

# PROSPECT

## WHEATSTONE WINS

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Praise for innovative project





Western Australia's resources industry has celebrated its successes throughout 2015, demonstrating resilience in an evolving sector and a positive outlook for the coming year.

Chevron Australia won the coveted Golden Gecko Award for Environmental Excellence in October for a project at its Wheatstone Development (story page 2).

The departments of State Development and Mines and Petroleum were also winners in October when each was awarded Premier's Awards for Public Sector Excellence for their successful partnerships with private industry (stories page 4 and 22).

A successful trade mission to Indonesia in November reinforced Western Australia's strong partnerships with our major trading partners in the resources sector and other key growth areas.

Indonesia is a significant trading partner for Western Australia and there is scope for growth across a number of sectors, particularly agriculture and tourism, as well as the resources and services sectors (story page 5).

Closer to home, Western Australia is full steam ahead planning for LNG 18 – the world's largest liquefied natural gas (LNG) event – which Perth will host in April, 2016 (story page 9).

Australia is on track to become the largest LNG exporter in the world by 2020 as it develops the fastest-growing LNG projects worldwide and Western Australia is leading the nation with the development of major LNG projects.

**Colin Barnett**  
**PREMIER OF WESTERN AUSTRALIA & MINISTER FOR STATE DEVELOPMENT**

**Bill Marmion**  
**MINISTER FOR MINES AND PETROLEUM**

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Cover photo: The Chevron-operated Wheatstone Project received the 2015 Golden Gecko Award for Environmental Excellence for its micro-tunnel shore crossing at Ashburton North (story page 2). Photo: Chevron Australia Pty Ltd

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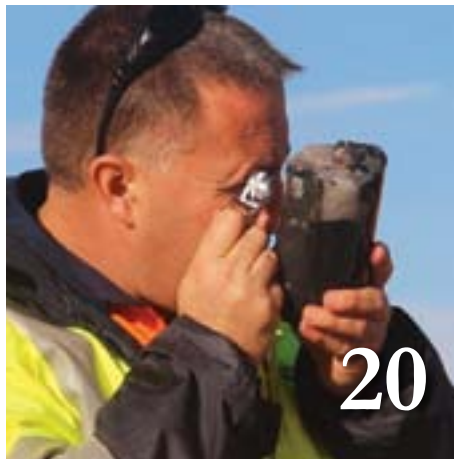
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# 2015 GOLDEN GECKO AWARDED TO CHEVRON FOR MICRO TUNNEL

**Chevron Australia has won the 2015 Golden Gecko Award for Environmental Excellence for a solution to a shoreline crossing at the Wheatstone natural gas development.**

Chevron Australia's Wheatstone micro tunnel links a 225 kilometre offshore gas pipeline to the onshore processing facilities, protecting the coastal area adjacent to the Ashburton River Delta.

The prestigious annual award was presented to company representatives by Mines and Petroleum Minister Bill Marmion at a ceremony in Perth in October.

Department of Mines and Petroleum (DMP) Executive Director Environment Dr Phil Gorey said the project stood out to the selection committee and was a very deserving winner of the 2015 Golden Gecko Award.

"The Wheatstone natural gas development is next to the Ashburton River Delta, which supports important mangrove and estuarine habitats," Dr Gorey said.



*The sculptor who created the original Golden Gecko, George Kosturkov, was a guest at the awards night.*

"Chevron investigated five options for a shore crossing and chose the one with the lowest environmental impact, even though it was the most expensive choice.

"Their commitment to environmental excellence was evident from the level of

assessment and engagement undertaken during the project's development.

"Monitoring undertaken on the Ashburton River Delta demonstrated excellent environmental outcomes with no ground disturbance and an increase in the number of mature mangrove trees adjacent to the tunnel corridor.

"Other excellent environmental initiatives included using biodegradable hydraulic oils, not using chemicals for the last 50 metres of tunnelling, re-using all tunnel spoil, recycling almost all recyclable waste, and formally recognising individuals who improved environmental awareness of the project through an award program initiative."

At 1.2 kilometres in length, the Wheatstone micro-tunnel is the longest large-diameter tunnel in the Southern Hemisphere. Measuring 112 centimetres in diameter, the trunkline is Australia's largest diameter gas pipeline.

Chevron Australia micro tunnel project chief Tony Spencer said Chevron took its role in protecting the environment and

demonstrating the highest standards of environmental stewardship very seriously.

