline, for example they may need to do a weld on a pipeline, the only way other they can do that is to drain the pipeline down and get all the water out of it to do their work.

What we do is we freeze the contents of that pipe - and it can be oil, it can be diesel, it can be water, whatever - as long as it's got a hydrogen atom in it, we can freeze the pipeline and make a temporary block with a cryogenic ice plug.

The client can then cut open the pipe make their repair without having to drain the water, refill or purge the air from the system. This saves water and crucial down time.

For example, say it is a bore line that might be 100 kilometres long– you are talking about millions of litres of water which they will have to work out how they will deal with it. By freezing just a small section of the pipe we can keep all that water in the pipeline yet still achieve the job that they need to do.

AMR: How large is the area are you freezing?
RG: It depends on the size of the pipe, the larger the diameter, the longer the plug we develop.

However with pipefreezing it is essential that there is no flow or air in the pipe. In our job planning we work with the client to determine the best approach for their specific requirements.

AMR: What are some of the benefits your service is providing to mining companies?

RG: The key benefit is maintaining system uptime. By pipe freezing we only need to isolate the exact area where work has to be carried out. This allows the continued use of the wider system.

For example, I am about to undertake work at a major South Australia mine site. Our work is focused on the ring main that services the safety shower network.

There are only two pipes that are faulty so they only have to replace a small amount of pipe work on these two lines, By using pipefreezing. the other 50 odd showers on that line, are live and ready to use.

The other alternative would have required draining the entire system resulting in having the safety showers inoperable for whatever length of time it took, then to do the repairs and finally refill the lines to get the system back up and functioning.

Another example is a fire protection situation for a power station. That power station provides about 40% of South Australia's power and there was a requirement to replace a valve on a fire protection line. Now there are probably around 20 valves of that size in this plant, but there is no other way to isolate that particular section as the valve is the isolation point. If we didn't freeze that pipe they would have to drain that line down which we calculated was carrying close to 200,000 litres of water. If that line is shut down then there is no protection for the plant.

AMR: There must be a great deal of expertise and experience in operating a critical service like this. How long have you been doing this for?

RG: I've personally been involved for nearly 15 years and our technology partner in Sydney has been in the business for over 30 years now. We've successfully completed well over 300,000 pipe freezes between us.

We would be biggest dedicated pipe freezing group in Australia. .

We are also the only Pipefreezing company in Australia that has all the relevant ISO certifications, we are certified to ISO 9001:2015 / ISO 45001:2018 / ISO 14001:2015.

AMR: Finally, why would mining companies hire Pipefreezer?

RG: Mining is all about keeping the "beast" moving, any downtime or loss of production for a mine site is extremely costly, by utilising our services we either minimize this or ideally there is no downtime at all.

At the same time, water is a very big component of a mining operation and where we can also add value is with water conservation. The miners don't want to be dumping

100mm stainless steel freeze on bore line to allow valve change over.





300mm steel pipe valve changeover.

millions of litres of water in the desert or cart it away to another location. There are new water conservation guidelines coming through so this is going to become more and more important.

Our purpose at Pipefreezer is to provide a cost effective and environmentally friendly method of pipe isolation on projects requiring pipe modification, pipeline maintenance or pipe repairs.

We add value for our customers by understanding their needs. We deliver quality, technical innovation, and a responsive service.

By partnering with us on your fluid isolation project, we significantly minimise system downtime and consequently reduce the impact of any pipe repairs or pipeline maintenance. One of the key benefits we can bring to the table is allowing your plant and equipment to continue normal operations with minimal disruption.

Pipefreezer's passion is to provide a superior, value-add service to its clients in the mining, HVAC, plumbing, fire services and building management industries by offering cost-effective and first-rate solutions to costly and time consuming system drain downs.

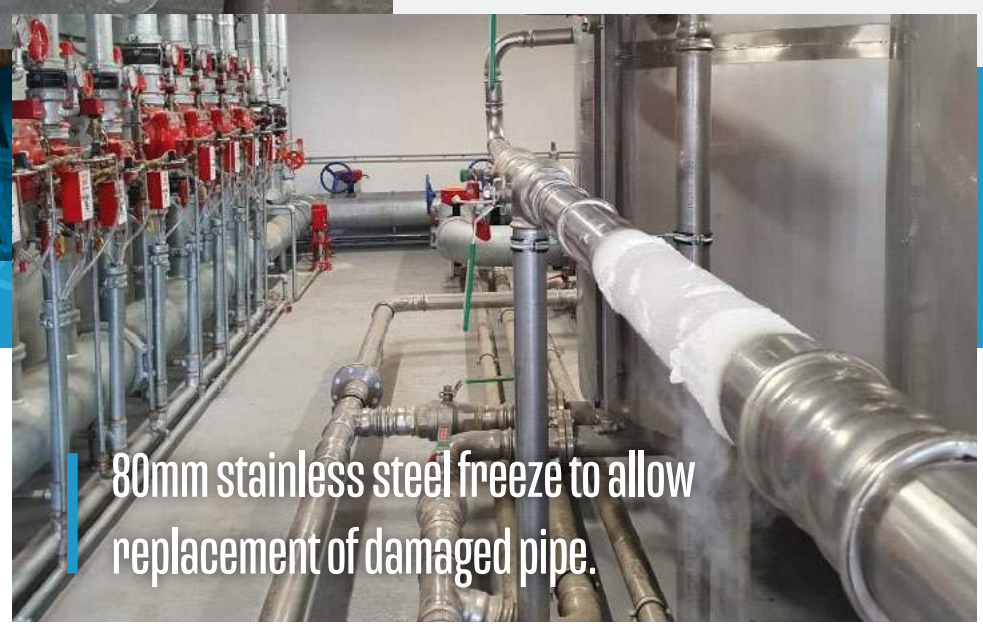
Our aim it so keep our impact on the environment at a minimum and we always put safety first in all of our practices.

Our processes and procedures are innovative, well planned and client focused – designed to create value through saving time and resources.

Why should they choose pipefreezing?

- It maximises system uptime
- There is absolute shutoff – no leaks
- Its cost effective
- It saves time
- Its environmentally friendly – there is no wastage of water, chemicals, glycol or other pipeline contents
- It provides isolation for leak detection
- We partner with you to tailor the best solution for your particular requirements

AMR



80mm stainless steel freeze to allow replacement of damaged pipe.

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PIPEFREEZER

Click to play video!

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Improving Safety & Efficiency With LOM Services Modelling

WATERLINE
CERTIFIED | EXPERIENCED | ENGINEERING

As an operational engineering company, Waterline has a major focus on allowing its clients to operate safely and maximise the production capabilities of their operations.

That was the clear tone we took out of our recent conversation with Louw Olivier, a Mechanical Engineering Team Lead at Waterline, who stressed the depth of measures the company undertakes to ensure the best results for a client's current and future operational planning.

"When we approach any project, we look at how Waterline as an operational engineering service provider, can support you in a way that enables you to operate safely while allowing you to supply sufficient services network demands to meet your operational requirements," Louw said.

"We like to ensure that thorough planning is undertaken in advance so that you don't run into barriers that lead to operational inefficiencies, while ensuring the network design is safe to operate during all potential scenarios."

"Our aim is for everyone to have the best possible chance of doing their job in an environment where the everyday operations are safe and follow a well-planned services installation strategy."

Louw, who brings to his current role vast experience as an operational engineer in Queensland coal mines, has an immense passion for delivering the right outcome, ensuring his clients are provided with a safe and practical solution.

This passion has helped Waterline take their modelling to the next level with developing "As-Built" models that are as close as possible to what is realistically happening on site so that the operator, and Waterline, can get a clear visual representation of the current state of the services network, and not a situation that is perhaps, just an originally-modelled design.

"We like to make sure the services modelling we produce is utilised for more than just an infrastructure planning exercise, building something that can be used proactively to identify production restrictions, safety limitations and requirements.

"There has been a mindset that once you have high-level scenarios on what is going to happen in the next five years, you can stop there. However, we all know mine plans are an ever-evolving thing, with operational requirements creating continuous change. As operational engineers we understand this. Therefore, with our services, we provide clients with the capability to understand the consequences of those ever-changing demands and provide clear and actionable plans to address the impacts.

"So, it is a very hands-on exercise. We identify any limitations within the services network layout and identify options to safely eliminate hazards, providing a pragmatic, compliant solution for our clients. We also support clients with incident investigations where service network infrastructure has potentially failed by modelling the affected services to assist in determining the root cause of a failure."

"We particularly like to build an As-Built model for the mine operator to own and to demonstrate that we don't just build services models and then sit on our hands with them. We make it an interactive tool for the site, the same way that an Electrical Engineering Manager would keep their power model up to date. We want to produce the same models for use on sites by the clients to manage themselves.

"To get accuracy for the models, we complete audits of the site services infrastructure. We physically walk the site and mark up every valve we can find, every PRV, or PSV station. We identify demands for compressed air systems, identify which venturis or air pumps are running, verify the expected consumption rates of these demand devices, obtain the flow curves for pumps and compressed air station supply levels and put the relevant detail into the site As-Built model. We will also sight available real-time monitoring, that is available on site within the services network installations.







“We can then go and compare the model to what we're experiencing in real life and calibrate the model to better simulate the physical characteristics of the services, so that it represents what the mine is experiencing to the best of its capabilities.”

Louw says Waterline can be brought in at any stage of a project, whether it is the pre-feasibility through to operational requirements.

“A comprehensive design of the Life of Mine services, at the start of any project, is of major benefit to the efficient and safe operation of all our clients’ operations. Being part of this phase has huge benefits to optimising infrastructure installation requirements, eliminating any hazards and optimising the network design."

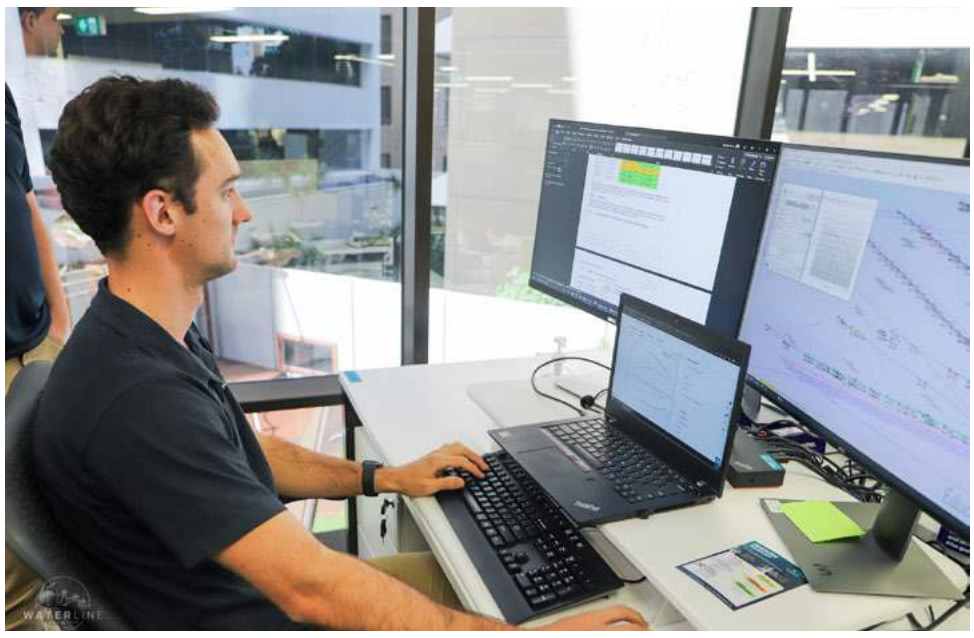
To support the ‘As-Built’ modelling and Project Planning phases, Waterline uses the latest in software tailored to services network design to assist with design and validation of a wide range of services networks.