“We are therefore very proud to receive a 2015 Golden Gecko Award for Environmental Excellence for our Wheatstone Project micro tunnel,” Mr Spencer said.

“Winning this award has allowed us to showcase some of the industry-leading work we have undertaken on our Australian projects to minimise our environmental impacts and conserve the unique values of the local communities in which we operate.”

Mr Spencer said Chevron was not aware of micro tunnelling of this size and application having been used in the oil and gas industry before.

“Through the commitment of Chevron and our subcontractors, we’ve been able to demonstrate that it is possible,” he said.

“As a result of our success, industry now has another solution for large-bore pipeline crossings in future development projects and the community has an example of resources developments successfully executed in sensitive physical environments.”

Certificates of Merit were also awarded to Pilbara Mesquite Management Committee Inc. and St Barbara Limited.



*DMP Executive Director Dr Phil Gorey.*

Battling the Thorny Menaces through Corporate Alliances was the Pilbara Mesquite Management Committee’s project to manage weed control across the Pilbara.

St Barbara’s Gwalia Operations Absorption Chiller Upgrade more than doubled the cooling capacity of the Gwalia underground mine by converting waste heat energy from the power plant to cool air.

The eight finalists for the 2015 Golden Gecko Awards were:

- Chevron Australia  
– Wheatstone Micro-tunnel Project
- Fortescue Metals Group / Ziltek Pty Ltd / PT Environmental Services  
– Better Environmental Outcomes from Hydrocarbon Spills using RemScan™
- Kalgoorlie Consolidated Gold Mines  
– Gidji Emissions Reduction Project
- Pilbara Mesquite Management Committee Inc  
– Battling the Thorny Menace through Corporate Alliances
- Pilbara Ports Authority  
– Mangrove Rehabilitation Program
- Premier Coal / Golder Associates  
– Lake Kewwari Trial Flow-through
- Rio Tinto Iron Ore Utilities Division  
– West Angelas Fuel Hub
- St Barbara Limited  
– Gwalia Operations Absorption Chiller Upgrade.

For information on entering the 2016 Golden Gecko Awards visit [www.dmp.wa.gov.au/goldengecko](http://www.dmp.wa.gov.au/goldengecko) ■



*Mines and Petroleum Minister Bill Marmion presents the Golden Gecko to Tony Spencer and Tye Pope of Chevron Australia.*

# 25 YEARS OF KINSHIP: WA AND EAST JAVA



*East Java Governor Dr H. Soekarwo and Premier Colin Barnett signed a re-affirmation of the Sister State agreement.*

**The Western Australian Government recently celebrated the 25<sup>th</sup> anniversary of its Sister State relationship with Indonesia's East Java province by recommitting to the relationship and pledging funding for health and disability programs.**

Premier and State Development Minister Colin Barnett joined East Java Governor Dr H. Soekarwo in November at a function at the State Reception Centre to sign a re-affirmation of the Sister State agreement.

Mr Barnett said he was delighted to welcome Governor Soekarwo to Western Australia for his first official visit as Governor, and to join him in marking the anniversary.

“Through the Sister State relationship many valuable programs and exchanges have occurred between governments, businesses, organisations and individuals in areas such as agriculture, health, social welfare, education, tourism and sport,” Mr Barnett said.

To mark the anniversary, the State Government committed funds towards services to support people with disability in East Java, including A\$80,000 towards the establishment of a scholarship for a high-level graduate from East Java to undertake a two-year Master of Clinical Audiology program at The University of WA in 2016.

The State Government is also providing A\$26,000, and the Autism Association of WA (AAWA) A\$21,000, towards autism services in regional East Java which were established in 2013 by the Disability Services Commission and AAWA.

With a population of about 38 million people, East Java has the second largest regional economy in Indonesia and contributed nearly 15 per cent of the country's gross domestic product in 2013.

Western Australia has maintained a trade and investment presence in Indonesia since 1992. The office was based originally in Surabaya, East Java before shifting to the Indonesian capital, Jakarta.

Two-way trade between Western Australia and Indonesia is now worth A\$3.1 billion, totalling about 30 percent of trade between Indonesia and Australia.

For more information on Western Australia's overseas network and areas of focus, visit [www.dsd.wa.gov.au/trade-with-wa](http://www.dsd.wa.gov.au/trade-with-wa) ■

## A WINNING PARTNERSHIP

**The Department of State Development (DSD) celebrated a winning collaboration with Western Australia's screen funding and development agency, ScreenWest, in October.**

The team was awarded the 2015 Premier's Award for Public Sector Excellence in the 'Western Australia in Asia' category.

The department worked in close partnership with ScreenWest to help connect production companies in Western Australia with production companies in China.

ScreenWest Chief Executive Ian Booth said the agency was honoured to jointly win the prestigious award.

“We've had some great outcomes from our work in this screen sector – numerous business delegations have been undertaken in both countries, business partnerships have been formalised and films made,” he said.

DSD Director of International Trade and Investment Stuart Crockett and Manager for China Ngor Tan joined Mr Booth at the award presentation by Premier and State Development Minister Colin Barnett (pictured aside).

The department was also a finalist in the same awards category for the successful Australia China Natural Gas Technology Partnership Fund.

First established in 2002, DSD administers the Fund, which aims to strengthen the relationship between Australia and China, encourage long-term partnerships in the energy sector and increase knowledge and skills through training and research.

The Premier's Awards recognise and celebrate achievements by those involved in the delivery of public services.

A full list of winners and their projects is available on the Public Sector Commission website <https://publicsector.wa.gov.au> ■

## TRADE FOCUS: WA AND INDONESIA



*L-R: Premier Colin Barnett; Indonesia's Minister of Maritime Affairs and Fisheries, Susi Pudjiastuti; and Chairman of the Australia Indonesia Business Council WA, Greg Gaunt. Photo: Australian Embassy, Jakarta*

### **Western Australia was the first Australian state to open a trade and investment office in Indonesia – in Surabaya in 1992.**

Indonesia has been among Western Australia's top ten trading partners for several years.

In 2014-15, two-way trade between the State and Indonesia was valued at A\$3.1 billion, with top export commodities from Western Australia to Indonesia including wheat, iron ore and live animals.

In early November, Premier and State Development Minister Colin Barnett and senior government representatives departed for Indonesia for a visit focused on expanding the State's trade partnership in key growth sectors.

"Indonesia is already a significant trading partner for the State, but there is scope for growth across a number of areas as our relationship continues to develop," Mr Barnett said.

"Western Australia has much to offer Indonesia's burgeoning middle class when it comes to world-class food, quality education, and breathtaking tourist destinations."

Western Australia's exports to Indonesia were valued at A\$1.6 billion in 2014-15, and were dominated by agricultural products such as wheat and live animals.

While in Jakarta, the Premier hosted a series of roundtable meetings with major

Australian and Indonesian companies across sectors with mutually beneficial potential – including agriculture, tourism and the resources and services sectors.

An agri-food roundtable was held for representatives from Indonesian and Western Australian companies, such as Indofood and CBH.

Another meeting focused on tourism and education and training, organised for airlines, travel agents and training providers to attend, and similar meetings were scheduled with the resource and service sectors.

In January 2015, the Western Australian Government expanded its trade and investment office in Jakarta to include tourism and agriculture officers.

A new Regional Director for Western Australia's Indonesia trade office, Chris Barnes, was appointed in June.

Mr Barnes said the visit by the Premier was important to demonstrate to Indonesia the commitment of the Western Australian Government to promoting business ties especially in agriculture and food, tourism and education and training. ■



*ScreenWest Chief Executive Ian Booth, Department of State Development Manager for China Ngor Tan, Premier Colin Barnett, ScreenWest Chair Janelle Marr, Director of International Trade and Investment Stuart Crockett. Photo: 3P Photography*

# OIL & GAS INDUSTRY LOOKS FORWARD



*The Western Australian display at the SPE Offshore Europe 2015 conference and exhibition, held in Aberdeen, Scotland.*

## **The Western Australian Government's European Office represented the State at an oil and gas industry event in September that confirmed a positive outlook for the industry's future.**

The WA European trade and investment team were joined by a representative from the Australian Marine Complex, Common User Facility in hosting an impressive display representing the state at the SPE Offshore Europe 2015 conference and exhibition, held in Aberdeen, Scotland.

Western Australia's new Agent General to Europe, John Atkins, attended the event – his first European event in his new role – and was kept busy meeting the industry's key players at the display and in one-on-one pre-arranged meetings.

Mr Atkins reported that with the downturn for the industry in the North Sea, the Western Australian stand at the conference exhibition was "extremely busy" for the full four days of the conference.

"The WA stand specifically promoted LNG 18 with brochures and key graphics, for which there was a large volume of interest that the European Office has been following up since," he said.