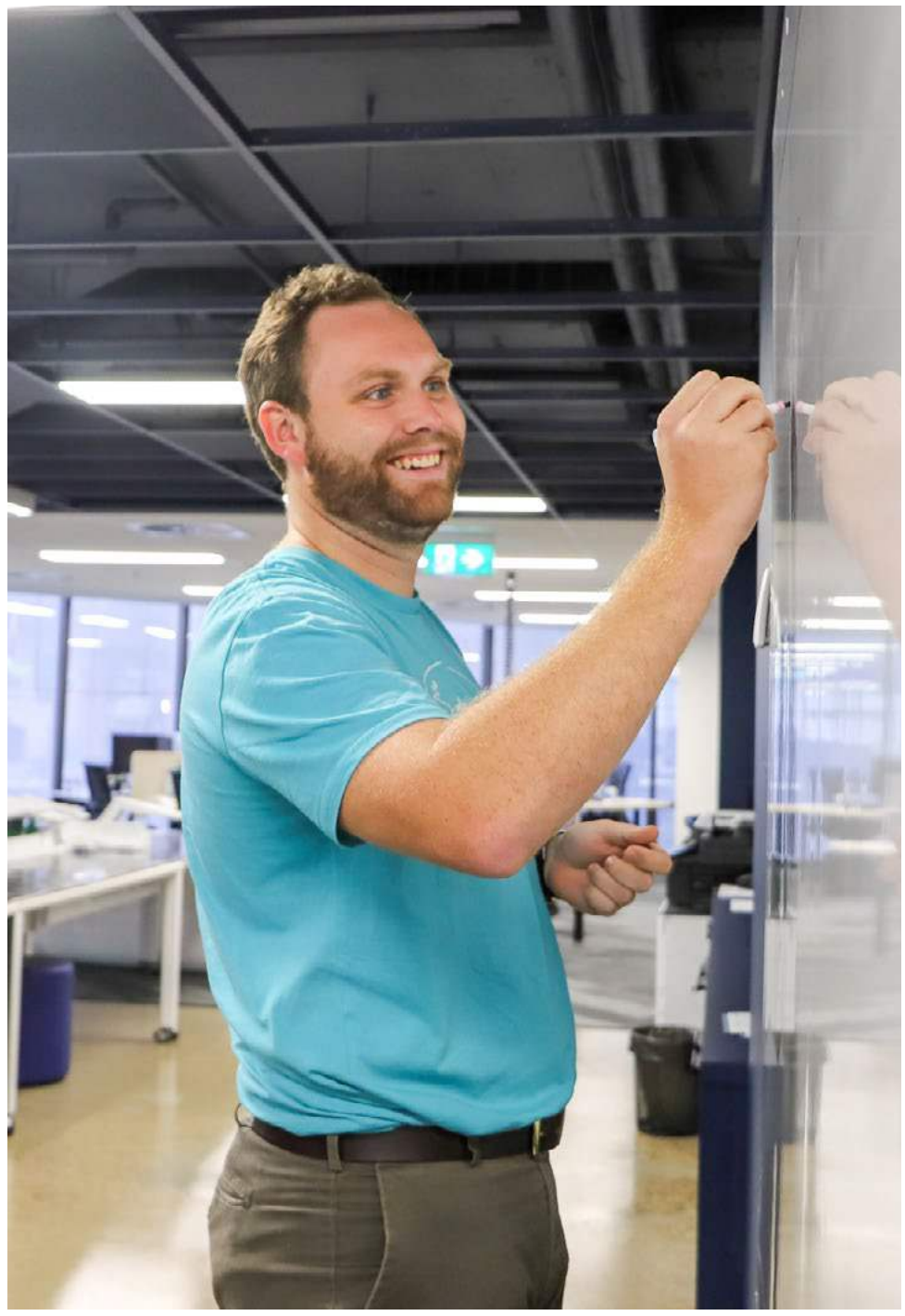
“There are a couple of packages available within the industry, but the one we choose to work with is called Pumpsim, as with all Waterline's designs and drawings, we believe the client owns their model and will provide the native as part of our deliverables.

“Pumpsim is widely used by our clients, has great functionally and interface, allowing information to be easily and visually displayed to improve understanding of the challenges being faced.

"A mine operator is well-placed to operate safely and productively when they are supported with a pragmatic operational strategy, backed by industry experienced Engineers like Waterline." ***AMR***

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AWARD WINNING ENVIRO SYSTEM GARNERING GLOBAL ATTENTION







A major award winner at the 2021 Australian Good Design Awards, Enviro Australis' unique broad spectrum pollution control system is now attracting attention internationally.

Refined over a dozen years, the innovative technology recently led to Enviro Australis being awarded a Social Impact accolade at the prestigious Australian Good Design Awards.

Recognised by the World Design Organisation (WDO) as Australia's peak international design endorsement programme, the Australian Good Design Awards represents the diverse spectrum of design with 11 design disciplines covering more than 30 categories and sub-categories.

In addition to the design disciplines represented in the Awards, the Good Design Award for Sustainability is awarded to a project that exemplifies excellence in design for sustainability practice and circular economy principles.

This standalone Award category has been established to inspire change and achieve a sustainable future through the application of good design principles.

Enviro Australis' unique system is now being closely studied by leading Mining, Energy, Government, and Universities for its ability to improve water and pollution management.

More recently, the company has won over Government and Industry Officials in India, with Enviro set to meet with delegates from that country in mid-May.

The Australian Mining Review recently caught up with Enviro Australis' Director and Engineer, Leo Crasti, the designer of this world first technology to gain further background on the company's award-winning system.

AMR: Can you tell us about the unique separation process Enviro has designed?

LC: We believe our technology is unique,







worldwide. We cannot find anyone else who does what we do in one integrated in-line device. Our Environmental Protection Systems remove a broad spectrum of pollutants which includes trash, litter, hydrocarbons, nutrients and particle bonded toxic chemicals.

We are proud to offer a system which also effectively separates oil from water to less than 5 parts per million, with added bulk spill protection of up to 20,000 litres, all in one device.

AMR: How would you best describe your device?

LC: Put simply, we offer a global stormwater solution created from a blank sheet approach. Followed by years of research and testing we launched the World's first Environmental Protection System (EPS). This supersedes the previously available and rudimentary catch baskets and GPT's. Next we added the oil/water separation function which creates a unique, totally integrated system.

AMR: How long have you been developing it?

LC: All told, I started development in 2009, so this is our 12th year.

AMR: All that hard work was acknowledged with the 2021 Good Design Award, must have been a real game-changer for your company?

LC: Yes, and it is still a very big focus for us. The Good Design Award recognition in 2021 has increased our recognition and standing within the Industry. It remains a pretty big deal as the Industry continues to recognise the importance of Global Water Sustainability.

What is notable on the Good Design Award certificate is the prestige of this award. It is an award of global significance, with a global standing as a seal of excellence.

AMR: Have you noticed an increased interest in your product since you won that award?

LC: Most definitely. It has done a great deal for elevating our presence and understanding in the global marketplace. Understanding the highly technical nature of what we do, it's nice to have the acknowledgement of those instrumental in the development of new and sustainable technologies.

We have been through due diligence now with the big end of town, major international Engineering firms like KBR who employ 5,000 Engineers. BP and Brisbane City Council have both conducted due diligence on our technology and more recently, sustainability. Our systems have been peer reviewed by various Universities with Uni of South Australia also undertaking testing. Whoever has undertaken a genuine due diligence on us has invariably commented that "well guys, what you've achieved is fantastic".

I guess the big thing for us as well is that we are now on a steep trajectory with substantial growing interest from the local and international markets.

AMR: I believe you have also received new international interest?

LC: We have established a joint venture subsidiary in India called Enviro Global Water India. There has been a great deal of interest in our system in that country, with our system being recognised by the Environmental Ministry. We have had great support from Austrade and our Consul General in promoting us to the India Government, the Central Government, all the way up to the Prime Minister.

We are now preparing to sign official agreements between Enviro and the State of Tamil Nadu, based out of Chennai for technology exchange, with our water technology being introduced into India. We are looking forward to meeting the Tamil Nadu Minister when he visits Australia shortly.

AMR: What makes your system so unique and now an award winner?

LC: It's a unique separation process. It's not a filter, it's not media. I developed a process whereby the contaminants are split out of the water stream and moved into a quiescent zone. In the state of quiescence there is no churning. We have replicated what happens in nature.

The problem with stormwater runoff is that its unpredictable as to when it's going to happen, how much is going to happen, how hard it's going to happen, and what's in it. And if you just run the stormwater through a filter basket or a mesh screen it will instantly block up. That's what everyone else has tried to do. There has been a margin of success in that, however the effectiveness is very limited. Whereas we are reliably removing particles down to 20 microns.

AMR: What makes your service critical to the resources sector?

LC: I think it's the fact that environmental compliance is fundamental to whether a mining operation exists or not. What we offer is an Environmental Protection System that ensures water discharged from a mining operation is compliant with the Environmental Protection Acts that prevail in different jurisdictions.

AMR: Enviro Australis has developed solutions to save the world's rivers and oceans from environmental collapse. This is caused by the transport of pollutants by stormwater runoff from hard surfaces associated with urban development, roads and other infrastructure.

The company's systems are being applied to various catchment types ranging from residential, commercial to industrial and high impact activities such as the Oil Industry and Mining. Enviro's world first technology restores this water to an environmentally sustainable condition and also safe for reuse.

The patented technology allows Engineers to design stormwater infrastructure to comply with Environmental Legislation Reduction Targets whilst also being low cost to install and maintain. These solutions have been embraced by many such as Australian Naval Industries (ANI) and BP Australia.

Sustainable materials are used in manufacture offering a long service life, potentially 100+ years. These are recyclable indefinitely and have the lowest carbon footprint impact possible, and potentially net zero.

Contact Enviro Australis to find out more about this award-winning technology. ***AMR***

ENVIRO

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YOUR PARTNER FOR ENVIRONMENTAL SOLUTIONS











ONTOTO – INNOVATIVE, AGILE AND CUSTOMER FOCUSED. A MESSAGE FROM TIM BLAKE

The pandemic has made it incredibly difficult to get parts, which affects production. Just look at the car industry ... up to 12 months wait for a new car! When dealing with environmental monitoring, you can't afford to wait 12 months for a device – in that time irreversible damage could take place. Since we are the designers and manufacturers of all our devices, we have managed to keep our production going and get the stock out the door. Flexibility and agility to redesign and produce in an incredibly short timeframe gives our clients the ability to meet their regulatory commitments. We listen to our clients, closely observe how our devices are used, and respond to that feedback to ensure we are always providing the latest technologies available in the best designed product we can. Ontoto, from the get-go, has done it our way. We've taken the time to observe what our clients do best, and we've given them the tools to do that better. We are a concise, honest, and transparent organisation and we instil that heritage in our devices.

Australia's $202 billion mining industry is heavily regulated, and it can be expensive and complicated to remain compliant.

Operators have a lot of data they need to monitor, analyse and store, but it has been traditionally difficult to collect this information in a user-friendly way.

In 2015, Australian IT expert Tim Blake noticed the Australian market was lacking true remote telemetry devices that could automatically record and transmit data from inaccessible locations to another system.

So he established Ontoto – a company making regulatory compliance simpler and more cost-effective with expertly designed data loggers.

"Ontoto was established to take care of compliance," the Ontoto Managing Director said.

"Each data logger we build has the capacity to log data for the life of the device and communicate to the cloud.

"In my experience, regulatory compliance is greatest when there is a simple and cost-effective solution.

"That's where Ontoto comes in.

"We have specifically designed our loggers to be a self-installed product that sends





THE CLIENT EXPERIENCE

Ontoto's products are designed to be self-installed. Clients receive an installation video to support them, but trained technicians can attend on-site for more complex jobs. Configuration is completed via the Ontoto Connect App and the company's tech support team are always on hand to check everything has gone smoothly during installation. The app logs immediately show whether installation has been done correctly and whether sensors are operational. Back at their desk, operators can configure their device via the web portal to make changes as required without having to visit the site. All changes are auditable.





data directly to your desktop, and is easily reviewed, downloadable, auditable and can be monitored and configured remotely.

"Since most of the mineral resources sector is located in remote areas with limited coverage, our solutions - which utilise NB-IoT and satellite connectivity - mean operators can manage data from any location worldwide."

WATCHING THE WATER

The data loggers have been particularly popular among mining operators looking to monitor impact to groundwater.

Ontoto data loggers gather rich and accurate information on a site's groundwater before an operation, which is sent to a cloud-based database where it can be used to model risk.

During an operation, the loggers continue to provide constant monitoring and have the ability to respond to changes quickly without requiring site visits.

Aside from reliable data collection, the Ontoto data loggers also provide significant financial advantages.

For example, a site with 10 locations for monitoring groundwater has been proven to be more cost-effective using the Ontoto Astro Satellite Data Logger rather than manually reading each site.

The Astro Satellite Data logger has a maintenance free guarantee for a decade, a fixed operating cost and does not need to be regularly visited, meaning cost over a 10-year period is likely to be $46,700, compared to a manual estimate of $118,000.

Mr Blake said these kinds of substantial savings were also apparent across their products for tailings dams, which he said addressed longstanding issues.

He said mining operators typically had to deal with maintenance, overflowing or seepage into surrounding waterways and groundwater, as well as spillage from unusual amounts of rainfall. .

"Again, monitoring is key," Mr Blake said.

"Just like a conventional dam, monitoring of the levels is important, because if levels rise, there is a threat of spilling the tailings into the surrounding environment and waterways.

"If the levels are decreasing, there is a leak and the tailings are seeping into the underground surroundings and groundwater.

"Ontoto's loggers can be set with alarms so when levels move in the wrong direction, notifications are sent as soon as it is noticed to allow mitigation to commence as quickly as possible.

"Typically, the cost of a monitoring site with Ontoto is comparable with the initial installation costs of a non-telemetered site in the current market.

"Our system is designed to run for 10 years maintenance free at a fixed operational cost of monthly data charge.

"Once again, this compares favourably with manual downloading of data, travelling to and from site, pre and post processing of data and of course data integrity and auditability."