The theme of the 2015 event was 'inspiring the next generation', which encouraged industry delegates to address technical,

business and human resources challenges the sector is currently facing as well as future challenges – including the need to attract and encourage new talent into the industry.

Close to 56,000 delegates from 104 countries attended the event – the second highest attendance rate in the event's history – and more than 1,535 global organisations from 44 countries exhibited.

The Western Australia European Office monitors current and emerging issues throughout the United Kingdom, Europe,

Russia and the CIS States to identify prime opportunities for attracting investment and trade for Western Australia.

The office is involved in a wide range of activities and forges essential links between global partners and Western Australian business. For more information visit [www.wago.co.uk](http://www.wago.co.uk)

In April 2016, Western Australia will host LNG 18 – the world's largest liquefied natural gas (LNG) conference and exhibition. For more information on LNG 18, see story page 9. ■



*WAGO European Office Senior Trade & Investment Manager, Stuart Russell and Agent General, John Atkins with the Lord Provost of Aberdeen, Scotland, Councillor George Adam.*





*Wolf Minerals Hemerdon Tungsten and Tin Project in Devon, UK. Photo: Wolf Minerals*

## WA COMPANY OPENS NEW MINE IN UK

**Western Australian Government European Office Agent General, John Atkins joined more than 200 guests, including the Australian High Commissioner to the UK, The Hon Alexander Downer AC, at Wolf Minerals Ltd official opening of its Hemerdon Tungsten and Tin Project, held on site at Drakelands in September.**

Wolf Minerals, a Western Australian specialty metals company, officially opened its Drakelands tungsten and tin project in Devon, southwest England, heralding the first new metal mine in Great Britain in 45 years.

Wolf Minerals Managing Director Russell Clark said the successful financing, development and construction of the project marked the realisation of the company's goal of building and operating the first new metal mine in Great Britain for 45 years and becoming a significant producer of tungsten.

"Wolf has invested more than £140 million into the project and has created more than 200 permanent jobs, with many more involved during construction," Mr Clark said.

"The mine is expected to make a substantial contribution to the Plymouth, Devon and UK economies during the next decade."

Mr Clark said the opening ceremony was held only 18 months after construction of Drakelands began on site in March 2014, with construction completed on schedule in June 2015.

"Everyone involved is incredibly proud of this achievement and I hope that the successful delivery of this project proves to be a catalyst for a wider renaissance of metal mining in the UK," he said.

The Western Australian Government's European Office, located in the UK, is involved in a wide range of activities and facilitates relationships between European companies and Western Australian business. For further information visit [www.wago.co.uk](http://www.wago.co.uk) ■



*Australian High Commissioner to the UK, The Hon Alexander Downer AC with Wolf Minerals Chairman, John Hopkins OAM at the opening.*



Gold Road Resources' Justin Osborne and Jordan Rogers logging Gruyere drillcore.  
Photo: Gold Road Resources



L-R: Sumitomo Metal Mining Oceania Managing Director, Hitoshi Ito; Gold Road Resources Executive Chairman, Ian Murray and Sumitomo Metal Mining General Manager, Eiichi Fukuda at the milestone ceremony at Parliament House. Photo: Tom Rovis-Hermann

## GOLDEN ROAD AHEAD FOR WA MINING COMPANY

### Recent milestones for Perth-based company Gold Road Resources have demonstrated growth in Western Australia's gold sector.

The company is developing a promising new gold project in the Yamarna Belt, a newly discovered gold region covering approximately 5,000 square kilometres in the Yilgarn Craton, 150 kilometres east of Laverton in Western Australia.

The Yilgarn Craton currently produces over half of Australia's gold.

A 2010 report by the Geological Survey of Western Australia found the geology of the Yamarna Belt to be of a similar geological age and character to the Kalgoorlie area.

The Yamarna Belt currently has reported mineral resources of 6.1 million ounces of gold, hosted within a number of deposits including Gold Road's 5.6 million ounce Gruyere deposit.

Gold Road Resources recognised the State Government for its support through the Exploration Incentive Scheme which co-funded a 1,703 metre-deep exploration diamond drill hole through its 100 per cent owned Gruyere deposit.

Gold Road Resources Executive Director Justin Osborne said: "The hole targeted an ambitious projection of the

Gruyere porphyry almost 700 metres below previous drilling and to intersect more than 90 metres of mineralisation is a terrific result."