THE ONTOTO WAY

Apart from an ever-growing range of sensors, Ontoto offers a full cloud-based suite of tools, which include data forwarding to SCADA and common third-party vendors.

The technology services provider offers device management portals for high level users, on-site and off-site tech support and a local field support management portal.

As well as groundwater monitoring with level and vibrating wire sensors, Ontoto provides pulse loggers for water metering and tipping rain gauges, as well as environmental monitoring units, which record weather parameters including dust.

The majority of Ontoto loggers are designed to retrofit into current assets, allowing operators to maintain and extend the life of their infrastructure.

Though the Australian company's focus was to create strong, user-friendly monitoring products, Mr Blake said it fit into a larger mission to support the environment.

According to Mr Blake, Ontoto was a small company formed by a vision to leave a legacy of change for the good.

"We identified a deficiency in compliance, not because people were opting out but because it was difficult to do and costly," Mr Blake said.

"We've developed tools to enable people to achieve the compliance easily and at a very affordable cost and at the end of the day that makes us all winners in protecting our environment.

"Everything and everyone are dependent on the health of our environment and of course, clean water and abundance of natural resources is vital.

"At Ontoto we have designed our solutions to be so simple to use that there is no excuse to not protect our environment.

"I would like to thank our clients in the mining industry for supporting us." ***AMR***

For more information, visit www.ontoto.com

THERE IS NOTHING BETTER THAN NOBLE SERVICE



Noble Engineering Services Pty Ltd has been working and supporting the mining industry for over 25 years through its Condition Monitoring, Non-Destructive Testing, Mechanical Engineering and Metallurgical services.

During that time the Noble team has grown from one, to now exceed 50 people with the expertise to protect a client's vital equipment.

The company's full suite of capabilities means it can quickly find the fault, provide the customer with the tools to manage or monitor the fault, identify the root cause, and then help implement a solution to prevent recurrence.

Noble's clients range from small fabrication shops or specialist investigators seeking assistance, single site mines, multi-national OEM Equipment manufacturers and global energy giants.

Professional Engineering Services
Professional Engineering is the origin of Nobles. At the heart of any good design is an understanding of the application and customer requirements with regards to capacity, reliability, and maintainability. The engineering services team is ably supported by the departments focussed on Condition Monitoring, Non-Destructive Testing, and Failure Analysis.

Remote Monitoring
Noble Engineering's flexibility has been highlighted in recent years with the company moving quickly to meet the changing, COVID world, significantly expanding its remote monitoring services.

Recent improvements in technology allows Noble to monitor equipment remotely wherever there is mobile phone reception, or Wifi. It is nearly as good as them being there.

The Remote Monitoring service is particularly attractive to clients in remote locations, or distant from the Noble Engineering team. The efficiencies created by eliminating travel make this high-level service available in ways where it was once cost prohibitive.

Vibration Analysis
Noble uses Vibration Analysis (VA) in various environments on site to effectively reduce maintenance costs and equipment downtime by detecting equipment and component faults for better machine management. VA is a key component of a Condition Monitoring (CM) programme and is often referred to as Predictive Maintenance (PdM). All of the company's consultants are qualified with either Cat II, Cat III or Cat IV through the Vibration Institute.

Airborne Ultrasonics
Noble Engineering Services uses Airborne Ultrasonics to hear what you cannot see.

Ultrasound detectors sense high-frequency signals and convert them into corresponding audible sounds while maintaining their original characteristics and qualities. The company's consultants use Airborne Ultrasonics for internal hydraulic leakage, air/gas leaks and electrical discharge detection.

Motion Amplification
Greater Understanding of Vibration

Motion Amplification is a revolutionary video-processing product and software package that detects subtle motion and amplifies that motion to a level visible with the naked eye. Every pixel becomes a vibration sensor creating millions of data points in an instant.

Noble Engineering Services has applied this technology to show structural defects, looseness, and resonance in any asset that the camera can see. The visual representation helps present technical issues in a more easily understood fashion.

Thermography
Thermal Imagery\Infrared Thermography (IRT), Thermal Imaging, and Thermal Video are examples of infrared imaging science. Thermographic cameras are ideal for understanding the surface temperature of any visible machine component.

Noble Engineering Services uses this technique to identify localised heating due to rubbing, ineffective cooling, misalignment, overloading and poor lubrication transfer which can lead to fires or equipment failure.

Non-Destructive Testing
Noble Engineering Services offers the best methods for evaluating materials and components for discontinuities. All consultants are AINDT qualified, familiar with industrial equipment, and understand your timeline for prompt reporting. Further to NDT capabilities, Noble also has a Metallurgical Laboratory and portable analysis equipment to provide full Failure Analysis and Positive Material Identification (PMI) services. Their experienced metallurgists have 'worked on both sides of the fence' and understand the motives of site Engineers and Production Managers.

Oil Analysis
Oil analysis (OA) is the laboratory analysis of a lubricant's properties, suspended contaminants, and wear debris. Collecting samples is always last on a shift fitter's list and is sometimes overlooked. Noble Engineering Services provides competent technicians to deliver reliable, repeatable sampling to show the condition of your asset. We deliver immediate visual assessment and use recognised laboratories to assess the samples against the criteria you require.

All of the above can combine to ensure your equipment has maximum availability.

CASE STUDY ONE

Incorrect Fitting Caused Bearing Failure

Costly downtime from catastrophic failure was avoided when a conveyor drive pulley bearing mounting sleeve came loose and was found by NES on a routine condition monitoring survey.

Situation: During a routine condition monitoring survey of the conveyor drive components and pulleys the NES Consultant noted an increase in the vibration levels and harmonics indicating looseness around the drive pulley. On closer inspection they noted unusual and significant movement of the whole drive assembly which was supported by the pulley shaft at one end and a torque arm anchor at the other end. The movement of the drive assembly was in time with the rotation of the pulley shaft indicating problems in the drive-side bearing.

Recommendation: The NES Consultant recommended site replace the drive assembly and pulley and conduct an investigation to find the causes of the movement found.

Response: Site staff arranged for the drive assembly and pulley to be replaced in a maintenance window and the new drive equipment reduced the vibration level and movement considerably. A new set of readings were collected as a baseline for the new drive set.

Follow-up: The inspection of the removed drive assembly and pulley found the drive side pulley bearing sleeve had come loose and was rotating on the pulley shaft causing serious wear and generating large amounts of fine metal particles. The sleeve had broken and had damaged the shaft beyond repair. A bearing sleeve can only come loose when the correct mounting procedure is not followed at installation as the design of the mounting system has features that prevent the tightening/retaining nut coming loose.

Wrap-up: Early detection of the damaged bearing and sleeve prevented the damage causing serious consequential impact to adjacent equipment and stopping the conveyor for an extended period. The conveyor in this situation was a feed conveyor for a coal preparation plant and its unavailability would have impacted the output of the plant and reduced the amount of coal available to deliver to the port for shipment.

Future failures of this type can be avoided with measures put in place to ensure that repair workshops use bearing manufacturer installation guidelines to fit all rolling element bearings used. In this case final bearing clearances were provided which ensured the well lubricated bearing could roll correctly and be securely mounted on the shaft for the full life of the in-service pulley.

CASE STUDY TWO

24 hour Longwall Breakdown Avoided

An unplanned and costly 24 hour mine longwall breakdown was avoided when Noble recommended replacement of a Beam Stage Loader gearbox due to a serious looseness detected.

Situation: Routine monthly monitoring of the longwall equipment by NES Consultants detected a developing fault within the Beam Stage Loader (BSL) gearbox that would stop the longwall cutting coal for at least 24 hours had the site not known about it and taken timely action. NES staff were able to identify the location of the damage and the severity which gave site engineers the information they needed to make the big decision to change the gearbox in the middle of a longwall block.

Recommendations: NES recommended replacement and repair of the BSL gearbox and close monitoring until the planned change could take place in case there were unexpected changes in condition that could have resulted in a breakdown.

Response: The site was able to safely and effectively plan and carry out the replacement of the gearbox saving considerable downtime and likely consequential damage to other parts of the drive system.

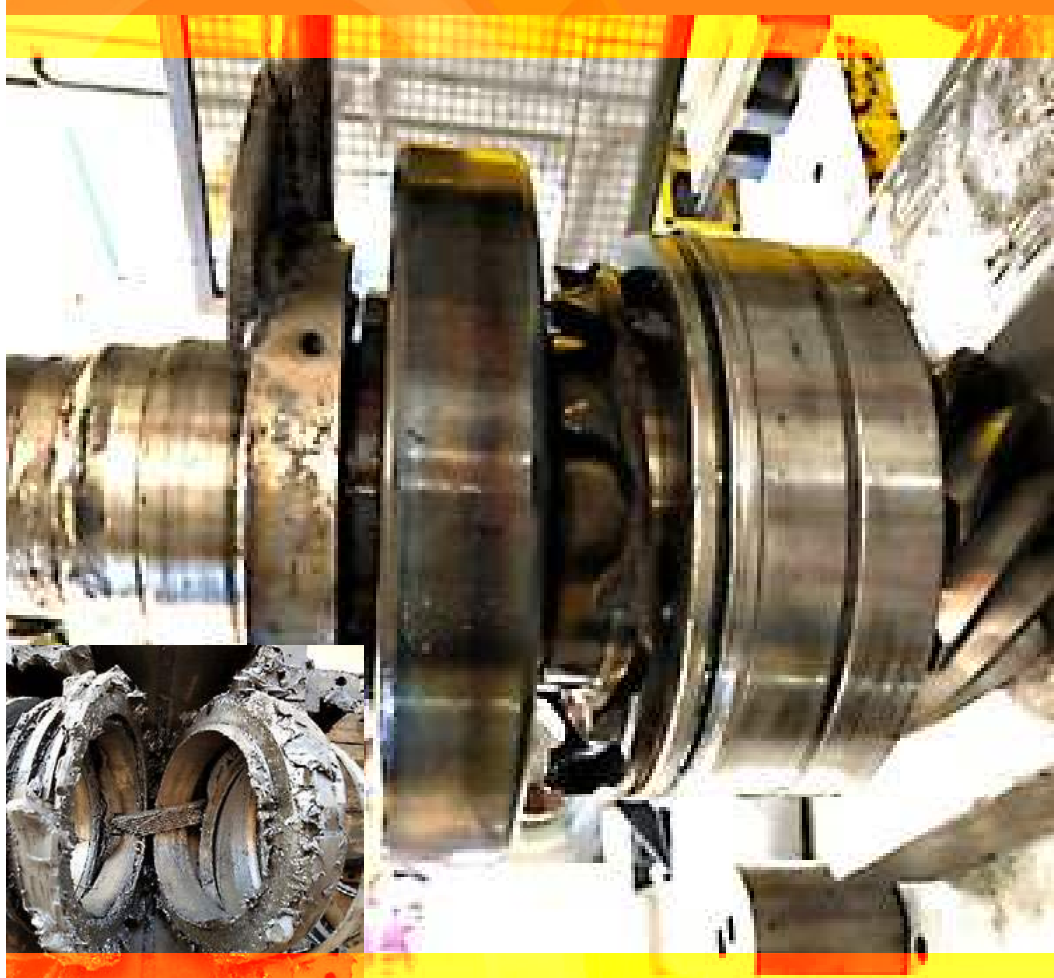
Follow-up: After the damaged gearbox was sent to the repairer, the strip-down showed failure of one of the input shaft bearings. This was due to a loose retaining shaft nut which had loosened over time to allow the split bearing to separate which then allowed the shaft to move axially. Investigation of the causes of the initial problem enabled effective and targeted actions by site engineers and managers to ensure such problems do not occur in the future.

Wrap-up: Such failures are not common but early detection by our experienced Consultants avoided the significant downtime that this type of failure will cause to a mine operation. Spare gearboxes are not kept on site and need to be found and transported to the site from repair facilities which are generally a considerable distance from the site. Early warning and close monitoring of the problem enabled the mine to locate a replacement gearbox, have it delivered to the site, transport it underground to the longwall section and then have people and equipment ready for the planned change. ***AMR***

noble ENGINEERING SERVICES

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RIV02 completed prism monitoring pillar with 300W solar power kit (housing 2x100 amp/hr Victron AGM 12V batteries and 300W hail resistant solar panel).

SLOPE STABILITY MATTERS:
Mine Site Safety At OBM's Riverina Pit

Article contributed by:
Joel Hedges
Chief Mine Surveyor
Ora Banda Mining Limited

In multiple open pit operations, the risks associated with slope stability range from small, isolated rockfall events through to large scale wall failures.

Large scale events can destroy an entire mining operation, potentially bury critical infrastructure, plant, machinery, access roads, the orebody and in the worst case cause the loss of human lives.

An example is the Brudaminho tailings dam failure in 2019, which released around 12 million cubic litres of tailings, claiming 270 lives and destroying the local environment.

A total of 24% or US$19b was wiped off Vale S.A.'s stock price in a single day and the economic reverberations were felt throughout the whole world, impacting global iron ore prices and changing the mining industry's legal and insurance landscape.