In November 2015, Gold Road Resources announced the first diamond drilling hole at its Toppin Hill Dolerite Prospect had successfully confirmed previously identified mineralisation.

This drilling – within the company's South Yamarna Joint Venture tenements – was also supported by the Co-funded Drilling Program as part of the State Government's Exploration Incentive Scheme.

The announcement follows a high-grade gold discovery recently made by the company at their Smokebush Dolerite drilling location, also within the South Yamarna JV.

Mr Osborne said the drilling success confirmed the detailed geology of the Toppin Hill discovery with visually obvious gold mineralisation.

"This new drilling has confirmed the detailed geology of the Toppin Hill discovery as being hosted within a very prospective differentiated dolerite sill," he said.

"The discrete nature of the shear zone, and visually obvious gold mineralisation provides us with a very good target model to follow up on.

"Along with the high-grade discovery recently made at Smokebush in a similar dolerite, we now have two exciting projects to focus JV attention on going into 2016," he said.

The drilling successes follow a milestone ceremony the company held earlier in 2015 to formally recognise Japanese company Sumitomo Metal Mining Oceania, a subsidiary of Sumitomo Metal Mining Co. Ltd, earning a 30 per cent interest in the South Yamarna Joint Venture.

The milestone represented the first major investment by a Japanese conglomerate in Western Australia's gold industry.

The ceremony, held at Parliament House, was attended by more than 30 guests including visiting international dignitaries from Sumitomo Metal Mining.

Gold Road Executive Chairman Ian Murray said the milestone demonstrated growing ties between Australian and Japanese businesses.

"The recent discovery of high-grade gold mineralisation within the South Yamarna Joint Venture at Riviera-Smokebush highlights what can be achieved through effective partnerships," Mr Murray said. ■

# LARGEST GLOBAL GAS EVENT: LNG 18 – WA, APRIL 2016

**Western Australia is home to the nation's largest known gas fields as well as its largest natural gas projects and is soon to host the world's largest liquefied natural gas event – LNG 18.**

The 18<sup>th</sup> International Conference & Exhibition on Liquefied Natural Gas (LNG 18) will be held in Perth from 11-15 April, 2016.

Chief executives from three of the industry's largest players – Shell, Woodside and Chevron – will jointly address delegates at the opening plenary session, speaking on "The Transformation of Gas".

The LNG industry has grown rapidly worldwide and Australia's gas sector has gone from strength to strength. The industry's rapid transformation will be under the spotlight at LNG 18 and Western Australia will be centre stage.

The conference program is now available and registrations are open.

Presentations by prominent speakers, high level ministers and policy makers as well as solid networking opportunities are only some of the highlights – the Conference Program offers insights from

a large number of CEOs and industry leaders, from both Australia and around the world, speaking at the one event.

Innovative projects such as Floating LNG, subsea technology and conversion of coal bed methane to LNG will be part of the program.

Additionally, content on challenges, trends and innovation facing the industry globally will be presented as part of the commercial, technical and special interest streams of the concurrent sessions.

The LNG 18 social program includes three functions, delegate lunches are included in the registration fee and plenty of other networking options, such as the Thought Leadership Lunches, Golf Day and Technical Tours, are on offer.

Start planning your LNG 18 experience today and visit the LNG 18 official website at [www.lng18.org](http://www.lng18.org) for a comprehensive event overview. ■



## FACTS – WA & LNG

- The Australian headquarters for leading international energy companies, such as Shell, Chevron and Woodside, as well as the operational head offices for mining giants BHP Billiton, Rio Tinto and Alcoa are situated in Perth.
- Western Australia's two current operating LNG export projects – the North West Shelf and Pluto – provide a total capacity of 20.6 million tonnes per annum.
- By the end of 2017, Western Australia will have five operating LNG export projects with a total capacity of 48.7 million tonnes per annum.
- Western Australia's LNG projects are located relatively close to the world's biggest LNG importers in Asia.
- The shipping distance from Western Australia to Japan is 3400 nautical miles, or eight days travel (similar to South Korea, China and Taiwan).
- In Western Australia, research shows that there is potentially twice as much gas available onshore as there is offshore.
- Major LNG investment projects in Western Australia include Chevron's Gorgon and Wheatstone projects, and Woodside's Julimar Development Project and Greater Western Flank Phase-1 project.

**For more information, as well as a full list of speakers and program outline, visit [www.lng18.org](http://www.lng18.org)**



# RARE OPPORTUNITY

*Northern Minerals' John Galt Prospect in the Kimberley region viewed from the west.*

**When Sidy Morin-Ka started work as a geologist with the Department of Mines and Petroleum (DMP) in March 2012, rare earth elements (REE) were the 'next big thing'.**

China was, and still is, the world's biggest producer, exporter and consumer of REE, but in 2007 it introduced export quotas, reputedly to clean up its highly-polluting rare earths mining industry and crack down on illegal rare earths production and smuggling.

This perfect commodity storm drove the price of REE sky high, and there were soon more than 400 companies exploring for rare earths worldwide.

In 2011, Lynas Corporation Limited officially opened its Mt Weld mine, about 35 km south of Laverton. Mt Weld is the world's richest known deposit of rare earths, and was the first mine to produce REE outside of China in many years.

Mr Morin-Ka, who specialises in REE geology, has seen a quick end to those glory days over the past few years.

"Things changed very quickly," he said.

"Companies found ways to reduce their consumption of rare earths, China abolished its export quotas in response to complaints to the World Trade Organisation, and mines outside China started to buffer supply, all of which helped to drop the price back to the levels we saw before the spike," Mr Morin-Ka said.

"It may no longer be the next big thing, but it is still a good thing for Western Australia, as we are very well placed to supply rare earths as global demand increases.

"I'll give you an example. Let's say a potential buyer, like the electric car manufacturer Tesla, is looking for rare earths essential to its production.

"Sure, they can deal with China, but Tesla is an American-based company, and China has a number of competing companies, so it's not going to make it competitive for Tesla to buy the REE, so where will they buy them?

"They'll buy from processing plants in other parts of the world and there's a very good chance the raw material will have come from Western Australia because we have abundant resources.

"Also, WA is part of a stable Western nation that can provide rare earths without any political considerations," Mr Morin-Ka said.

"Where we really have the edge over the rest of the world is our variety of rare earths, especially the 'heavies', which are more valuable."

Mr Morin-Ka explained that REE can be divided into two broad categories based on their atomic masses – light and heavy.

Geochemists generally believe there are 15 rare earth elements, which can be divided into light and heavy groups based on their atomic masses. REE deposits

tend to be dominant in either light or heavy element groups. Light REE are more common and generally have a lower economic value.

The largest known REE deposits in Western Australia occur in four main areas, situated in the eastern Yilgarn, the Gascoyne and the east Kimberley.

The world's highest-grade REE deposit is Lynas Corporation's Mt Weld mine which produces mainly lights about 35 km south of Laverton.

Hastings Technology Metals Limited has two promising projects – one for light REE at Yangibana, about 270 km east-north-east of Carnarvon, and another for heavy REE at Brockman, about 18 km south-east of Halls Creek.

Northern Minerals is developing a heavy REE deposit at its Browns Range project about 160 km south east of Halls Creek, and is exploring for more heavy REE at its John Galt project, about 120 km northeast of Halls Creek.

Anova Metals (formerly Kimberley Rare Earths) has a light REE prospect at Cummins Range, about 130 km south-west of Halls Creek, that Mr Morin-Ka described as very similar geologically to Mt Weld, but presently sub-economic.

"The companies we have now are likely to be the ones that stay on and we probably won't get many more," he said. "You don't need that much material to feed the market."



*Sampling at the John Galt Prospect.*

“The REE industry in Western Australia really needs a period of stability when it comes to price, demand and production.”

“If we start seeing too many companies moving to production in the rare earths market, the price may drop.”

Mr Morin-Ka believes there are reasons for the REE industry to expect a period of price stability.

“China is not going to stop consolidating and regulating its REE industry or stop its efforts to control the smuggling,” he said.

“If the price does go higher and helps competitors such as WA, the competition is not big enough to concern China.” ■