Assessing Slope Monitoring Technologies
There are a range of slope monitoring technologies currently available to mining companies, each with a unique set of strengths and weaknesses.

Commonly used ones include Radar, Lidar, InSar, GNSS, Inclinometers, Extensometers, Piezometers, Meteo-sensors and Electronic Distance Measurer (E.D.M.) Prism Monitoring.

They are selected based on a number of factors that determine the best fit for controlling the risk types that personnel may be exposed to.

The Ora Banda Mining (ASX: OBM) survey department assessed several common types of displacement monitoring techniques including radar, GPS levelling and photogrammetric surveys to determine what systems would be best suited to the current pit design, the environmental conditions present in the locality, and the pits life of mine in the strategic plan.

The selected monitoring system had to accommodate a process to allow trigger, action, response standards and check survey measurements to be observed and reported to management for action. This system had to be capable of verifying pit wall stability, monitor effectively and continuously, as well as provide adequate notification to prevent unexpectant wall failures occurring that could endanger mine employees.

The system had to also give personnel such as the principal employer, or registered manager, the opportunity to inspect the mine pit wall or berms, then correlate that data to be used in conjunction with the analysis from the survey prism monitoring information, for further risk assessment.

A ground control management plan (G.C.M.P.) was then required to outline strategies and engineering mining controls to minimise risk of ground movement based on the Geotechnical assessment.

Following this, OBM formulated a trigger-action-response plan (T.A.R.P.) to monitor and manage pit wall stability.

This plan included continuous pit wall monitoring where progressive wall failures were present as well as maintained regulatory requirements outlined with the Department of Minerals and Energy Guidelines (in WA).

OBM Chooses EDM Prism And Continual Automatic Monitoring
After a thorough review, OBM decided on and selected a E.D.M. Prism Monitoring System.

This setup allowed for three autonomous monitoring stations to be mounted on existing pillars located around the pits highwall perimeter.

The system integrates the best-in-class Leica TM60 robotic total station, controlled remotely using Leica GeoMoS Monitor software to drive the total station.

The Leica TM60 was specifically made for monitoring, with its robust, weather resistant design and IP65 rating.

The durable piezo drives ensure unrivalled longevity, speed and performance, while the long-range ATR ensures that monitoring prisms can be tracked and measured at distances of up to 3000 metres with high precision.

Angular precision of the ATR is specified at 0.5" seconds and the E.D.M. (electronic distance measurement) is accurate to 0.6mm +/- 1mm per kilometre.

Put simply, it is the most precise long range total station ever made.

Specific risks areas in the pit, such as existing failure zones and other potential areas of instability identified through consultant geotechnical mapping and risk modelling of the pit wall and crests, where complied into a risk report.

This report was then supplied to contract abseilers who specialise in pit prism installation in generally inaccessible areas of the mine.

These prism monitoring points comprise of a 64mm prism designed to 5 seconds of angular accuracy that is housed in a UV resistant cannister suitable for long term outdoor all weather monitoring.

The prism housing mounts to rock friction bolts drilled in the pits highwall.

Berm prism were also installed comprising of "L" bar type prisms attached to 600mm star irons pickets driven into the berm crest.

E.D.M. prism monitoring systems can also be used to collect survey or geotechnical data by manual means for slow moving or low risk environments.

Continual or automatic monitoring (robotically) using "real-time" or "near real time" data acquisition systems and technology are more appropriate for higher risk environments, for example where miners may be actively working close to pit walls, which are designed to be as steep as possible to maximise efficiency, but without compromising human or environmental assets.

The system OBM survey decided to use was continual automatic monitoring.

The system selection criteria included reliability, durability, how well they were supported, how well they integrated with other monitoring technologies and, of course, fitting within the allocated budget.

As a result, Pangea Geosystems were selected to provide the monitoring instrumentation and technical support for OBM.

Prism Monitoring For Ground Movement
Prism monitoring remains the most widely used method/system for monitoring open pit mine walls in Australia and around the world.

This is largely because prism monitoring systems are versatile, scalable and are regarded as being reliable and durable with lower ongoing costs and maintenance in comparison to other monitoring technology.

A manual prism monitoring campaign is often implemented in the early stages of the pit before it is deep enough to represent any real risk.

The purpose of this early data is to establish a baseline for "normal" ground movement so that movement that occurs later in the project can be better analysed for risk by geotechnical engineers.



RIV03 monitoring pillar overlooking on western wall of Riverina Pit.



Leica TM60 1" R1000 total station continuously measuring to wall monitoring prisms.



IP65 communications box with Moxa NPort Serial Server, 20 amp MPPT Victron Smart Solar regulator and Ubiquiti Nano Station.



Riverina Pit GNNS base station pillar next to RIV01 monitoring pillar prior to mini shelter installation.



Survey office and storage shed with monitoring base communication tower (WiFi data radio link).

RIV02 monitoring pillar overlooking on eastern wall of Riverina Pit

Manual prism monitoring is best performed by surveyors using software installed on the robotic total station, such as Leica's "sets of angles" software which runs a measurement routine that uses the instruments Automatic Target Recognition (A.T.R.) to search for prisms in pre-identified or learned prism positions before homing in to measure right down to sub-millimetre precision, depending largely on the number of measurements taken and/or averaged, the distance or range of the measurement and the method of atmospheric correction.

The surveyor would complete pit monitoring quite simply by placing the total station on the established survey control pillar, set the azimuth/horizontal angle, then run the on-board software.

This frees up time to complete other duties and return to the total station later to collect the recorded data after sufficient time to measure all prisms in the round.

The data collected is uploaded into Pangea Geosystems "Quikslope" prism monitoring software.

The uploaded raw data (angles and distances) can be vetted for quality by the surveyor, then calculated and stored as XYZ coordinates within the Quikslope database.

Analysis of this data over time allows users to see the movement in the ground that the prisms are fixed to, in all three dimensions so that the dip direction can be determined showing changes in the direction as well as acceleration of movement over time.

OBM is able to increase or decrease the frequency of this process as required to maintain appropriate control over the risks if they are not deemed to be significant enough to warrant a more automated "real time" monitoring system.

Economic And Process Benefits Of Automatic Monitoring Systems

Given the skill shortages in the Australian mining industry and relatively high wages of personnel, the economic benefits of automating the prism monitoring process alone were quickly realised.

The transition at OBM from manual pit monitoring to automated monitoring basically freed the services of one full time surveyor previously employed to manually observe prism observations three times a day at two pits

OBM Survey made the decision to purchase two automated prism monitoring systems for the open pits at Riverina and Missouri Operations.

24/7 Automation also allows alerts if prism movements exceed any of the thresholds configured in the control software.

These alerts have been designed at OBM to be delivered using email, and SMS, however we have the option of installing connected devices with flashing lights and audible tone within an office environment or in and around the pit.

This alarm system can be automatically triggered by wall movement and is powered by solar and connected wirelessly to the monitoring system.

The precision of the instrument measurement is also significantly improved by automating the prism monitoring because real time integration with weather stations and other methods of atmospheric correction can be applied as conditions change.

Furthermore, the total station is not being taken on and off the control pillar every time there is a new round of measurements, so there is less "play" in the control.

OBM is, after all, looking for only millimetres of movement in most cases.

Mobility, Interconnectivity And Communication Reliability

The Leica GeoMoS Monitor software typically runs on a computer located in a site office that is relatively nearby the total stations that are positioned around the crest of the pit using line of sight wireless communications, with a point-to-point range of up to 30 kilometres.

This method of communication is often chosen because it is robust and reliable with low levels of latency and can be supported by communications and IT personnel on site.

Other means of communication can include direct cable connection or LTE (mobile data network) depending on the existing infrastructure.

However, these are often less viable in remote locations or where LTE bandwidth may be intermittent or insufficient.

Using robust and versatile hardware to house and protect the electronics componentry which is comprised mostly of solar power and communications related equipment, the system is durable, easily installed and can be relocated from one pit to another with relative ease.

The mobility of these units was another critical factor in the system selection, which allowed survey to simply unbolt and move via light vehicle to the next operating pit should it be required.

Completing the OBM monitoring system is the analytics software developed by Pangea Geosystems, known as Quikslope, which was designed specifically for open pit mining operations to simplify and enhance the workflow for surveyors and geotechnical engineers alike.

A Windows "service" called Pangea Autosync runs in the background transferring data from the Leica GeoMoS database into the Quikslope6 database, which is structured to provide additional analytical tools with superior performance.

Quikslope can be used to show the data graphically with a range of different charts.

Report data can be exported easily in CSV format and there is a CAD module that enables users to plot prisms and display movements using colours, directional arrows, and other methods of displaying movement visually.

The unique data shaping features allow falsely perceived steps in the data to be easily removed with the click of a button, so that real movement can easily be separated from falsely induced or perceived movement that can occur for reasons like survey control changes/updates, mine cutbacks or simply bumping or moving a prism in the field accidentally.

This way the trend in movement remains intact so that any deformation remains clearly visible.

Quikslope can be integrated with other deformation monitoring systems and technologies – GNSS, meteo sensors, extensometers, inclinometers, crack meters, piezometers and other geosensors.

In the future the software is being developed to work on Radar, Lidar and Satellite/InSar data integration. ***AMR***



The Australian Mining Review recently caught up with *Daniel Lewis, the Digitisation Manager* at Applus+, for insight into Reality Capture and it's uses in Condition Monitoring.

AMR: What is Reality Capture?

DL: Reality capture is the process of capturing the physical world into a digital environment. An example is when a client has many remote assets and they want to make them as photorealistic as possible.

AMR: What are the top reasons for using reality capture?

DL: Reality capture, or Digital Twin, is used for capturing and recreating a real-world asset in a digital environment, and using it for functions such as inspection, condition monitoring and assessment, engineering or consultancy. This allows the work to be completed remotely.

AMR: What are the cost benefits of using a 3D model for condition monitoring and assessments?

DL: There's the safety element of removing unnecessary personnel from site. Applus+' capture team are generally quite small. Also of benefit is how fast it is to capture. It's significantly quicker than conventional methods such as scaffolding, rope access or elevated work platforms. Where Applus+ have a lot of strengths is with the unmanned based capture using unmanned aerial and marine vehicles, we're able to capture the assets in a fraction of the time it takes to carry out a conventional assessment. All of this reduces overall cost, including removing the need for return visits to a site, significantly reducing travel costs. By capturing an asset we can then carry out a condition based assessment, marking up areas as required.

Our clients can view those same areas without needing to go to site.

AMR: How have Applus+' clients benefited from using 3D models? Can you give an example?

DL: An example is the reduction for multiple site visits. The client can see the results in the same environment that they've been captured in, enabling a richer understanding of what the issues are, compared to the conventional method of sharing photos and trying to explain them. Now the client can virtually see the asset and see that anomaly information themselves on the asset without needing to travel to the site. We can also use the data for reverse engineering into CAD to perform structural assessments.

AMR: How does the reality capture benefit condition monitoring?

DL: Some assets we may not be able to get access to for sustained periods of time, such as when processes are running or there are access restrictions, for example a wharf, chimney stack, pressure vessel or road bridge. By capturing the information and then reviewing it remotely we save on the costs of taking that asset offline. That time can be used for any remediation instead.

AMR: Is Reality Capture hard to use and interpret?

DL: No, they're very easy to interpret and control with a bit of practice. It's controlled by dragging and dropping with the mouse.

A benefit of using it for the condition assessments is that you can move up and down an asset, instantly. There's no need to climb around that asset or gain access to certain hard to reach locations. By moving and orbiting around the virtual asset, you can bring yourself to those locations as required.

AMR: Can you compare models of an asset taken at different times?

DL: Yes, you can do a side by side comparison to look at historic changes. There's overlay functionality currently in development. You can assess how rapidly degradation or deterioration of an asset is occurring.

AMR: Will the system automatically highlight any differences between the side by side comparison?

DL: Not currently. It's something on the road map but there are some challenges.