## Key rare earths and their uses:

<b>Yttrium:</b>	Superconductors, powerful pulsed lasers, cancer treatment drugs.
<b>Lanthanum:</b>	Special optical glasses.
<b>Cerium:</b>	Catalytic converters in automotive exhaust systems, precision glass polishing.
<b>Praseodymium:</b>	Magnets, creating high-strength metals for aircraft engines.
<b>Neodymium:</b>	Strong magnets in most modern vehicles and aircraft, headphones, microphones, infrared lasers, computer hard drives, wind turbines, hybrid cars.
<b>Samarium:</b>	Strong magnets, also used in conjunction with other compounds for intravenous radiation treatment to kill cancer cells.
<b>Europium:</b>	Colour TVs and monitors. Fittingly, it is used to make the special phosphor marks on Euro notes to prevent counterfeiting.
<b>Gadolinium:</b>	Targets tumours in neuron therapy, enhances magnetic resonance imaging, cancer diagnosis.
<b>Dysprosium:</b>	Added to rare earth magnets to help them operate more efficiently at higher temperatures.
<b>Erbium:</b>	Nuclear applications such as neutron-absorbing control rods.
<b>Thulium:</b>	Widely used as the radiation device in portable X-rays.
<b>Ytterbium:</b>	Cancer treatments, enhancing stainless steel.
<b>Lutetium:</b>	Dating ancient items such as meteorites, petroleum refining.

## Rare earths facts:

Rare earth elements (REE) aren't actually rare. They occur in rocks all over the world, but generally in very low concentrations. Deposits of a grade economical to mine are rarely formed.

Only a handful of REE minerals can be recovered economically, particularly monazite, bastnasite and loparite for the light REE, and xenotime for the heavy

REE. Host minerals show variable light-to-heavy REE ratios that are unique for each deposit. It is this ratio that determines the attractiveness of a REE deposit to investors.

Collectively, REE contribute to vital technologies we rely on for safety, health and comfort.

The unique properties of these elements help make many technologies perform

with reduced weight, emissions and energy consumption. They can also boost efficiency, performance, miniaturisation, speed, durability, and thermal stability.

Demand for rare earths ramped up in the 1960s after the launch of the first colour television sets, because europium was essential for producing colour images.



Department of Mines and Petroleum  
Executive Director Petroleum, Jeff Haworth.

**A historic land access agreement developed to streamline negotiations between oil and gas companies and Western Australian farmers was signed in November 2015.**

The agreement, endorsed by the Australian Petroleum Production and Exploration Association (APPEA), WA Farmers Federation, the Pastoralists and Graziers Association of WA and Vegetables WA, follows two years of negotiations between the industry groups.

“With increased exploration activity for onshore oil and gas in Western Australia the land access agreement will assist negotiations between petroleum companies and farmers,” Department of Mines and Petroleum (DMP) Executive Director Petroleum Jeff Haworth said.

OIL AND GAS AND  
FARMING INDUSTRIES  
DEVELOP LAND ACCESS  
AGREEMENT

“The agreement will outline the rights and responsibilities of property owners and petroleum companies during negotiations over land access, and will include information on compensation, mediation and land rehabilitation following exploration activities.”

The model agreement will be accompanied by a ‘Farmers Guide to Land Access’, which provides easy-to-read information on how rural land owners can negotiate fair and equitable agreements for exploration on private land.

Mr Haworth said the agreement is complemented by new regulations for the petroleum and geothermal industries that came into effect in 2015, giving Western Australia the most stringent environmental conditions in the country for the emerging shale and tight gas industry.

DMP assesses applications before drilling programs are approved to ensure they comply with State legislation relating to protecting public health, the environment and water resources.

Future projects will be assessed by DMP on a site-by-site, project-by-project basis with safety and environment auditors conducting inspections to check compliance with safety and environmental standards.

As part of the approvals process, companies are legally required to formulate an environment plan that assesses the potential impacts on groundwater, as well as flora and fauna.

All companies are required to submit a list of all chemicals planned for use in hydraulic fracturing activity and that information is published on the DMP website. ■

PARLIAMENTARY REPORT ON HYDRAULIC  
FRACTURING IDENTIFIES LOW RISK FOR WA

**A Western Australian Government Parliamentary inquiry into hydraulic fracturing for shale and tight gas has shown confidence in the Department of Mines and Petroleum’s (DMP) ability to regulate the emerging industry.**

The findings from a two-year inquiry presented in November 2015 have shown that the State’s regulators are well prepared to manage the industry and identified a low risk of negative impacts on the environment, water resources and public health.

The Standing Committee on Environment and Public Affairs report, *Implications for Western Australia of Hydraulic Fracturing for Unconventional Gas*, examined in detail the agencies involved in the regulation of hydraulic fracturing.

The inquiry investigated the main areas of concern raised by the community, including:

- land access and the rights of resource companies to enter onto private land;

- the use of chemicals during the process and their potential risks;
- how much water is used and alternatives to taking water from aquifers; and
- the legacy of hydraulic fracturing on land and on communities.