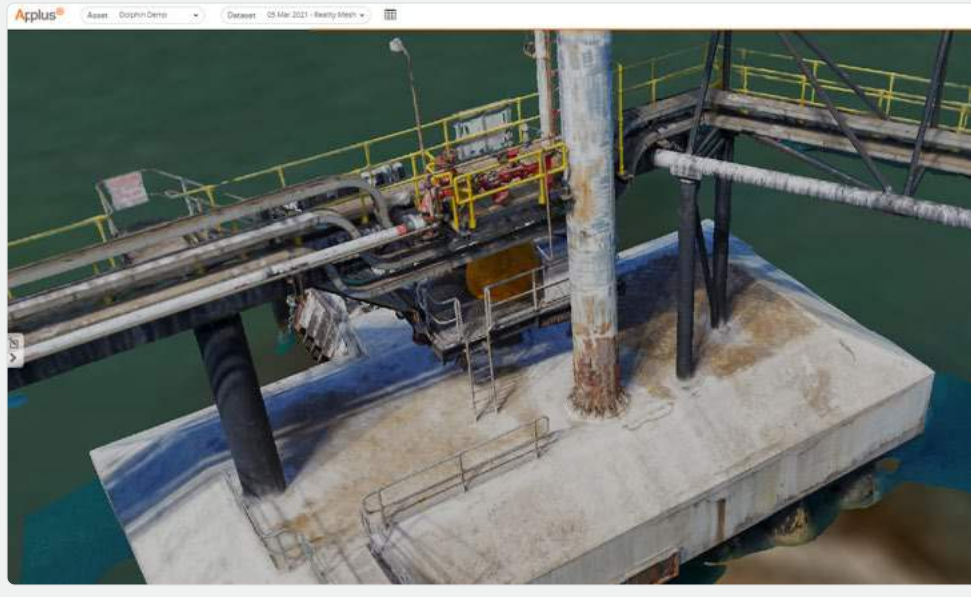
It's about partnering with our clients, tailoring their computer vision models for the their specific assets that we are inspecting.

AMR: Is there an easy way to measure how long it takes to capture a particular asset and what kind of issues might arise if you're trying to capture too quickly? How will that reflect in the model?

DL: That is where our engineering and integrity knowledge at Applus+ comes in. Applus+ consult with clients when they are not able to provide a detailed or defined work scope. We work with them to find the most optimal way to capture an asset. The asset capture is then based on the resolution requirements for that capture.

If we capture an asset at a high resolution, we need to take a larger number of photographs. If we capture it a lower resolution, a lower number of photographs, which correlates proportionally to the speed that we can capture. We can also create multi resolution models.

We identify high risk locations on an asset





Applus+ Providing Clients With A Digital Twin Advantage



and have our pilots really focus in on those areas with a variety of powerful inspection payloads to complement the reality models.

AMR: How is the data stored and accessed? Is the client in control of the access to the to the data or is that through Applus+?

DL: Two of the most important things in digitalisation are data security and data ownership. Applus+ utilise an ISO 27001 certified platform which goes through regular penetration testing, so the data is very secure. The client owns their data which is available in a number of formats.

The cloud-based platform is specifically designed to make that data manageable and viewable inhouse or to third parties under the authorisation of the client.

AMR: How reliable is the data, for instance, how accurately could you see scale corrosion on a bolt head?

DL: It's precision digital twins, meaning it is photorealistic. Depending on how close we can get to an asset and the resolution requirements, we can see very small detail. We use a term which is Ground Sample Distance. GSD essentially means the ratio of pixels on a camera image to physical millimeters in the field. We can accurately go down to less than a millimetre if required.

Resolutions are also dependant on the model size. The more data you capture the larger than model, so there's a trade-off to only capture the amount of data that you require. We can also complement the models with additional data, such as annotations or attaching additional photos. Applus+ have specific payloads for our UAS, which are designed specifically for high definition image capture. They can zoom in and see some really fine detail during inspections.

AMR: Where do you see the future of 3D models? What's the next phase? Would it incorporate AI for example?

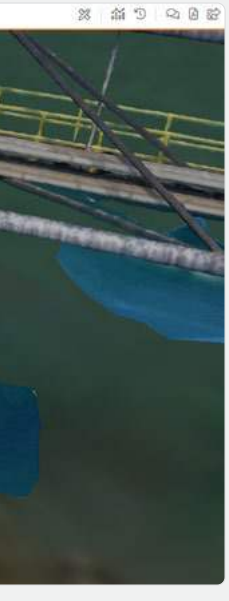
DL: I think some of the important next steps will be things like model segmentation or classification. Such as breaking an asset down into its components. For example separation of a vessel from associated access platforms or associated pipe work. Then there's the AI type work, which we are currently working on to make the interpretation of those assets more efficient.

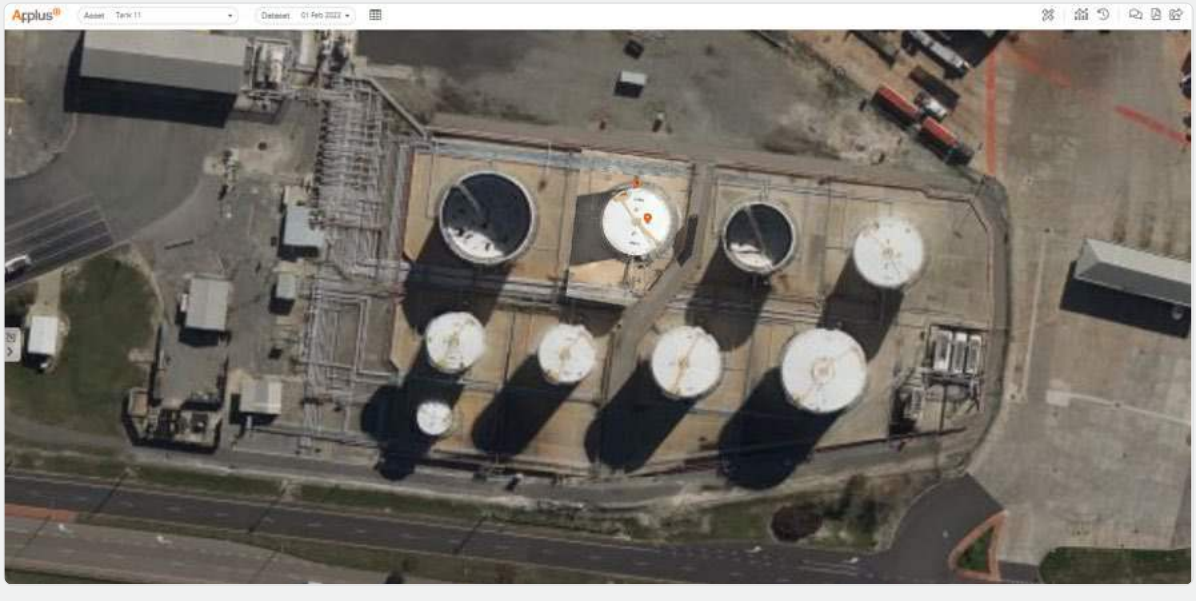
AMR: In this fast paced economy, where technology is constantly in development and we have a lot of innovation, is 3D capture money wasted down the line through advancement of tech?

DL: We're on the very beginning of the journey into the reality capture space, or metaverse of information. We've got a long time to go before we progress to the next technology leap. However, we do make sure that data is future compatible. The clients embracing inspection technology now will be much further ahead of their competitors who don't have 'big data' through lack of adoption. When there is a technological evolution, information previously captured can be transformed into the new system or technology.

This is certainly at the very foundation of what the team at Applus+ does. ***AMR***

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Reality capture models captured by drone: marine assets and topographical view of a tank farm.



OPTIME MAKES THE CONDITION MONITORING OF MACHINES IN PRODUCTION PROCESSES EFFICIENT AND COST-EFFECTIVE.

SCHAEFFLER'S AWARD WINNING OPTIME SYSTEM REVOLUTIONISES CONDITION MONITORING



As a company Schaeffler has always approached condition monitoring with the view to extending machine life using proven techniques and technologies.

Tracing its history back to the 1950s, Schaeffler has built a reputation as a reliable technology and service partner in all facets of condition monitoring, which complements the company's strong tradition of manufacturing bearings, maintenance tools and lubrication solutions.

Like all leaders in their field Schaeffler has also shown a willingness to adapt to changing circumstances and technology.

The company's customers have evolved over time into the world of Digitalisation, and with this brings demands to reduce lead times of technologies to site.

This is supported by the company's strong focus on providing clients with sustainable and reliable supply chain solutions, ensuring Schaeffler is well positioned to meet these demands.

The Australian Mining Review recently spoke with Mark Ciechanowicz, and Industrial Services Manager at Schaeffler, about some of the recent developments that the company is using in its support of condition monitoring issues.

AMR: Are there any particular tools which you use in your condition monitoring service offering?

MC: The tools are very much dictated by the application of rotating equipment to be monitored, such as rotational speeds i.e. fixed, variable, slow etc.

Measuring vibration, temperature, Acoustic Emission, RPM, load are common techniques Schaeffler deploy.

Further to this Schaeffler have developed Artificial Intelligence / Machine Learning algorithms using its' vast experience in the field of condition monitoring.

AMR: What is the most common issue mining companies face that the correct condition monitoring can alleviate?

MC: Capacity planning with their resources is an issue faced by all mining companies, so by means of automating the monitoring using expert algorithms, this affords companies to spend more on making their plant run more reliably and in-turn increasing the plant availability.

AMR: What are the types of cost savings that a proper condition monitoring service can provide?

MC: A proper condition monitoring service delivers visibility on plant availability and ensures production and maintenance cost savings are significant by preventing catastrophic machine failures, by better preparedness when it comes to spare parts and machine overhauls.

AMR: What stage of the process does Schaeffler like to become involved with a project?

MC: Schaeffler can deliver turn-key projects and partner with customers over a long period by offering remote monitoring services.

Mark says that one of Schaeffler new technologies that is achieving growing interest is the award winning OPTIME system.

The innovative OPTIME condition monitoring solution from Schaeffler was a recent winner of the year's Red Dot Design Award in two categories.

A jury composed of designers, professors, and journalists from various specialist fields awarded OPTIME in the categories of "Smart Product" and "Industrial Design", confirming the outstanding product design, functional configuration, and high level of innovation demonstrated by the digital service solution from Schaeffler.

"Our passion for technology and innovation is a key part of our DNA," said Dr. Stefan Spindler, CEO Industrial of Schaeffler AG. "OPTIME receiving the award proves that we can successfully expand our portfolio with digital services that prioritise the benefit to the customer."

A Wireless IoT solution, OPTIME makes the condition monitoring of machines in production processes efficient and cost-effective.

"Receiving the Red Dot Design Award for OPTIME has made everyone involved in this project very proud," said Rauli Hantikainen, Head of the Industry 4.0 Strategic Business Field.

"For the development of OPTIME, we established an ecosystem of partners who were each in possession of the leading technologies and skills in their respective fields. At the same time, we collaborated closely with our pilot customers, as the guiding principle of agile product development has always been to achieve the maximum benefit for our customers."

High-Scale Monitoring At The Lowest Cost

OPTIME - Plug. Play. Predict.
Condition monitoring can be expensive. Which is why up to 95% of all machines inside factories are only sporadically monitored, or often not at all. This can lead to unplanned breakdowns and downtime.



CONDITION MONITORING MADE EASY WITH OPTIME.



THE INNOVATIVE OPTIME CONDITION MONITORING SOLUTION FROM SCHAEFFLER WAS A RECENT WINNER OF THE YEAR'S RED DOT DESIGN AWARD IN TWO CATEGORIES.

reddot winner 2021

OPTIME from Schaeffler allows for comprehensive condition monitoring that is both easy and affordable. Thanks to its simple plug and play installation, OPTIME allows you to start monitoring hundreds of rotating machines in just a few hours.

With the ability to work on almost all machines, OPTIME can detect potential damage, imbalances or misalignments – even weeks in advance! This enables you to easily and conveniently plan your long-term maintenance, manpower or spare-parts requirements.

Key benefits at a glance:
- Highly cost-efficient monitoring
- Monitoring hundreds of rotating machines for a few cents each per day – up to 50% cheaper than handheld measurement
- Installs quickly
- Installing the sensors and setting up the OPTIME app takes mere minutes – no prior experience required
- Expert know-how
- Digital Service provides professional diagnostics based on expert algorithms and machine learning, available 24/7 via app – so you'll always make the right decision
- For beginners and experienced users
- With its intuitive operation, OPTIME provides crucial information and comprehensive expandability – perfect for a broad range of users and applications

How OPTIME works

Plug.
The vibration sensors are attached to each machine using screws or adhesive. Then they are activated via NFC.

All sensors automatically connect to each other and the gateway.

Together they form a mesh network, which is among the most reliable and energy-efficient IoT networks available today.

The system can be expanded with additional sensors at any time.

Play.
The app displays trends and, using a multi-stage warning system, provides a visual representation of the severity of potential incidents. In an emergency, it can sound an alarm and present additional information.

Exceptionally intuitive in its operation, the app offers a comprehensive array of tools that make it the perfect solution for everyone – from beginners to experts. Depending on the user's requirements, the monitored machines can be organized into groups. The machines' operational status can then be displayed in a variety of user-specific formats.

Predict.
The system detects malfunctions weeks in advance and provides information on the root causes. This works with continuous automatic analysis based on Schaeffler's extensive rolling bearing expertise, know-how in condition monitoring as well as machine learning algorithms. This way, OPTIME can make planning maintenance work, identifying manpower requirements, and procuring spare parts quick, easy and cost-effective.

The OPTIME system consists of three components:

Wireless, battery-powered vibration and temperature sensors that are attached to the machines to monitor their condition. Remarkably quick and easy installation means hundreds of machines can be equipped with sensors in just a few hours.

A gateway that receives the data from the sensors. The sensors and gateway connect autonomously to form a mesh network, and the gateway transmits the data straight into the cloud – without having to be integrated into the customer's network.

A digital service that analyzes the data using proprietary algorithms that draw upon Schaeffler's extensive technical expertise. The service then supplies you with intuitive diagnostic reports – via an app on your desktop or mobile device – that help you schedule your maintenance activities.

Avoid downtimes, increase profitability
Particularly for companies operating in system-intensive process industries, avoiding unplanned downtimes means greater profitability. Via the smartphone or desktop app, customers with OPTIME have a constant eye on the status of their plant, even with hundreds of machines, as the messages are user-friendly and prioritized according to criticality.

As a result, in-house maintenance personnel or even service companies can plan maintenance measures, personnel utilization, and the procurement of replacement parts in a timely and cost-efficient manner. They have the flexibility to decide whether they want to draw on other services and if so, which ones. The modular service concept offers online, remote or on-site services.

Condition monitoring can be easy
Users of digital services in the industrial environment also expect the information provided to be easily understood and the hardware and software to be uncomplicated to get around.

Condition monitoring systems by Schaeffler can be used without needing extra qualifications because with the help of the Schaeffler know-how, the system configuration and data analysis are largely automated.

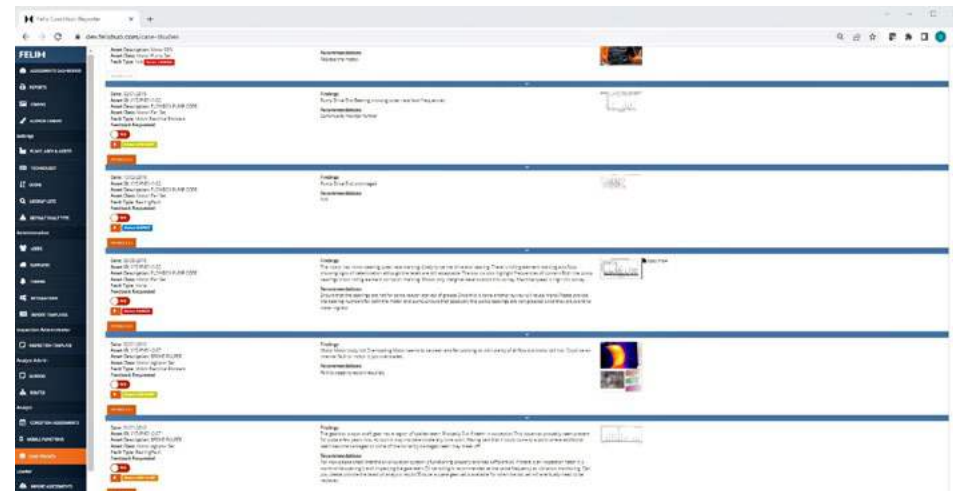
This integrated knowledge is integral not only to the highly scalable OPTIME solution with wireless single-channel sensors, but also to the two systems for machines with dynamic speed and load conditions and involving environments with temperatures in excess of 85 degrees Celsius – the single-channel CMS SmartCheck and the multi-channel CMS ProLink.

With condition monitoring solutions from Schaeffler, operators and maintenance personnel have an expert eye tracking the condition of practically every machine in the plant via the app. ***AMR***

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KEEPING YOUR VITAL CONDITION MONITORING DATA IN ONE PLACE







Technology assisted condition monitoring has been around for decades now. Almost every industrial facility operates some form of condition-based maintenance detection.

Despite the huge technical advances in computing power applied to machine condition monitoring, failures still occur, prognosis' can be quite poor, and the tribal knowledge to challenge and improve outcomes is often diminishing.

The condition monitoring programme commonly operates in a silo decoupled from reliability and business improvement departments. Defect elimination takes a back seat to defect detection. Black box, algorithmic fault detection can be good at detecting abnormal running conditions, but is often poor at identifying the exact problem- and even worse at orchestrating the elimination of the failure mode.

Common challenges for condition monitoring programmes:

- Same faults detected but re-appearing over and over.
- Over maintenance due to poor prognosis.
- Poor prioritisation and/or collaboration of CM with maintenance and operations.
- Reports are in a speak which is not straightforward to interpret into specific maintenance action, or strategy change.
- Poor visibility into how findings and recommendations are arrived at.
- Variable performance - mostly dependent on the talent of the analyst of the day.
- No policy or mechanism for knowledge succession.
- Poor feedback on recommendations impeding learning and improvement.
- Long time to competency for new analysts.

According to John van Bynen from Felixhub, most condition monitoring programmes have years worth of valuable condition monitoring history which has been lost or become unavailable. Vital information that could have a dramatic impact on condition assessment performance, and hence a company's bottom line, or even the day-to-day safety of an operation.

A major challenge facing all industries at the moment is the "great retirement". Experience is retiring, or at best becoming much more mobile, so experience gets lost, along with tribal knowledge of the plant, and the behaviour of its assets. The situation is completely analogous to your family GP. You would rather visit the same doctor that has known you all your life, than a different one who has never met you before every time.

The Felixhub developed Felix system is a cloud SaaS online repository and collaboration system for all your condition monitoring assessments. Felix is designed for both asset owners and service providers to store and share vital history, trends, feedback and case studies in an easy-to use and flexible manner that is proving a big winner with Australian mining companies.

The Australian Mining Review recently caught up with Mr van Bynen about the importance of being able to easily access critical data in diagnosing machine condition in complex, variable speed and fixed speed machines.

AMR: What led to you designing the Felix system?

JvB: Felix, was originally developed in the early '90s, as an internal business system, to solve the problem of getting our condition monitoring consultants up to speed much more quickly. It used to take years to train analysts to the point they were standalone consultants. With Felix, and its disciplined review work process, we were able to rapidly impart past experience, and get our consultants doing high quality work without supervision in a matter of short months. The results were a win for our customers, and our condition monitoring business. Our main focus really was to gather together all the results from all the condition monitoring technologies, applied on a particular asset, for each asset on site, and to bring those results together in a single place to provide a single source of truth for the client, on the health of their machinery. Capturing feedback, recording failure modes, and post mortem results against each assessment closed the knowledge loop, and imparted great confidence in our customers- and staff!

Over 30 years I have been involved with condition monitoring, particularly specialising in vibration. What I've seen happen time-and-time again, is, for example, people may use vibration contractors, and they get a report, but then that report goes to some people and not others. Then maybe the electrical guy lines himself up a thermographer and their report resides with the electrical guy. Somebody else may be brought in to do some ultrasound or whatever and that report is never found in one easily accessible place, and it may be on someone's personal computer. Then suddenly that person may get employment elsewhere and all those reports and all that history just disappears.

We identified that gathering all those results - and ultimately those results all come at a significant cost to the facility owner– in an easy to use system that brings together the different CM technologies and manages the assessment process in a tightly controlled work process, was key to not just continuous improvement but actually maintaining consistency of condition assessment performance quality.

Felix is quite unique. When you think of it as a single point of knowledge, single source of truth, it is the single source where everybody can go and understand everything the business knows about the assessed condition of an asset. In that sense it democratises, and in many ways demystifies the asset condition assessment program.

AMR: Is it an easy system to implement?

JvB: As a cloud SaaS offering, Felix is super quick to deploy and implement. Its graphical in nature, and very easy to use. Because we believe everyone should have an interest in the health of your plant, we allow any number of users. A site simply pays for a subscription, based on the number of assets, which encourages both small and large companies to use it.

Customers can decide to create a list of people they would like to have access to the Felix system and that makes no difference to the annual subscription.

Most of my clients may decide to navigate to the different areas of the software to look at what the condition of their plant is. Then if they want to print a report, they do that themselves.

That easy access information is really important. Having the right answer and having the right information in a timely manner can be critical.

AMR: When did you first come up with the idea for this system?

JvB: The idea came around surprisingly, probably more than 30 years ago, when we started using something similar in our own work. Working in the vibration industry we saw not only all the effort that people were putting into writing reports and using Excel spreadsheets and Word documents but also that the insights captured from previous analysis was not being captured and used in a way that would help the analyst conducting the next survey.

It occurred to me that we never saw anything that brought all this information together. So eventually we came up with our own idea because there was really nothing out there of a similar nature. We thought about it for a few years and eventually decided, right, let's do something about this. Let's put our money where our mouth is. Let's develop something.

I've been using it right from the get-go for all my clients and it is working very well and eventually more-and-more of my clients asked if I could provide the same system for them.

AMR: The uptake of the Felix system continues to expand from those humble beginnings with miners across the globe now using it to store critical condition monitoring data – helping to save costly downtime and potentially disastrous break downs. ***AMR***

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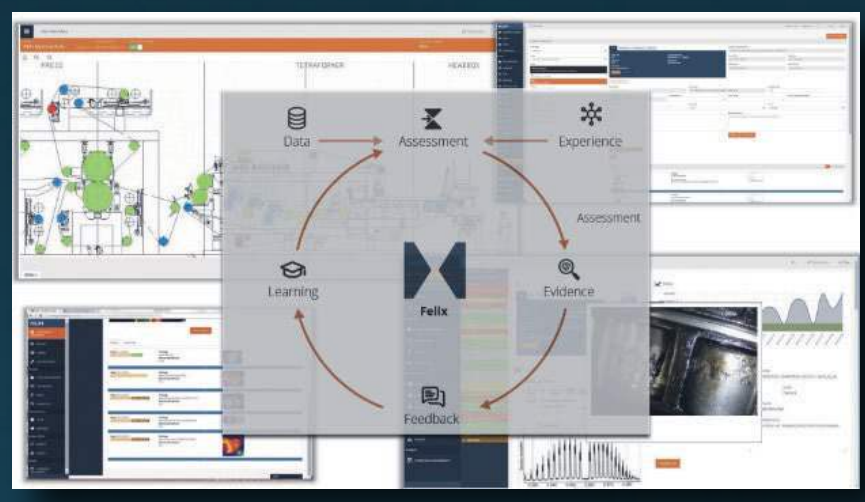
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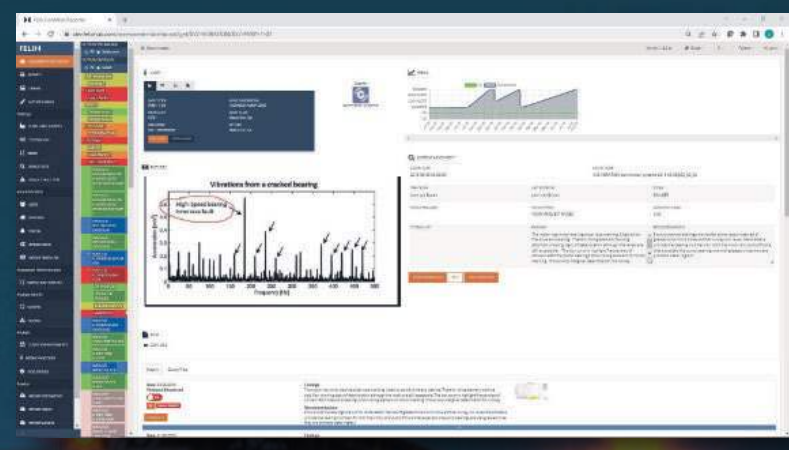
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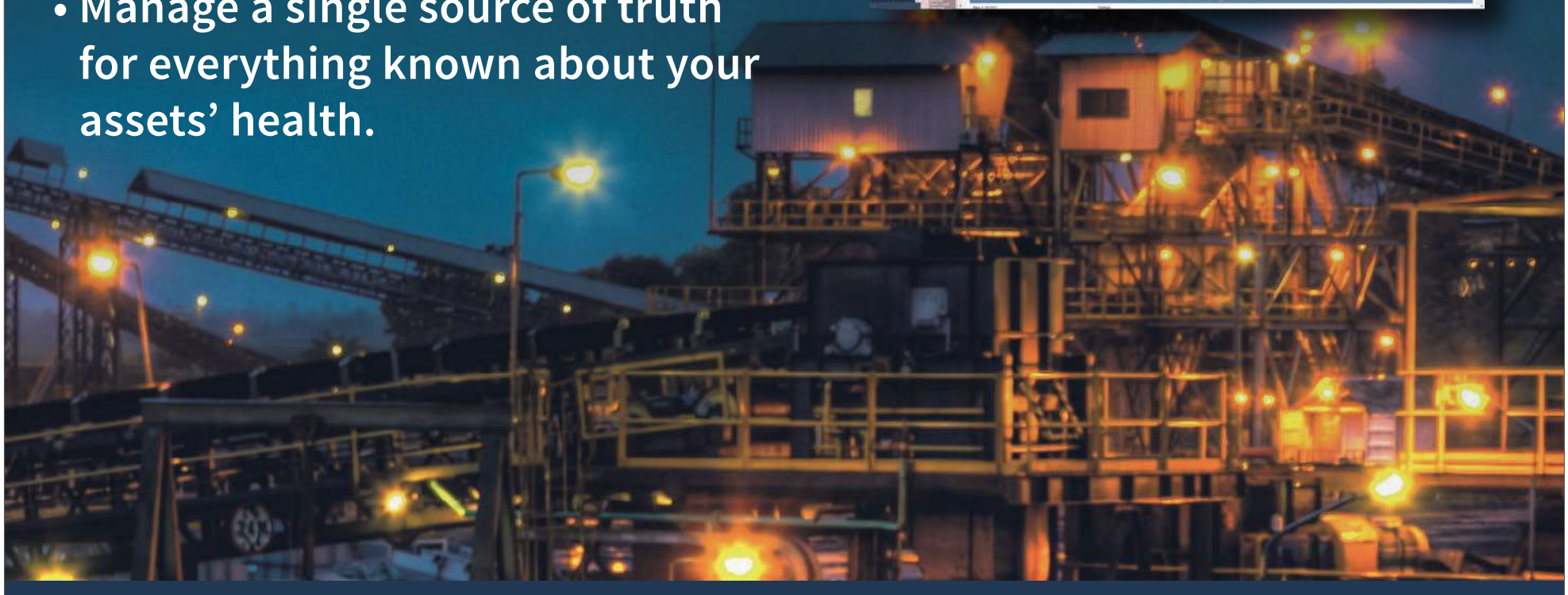
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HYDAC WILLING TO CUSTOMISE SOLUTIONS FOR YOUR CONDITION MONITORING NEEDS

HYDAC International is a world leader in motion control and fluid technology, operating in over 50 countries with more than 9,000 employees and 500 sales and service partners worldwide.

The company offers an extensive product range to cover all areas of fluid power. HYDAC also provides an on-site reliability audit programme, cleanliness solutions for oil and fuel, calibration services, engineering advice, bespoke design, drawings, hydraulic services, technical training, and predictive maintenance / Industry 4.0 solutions.

HYDAC components can be found in all areas of industrial and mobile hydraulics. Its products are locally engineered, manufactured and tested under a quality system certified in accordance with ISO 9001 (2015 version). HYDAC is one of the first companies in the country to be certified under this new version.

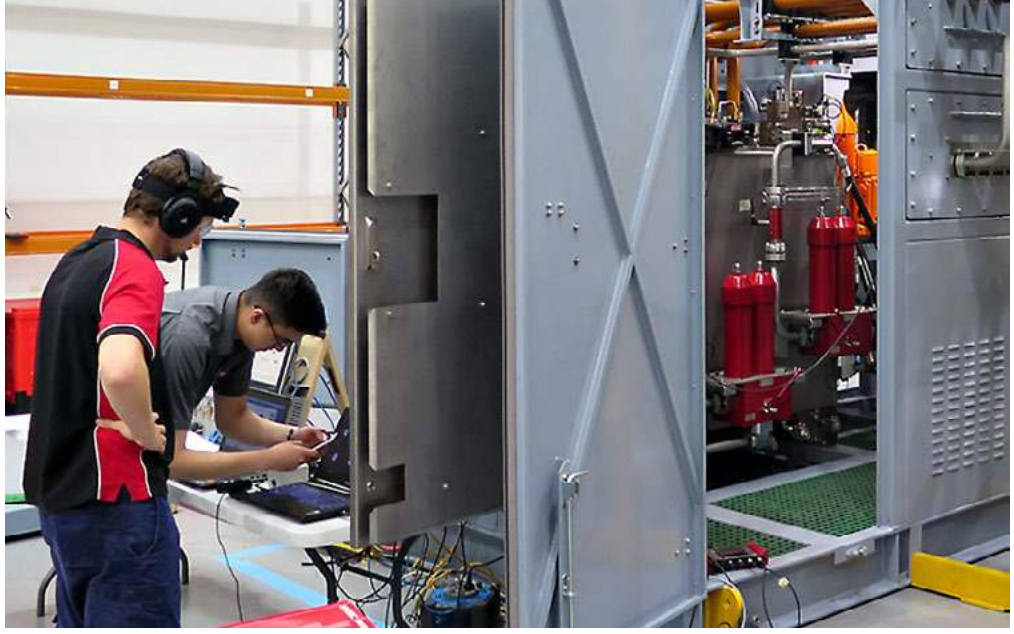
The Australian Mining Review recently spoke with HYDAC Project Engineer Nick Blyth to discuss how the company is using its technology and expertise to upgrade a critical ore handling operation for a major local iron ore producer.

AMR: I believe HYDAC has won some significant work in the Australian mining sector recently. Are there any new developments in the area of condition monitoring within HYDAC that has led to these successful contract wins?

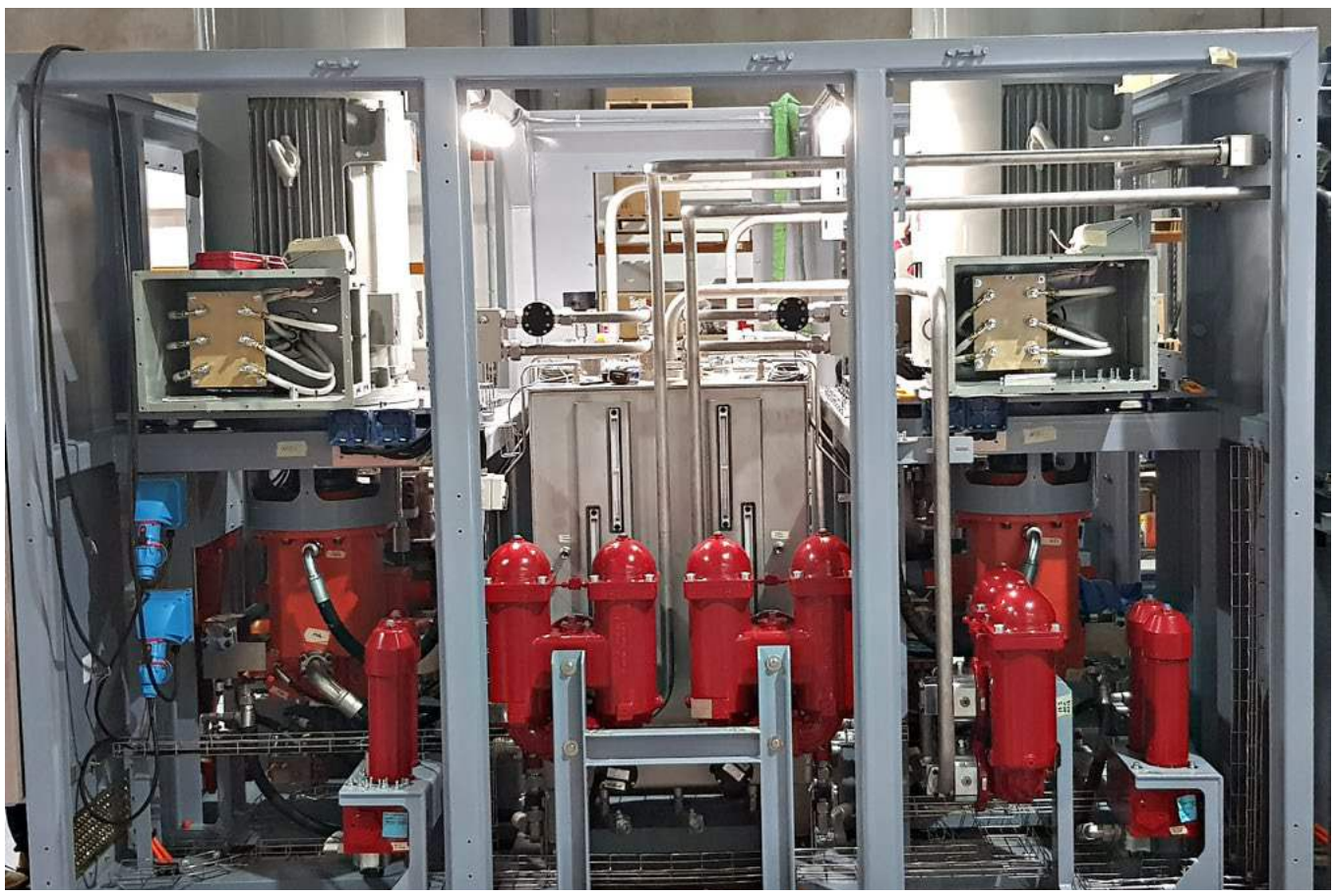
NB: There are not so much new developments, but our recent successes are probably more about our ability to apply all the condition monitoring instruments we have to a system. So basically, we are using all our components, pumps, filters, whatever electronic instruments and coming up with the solutions to create a usable system that met their requirements.

We have recently supplied quite a large hydraulic power unit (HPU) to a major Australian iron ore producer, which utilises a lot of condition monitoring and predictive maintenance.

This new HPU system is for an apron feeder









and it is providing all of the hydraulic control of the apron feeders installed at one of their dumping stations, where all the ore comes in on the trains from the inland mines, and needs to be dumped once it gets to port. They have five dumping stations there.

AMR: Is there any new technology or ideas involved with bringing together these systems?

NB: The HPU we are supplying is a new system and it replaces a system that was probably 15 to 20 years old.

The unit was designed, manufactured and factory tested in Australia. The HPU offers increased capacity to reduce cycle times. It is fitted with a condition monitoring suite to assist maintenance activities and reduce unplanned downtime.

I guess a differentiation with this high-tech system is that we can operate two apron feeders down at the open feeder level, which is like two or three stories below the ground.

They were previously driving them with two individual HPUs and we have consolidated this with the use of a common HPU with two big pump motor sets, with one driving each apron feeder.

That has provided huge benefits in terms of space requirements and is also a huge benefit on the installation front for the customer.

Notably, we have added a whole suite of sensors and condition monitoring equipment, which is collecting data in the HPU. This is providing important information for the operator.

The mine operator is actually very good in driving condition monitoring and wanting to know and collect as much data as they can. Some customers haven't really bought into that yet, but this company is one of the drivers in that area and they wanted to add in flow meters and to monitor pressure on both ports and monitor pressure on a lot of the pump control portions. It is quite a complicated pump we are using for this project

There is a heap of data that can be collected and used for either troubleshooting or predictive maintenance, including monitoring all the temperatures of the operating system and utilising oil condition sensors.

We are also introducing what we call a high-tech lab and installed it in the system. It's constantly running and monitoring for any change in the oil's condition.

AMR: What is the extent of this contract?

NB: We won the first installation contract in February last year, and we delivered it in September. The contract for the system we are currently installing was awarded around April last year. It will be installed when the project operator's shutdown and maintenance periods line up, possibly in June or July.

AMR: Are only two units required?

NB: Well, from our side we're optimistic. There are still three others on site and if they do come to replace them we will be ready to assist. We hope that as we supplied the standardised design for the other two they will implement our system again.

AMR: I believe this is not the only HPU system HYDAC is supplying for this client?

NB: There is another style of HPU we are providing for them. These are part of a wheel lock device on the back as the trains come into the dumping station, and they hold the train in place. We provided the first one of them in 2019 I think and we are building our fourth one at the moment. I believe we may supply up to five of those in the end.

AMR: The iron ore company looks to be one of your major clients?

NB: They are and they are a good client to work with. I guess what has helped sway them into awarding us all these important contracts is that we are much more willing to customise this solution to fit in with what they want.

The system we have provided has over 60 monitoring parameters including things like oil pressure sensors, temperature sensors, oil condition sensors and even an offline pump efficiency test.

The pumps on these systems are the most expensive single component. It is quite a unique system, and it is not something you can quickly replace.

We have developed a system where, in between the trains arriving and when the HQ is not in use, we can isolate the HPU from the apron feeder, and we utilise a flow testing block with flow meters and a method of artificially loading the pump hydraulically.

This takes all up about 90 seconds, so they run the pump through at full flow with no load and then we take a load point, like a flow point at about 25 or 30% of the flow. We then raise the pressure to between 50 bar and 100 bar and 150 and 200 bar and we monitor how much oil we're losing over the case strain and things like that.

That becomes a benchmark that over time we can use to monitor loss of efficiency of the pump and if we hit a certain point, that can trigger a reorder or trigger a refurbishment - depending on how far away they are from the next maintenance window.

AMR: I believe you also had to customise some of your pre-testing?

NB: We have just completed a factory acceptance test with our customer. In the last 18 months or so we have had to adapt how we conduct factory acceptance tests due to COVID restrictions. Customers would normally fly over and would send in a representative from each discipline, like a civil electronic control guy, a hydraulic guide, and we would all run through an agreed procedure.

We have adapted that so we do these tests remotely now. I wear like a GoPro and use wireless Bluetooth audio so they see what I see and hear what I am saying in real time. They can talk and ask questions the whole time. In the meantime, all the parameters of the HPU are running back to one of our PLCs and are all displayed there. And we share that PLC screen with them in real time too.

We are seeing benefits in doing it remotely and in the future it is going to make it easier to do these type of inspections. The benefit for the client is that they may have wanted to send say eight to 10 people, but in the end would have had to limit that to three or four. So, some things might get missed from the customer side. Now they can have a particular expert come in, just answer a few questions, and then jump back out rather than having to fly over here for a few days.

There is also the benefit that we have everything that happened on hand for later recall as everything is recorded, and we are monitoring all the data and recording that too.

AMR: This is just another example of HYDAC's adaptability and ability to match a client's needs. ***AMR***

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ALLU TRANSFORMERS BRINGING GAME CHANGING VERSATILITY

Efficient material flow is a key issue in any mining operation, power plant, bulk harbour and bulk material or storage area and any improvements made in this area reflect positively on the bottom line of the operation's P&L.

The ALLU series of screener crusher buckets offer solution for heavy duty carriers and operators to reduce material double handling needs.

The ALLU Transformer M-series is a range of multi-faceted screener crushers powered by the carrier they are mounted on.

These hydraulic attachments help with quick and efficient material production in quarries or mining operations, solve chute blockages and other material flow problems, and transport saturated material heaps.

When mine and quarrying veteran Len Hardy decided he needed two "big" new buckets for his Bonnyview Quarries business in NSW, he knew exactly what brand he wanted and where to turn to when he wanted to buy them.

Having used a number of smaller ALLU buckets on his excavators over the years, Len had his eyes on a pair of ALLU DH4-23 XHD25 screening buckets to take on the bigger jobs and provide additional versatility to his operation, which supplies customers right across NSW.

Built by Finnish private limited company ALLU Finland Oy, the ALLU screen crushers are highly versatile and the ideal tool for creating material such as road base and building materials.

According to Len, they are the perfect fit for his business.

"They are the best constructed buckets for the applications we use them for. They are really well engineered and provide a very reliable performance," he said.

"The two new buckets we acquired are performing really well and we couldn't be happier."

ALLU has the widest range of screening buckets and screener light crushers on the market. The units fit for almost any base machine size starting from the most compact ALLU DL Series to the massive ALLU M Series that will fit up to 160 tonnes excavator and up to 90 tonnes wheel loaders.

ALLU Transformer Screener Buckets mounted on an excavator improve efficiency in material processing due to work speed and reach which results in almost double the processing capacity compared to a slow-moving wheel loader as a carrier.

One-step screening and loading solution

With ALLU's Screener technology, existing loaders and excavators can be converted into effective processing, sorting and screening equipment due to the ALLU Transformers ability to deliver a one-step screening and loading solution capable of handling all materials from wet soils to coal and softer rock materials.

To meet the specific needs of each application - a range of blade and drum sizes are available to provide fragment sizes of 50, 75, 100 and 150mm.

This helps improve efficiencies through less chute blockages and also reduces the need for buffer storage areas and transportation of material heaps that are clogged due to moisture or contamination.

When looking at a project with a holistic approach given multiple equipment mobilisations, fuel costs and cost to process in low margin return Ore reclaiming projects etc.

ALLU Case studies have shown between $1.50-$2.50 per tonne savings in running

costs in comparison to multiple unit processing configurations.

ALLU Tracker
ALLU Tracker, launched to the market last year, is an effective tool for measuring performance and knowing where the equipment is located. It eliminates the need for lots of manual time keeping and owners and operators can understand the performance of their equipment.

ALLU Tracker works with all ALLU attachments and can be fitted to all models. The benefit of having the tracker is you know where your equipment is by GPS pinpointing, and geo fencing. Giving you the ability to understand what your equipment is doing, and last known location.

By Increasing the awareness of what your machine is doing, helps you plan your working load effectively, including operational hours and operational ability. The ALLU Tracker stores all information sent over to an easy-to-use dashboard, and the data is stored in the cloud including with the last known location.

ALLU network
ALLU products are distributed to over 30 countries around the world and in Australia through a nationwide network, servicing major infrastructure projects including water and gas, and the versatile ALLU system is quickly making inroads with civil and composting contractors.

Sales Area Manager in Rocklea Queensland, Craig Einam, said ALLU bucket applications and installations continue to grow and develop each year.

The network includes:
Walkers Hammers (VIC, SA, TAS)
Groundtec (NSW)
QLD Rock Breakers (QLD and NT)
Total Rockbreaking Solutions (WA)

AMR



M-Series for excavators

Unique design for bulk & mining material handling

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   • Power: 2 x 70kW
   • Max. Torque: 14,000Nm
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3. Pin mount adaptation and bushings
4. Rotating crushing drums
5. Patented rear-mounted bearing + drum construction
6. Heavy duty chain drive
7. Changeable wear parts

MATERIAL PROCESSING & LOADING IN ONE STEP

ALLU Transformers screen, process and load oversize materials such as soft rock and other similar materials in one step. **Wet or dry.**

One ALLU can produce multiple fragment sizes, with various blade and drum configurations.

Machine to Material

ALLU Transformer buckets offer the most portable processing solution available by allowing the machine to go to material pile instead of hauling the pile to the machine.

For excavators and loaders from 8t to 160t.



Processing times, cycle times and processed tonnes can be viewed and analysed via ALLU Tracker.

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IWC A GLOBAL COOLING SPECIALIST



BULK AIR COOLER | KLOOF MINE | SOUTH AFRICA

Mining operations make use of some of the largest ventilation and cooling systems in the world and these operations typically incorporate various types of cooling technology such as evaporative condensers, refrigeration plants, pre-cooling and condenser cooling towers as well as bulk air coolers.

Global cooling specialist, IWC has been providing engineered cooling solutions to some of the biggest and deepest mining operations across Globe and Africa since the 1980's.

The company's engineering expertise, backed up by experience enable it to provide cooling solutions to any mine.

IWC's product range of bulk air cooling towers, field erected pultruded cooling towers, heat exchangers, chillers as well as factory assembled 'package' type cooling towers and evaporative condensers.

As a global specialist in designing and constructing bulk air coolers for the mining sector, IWC's range of bulk air coolers (BAC's) help to keep underground temperatures at an optimum level, ensuring increased productivity and a healthier, safer work environment.

The range comprises of both cross and counter flow packed bulk air coolers in either forced or induced draft configurations. Each bulk air cooler is custom designed to suit the mines requirements.

IWC's field erected BAC's can be constructed of various materials and would typically include, cast in situ concrete, clad steel (hot dip galvanised or painted) or clad pultruded fibreglass structures.

The latest addition to our BAC range is a containerised BAC (single and two stage) unit which is ideal for both surface and underground use. The BAC offers air cooling rates of up to one to 100kW, making it ideal for smaller capacity installations as well as spot cooling.

These containerised induced draught, cross flow BAC's are equipped with directly driven axial flow fans, air mixing louvres and are designed to be easily transported to site, making for a simple installation that can be deployed to remote mine sites and can be relocated if required.



ROXGOLD COMPRESSOR COOLING TOWER IN BURKINA FASO.



Solution Cooling Tower | Dominican Republic



Bulk Air Cooler | Brazil

IWC's BAC's are typically used for smaller capacity installations and are usually of the forced draught, cross flow design and are available in single or two stage configuration. These BAC's are designed to be easily transported to site in large sub-assemblies making for a simple site installation that can be easily relocated if required.

The company's pultruded GRP cooling towers are built according to precise project specifications and conform to CTI STD-137 & CTI STD-152 standards. Pultruded GRP is becoming the industry norm for the construction of large field erected cooling towers, and owners and operators can benefit from long service life of cooling towers constructed from pultruded GRP.

IWC has an impressive installed base of cast in situ concrete cooling towers, across a number of different industries, and countries. Cast in situ concrete cooling tower structures have a superior lifespan and generally require very little, to no maintenance when compared to other materials of construction.

The company is proud to be associated with the gold and platinum mining industry and has provided several surface and underground bulk air coolers as well as field erected condenser cooling towers across Africa and internationally.

Recognised as a market leader and global supplier of pultruded GRP, concrete and steel structured cooling towers, IWC's expertise in this field is highly sought after.

The company's flexible approach to designing customer centric solutions considers fan power, pumping head, plan area, water quality and environmental considerations to ensure the best possible solution. IWC's engineers review each cooling tower application to assure that the components selected will work together as an integrated system, ensuring efficient performance and a long, reliable operational life.

Some notable bulk air cooling projects include South Deep - South Shaft at Sibanye, Kloof No 4 Shaft in Rustenburg, South Africa, Roxgold in Burkina Faso and a tower for a copper mine in Brazil.

IWC has also provided condenser cooling towers to a number of gold mines in Australia, a sugar producer in Ghana and more recently, a number of solution cooling towers and a large pultruded fibreglass tower to a mine site in the Dominican Republic. ***AMR***

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CONTAINERISED BULK AIR COOLER

Unparalleled Cooling Solutions



As a global cooling specialist within the mining sector, IWC provides numerous cooling solutions to help keep underground temperatures at an optimum level, ensuring increased productivity and a healthier, safer work environment.

Our cooling solutions are widely used in some of the world's biggest and deepest mining operations, and typically include:

- Bulk Air Cooling Towers
- Field Erected Cooling Towers
- Package Cooling Towers
- Slurry & Solution Cooling Towers
- Side Stream Filters and Chemical Dosing Equipment

With clients like Roxgold, Barrick, Newmont and Glencore, we're the obvious choice when it comes to cooling solutions.

IWC

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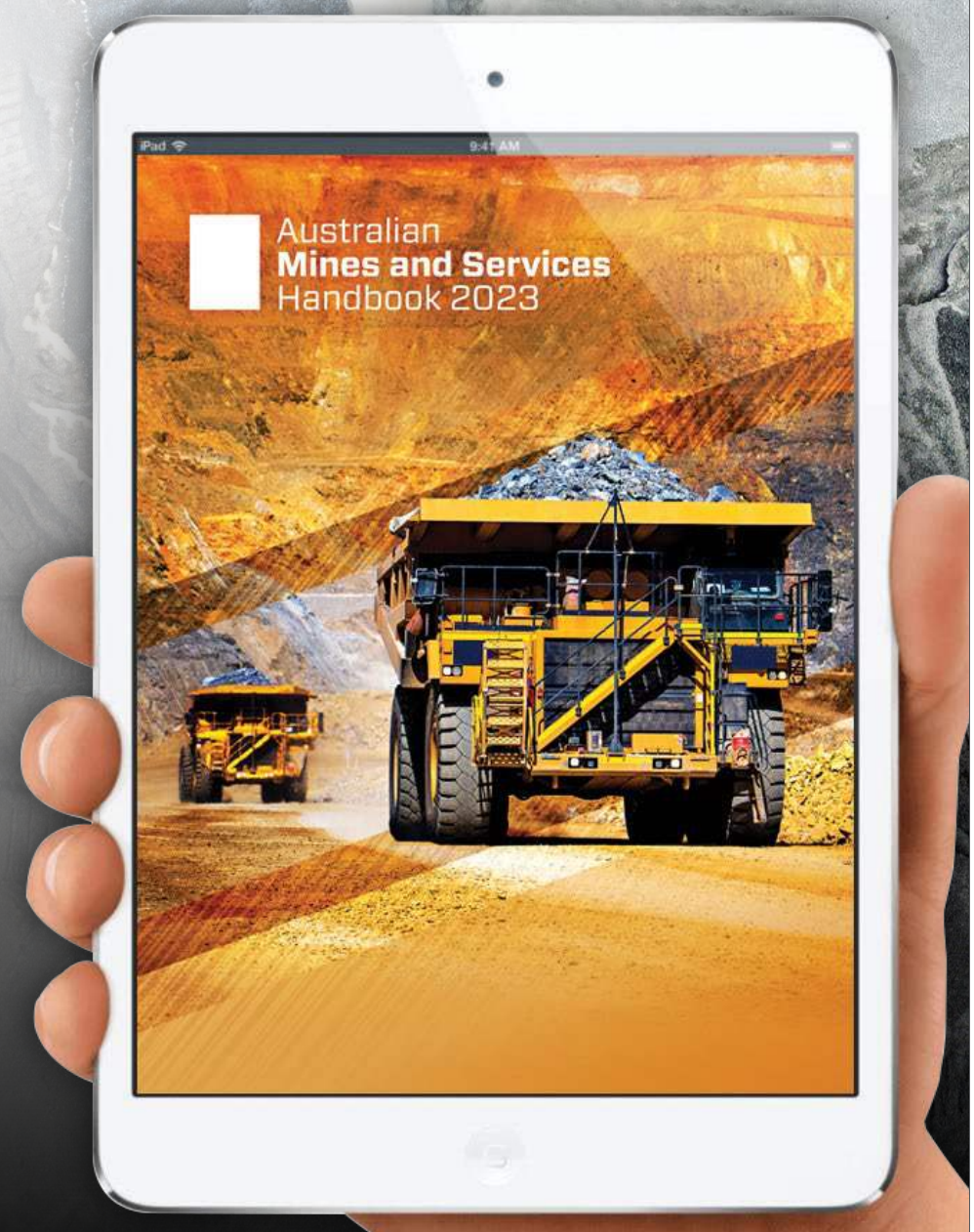
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