The committee found that improved regulatory processes and compliance activities by DMP provided sufficient safeguards to manage the developing industry.

NEW RESOURCES SECTOR AWARD  
RECOGNISES COMMUNITY  
PARTNERSHIPS

**A new resources sector award recognising outstanding achievement and leadership in building community partnerships will be presented by the Department of Mines and Petroleum (DMP) in 2016.**

Mines and Petroleum Minister Bill Marmion launched the new Community Partnership Award on 29 October, 2015.

"The new award will be presented for the first time in 2016 and will acknowledge companies and communities that demonstrate outstanding leadership in developing meaningful community partnerships," Mr Marmion said.

"The State Government is committed to supporting a responsible and sustainable resources sector that benefits all West Australians.

"Resources companies are expected to be good corporate citizens who engage in a meaningful and ongoing capacity with all stakeholders including communities.

"By engaging with communities and community groups to understand their issues and concerns, resources companies can help leave an ongoing positive legacy in the communities where they operate."

DMP Executive Director Mineral Titles Dr Ivor Roberts said the Community Partnership Award would recognise resources companies that went beyond merely gaining a social licence to operate.

"This award will help build the reputation of Western Australian resources industry organisations that are raising the bar and setting new benchmarks in community consultation and partnerships," Dr Roberts said.

Any company or individual operating within Western Australia's minerals, energy resources or extractive industries is encouraged to nominate a project for the Community Partnership Award.



Community Partnership Award nominees will be assessed against the selection criteria and not other applicants, meaning more than one award can potentially be presented each year.

From 2016, DMP will host an annual Awards for Excellence night each October that will incorporate the presentation of the new Community Partnership Award and the Golden Gecko Awards for Environmental Excellence.

Nominations for the 2016 Community Partnership Award open on 1 February 2016. For information, visit [www.dmp.wa.gov.au/communitypartnershipaward](http://www.dmp.wa.gov.au/communitypartnershipaward) ■



*Mines and Petroleum Minister Bill Marmion.*



*A report on hydraulic fracturing was tabled in the Western Australian Parliament in November.*

It also found that water source protection policies in place were adequate to protect public drinking water source areas.

The committee identified there is significant community concern about the risks associated with hydraulic fracturing, but highlighted there was also a level of misinformation being presented that may cause confusion and mistrust within communities.

Mines and Petroleum Minister Bill Marmion welcomed the report saying it focuses on an industry that could be very important for Western Australia's energy future, and for local jobs in particular.

The Minister said the State Government would carefully analyse the 51 findings and 12 recommendations and respond in due course.

"The bottom line is that we are committed to protecting public health, water supplies and the environment, along with farming, horticulture and tourism assets – in line with community and landowners' values and expectations," Mr Marmion said.

The report was tabled in Parliament on 17 November 2015 and is available at [www.parliament.wa.gov.au/env](http://www.parliament.wa.gov.au/env) ■



Department of Mines and Petroleum Director General Richard Sellers.

# DMP COMMITMENT TO ENGAGE WITH COMMUNITY AND INDUSTRY STAKEHOLDERS

The Western Australian Government's ongoing commitment to stakeholder engagement is now being highlighted through quarterly reports publicly available on the Department of Mines and Petroleum (DMP) website.

The stakeholder engagement activity reports provide a summary of DMP's engagement activities with community and industry stakeholders in relation to WA's developing shale and tight gas industry.

"DMP has an ongoing commitment to stakeholder engagement regarding this emerging new energy sector, and engagement activities will be reported on the department's website on a regular basis," DMP Director General Richard Sellers said.

He said that continuing community engagement addressed concerns about potential risks associated with resource extraction.

"As with any industry, the community wants assurance that there are appropriate regulations and processes in place to protect WA's communities and environment," Mr Sellers said.

"DMP has adopted a policy of 'engage early and often' in all areas of our business and we are committed to making sure that our operations are open and transparent to the public."

DMP has prioritised stakeholder engagement in its revised three-year strategic plan.

"The department reviews the strategic plan annually and adjusts its focus to align with changes in the resources sector and community expectations around responsible resources development," Mr Sellers said.

"Just as resource companies must earn their social licence to successfully operate in Western Australia, DMP needs to maintain community and stakeholder confidence in our regulation of industry.

"Building relationships and consulting early will be key to maintaining trust and confidence in DMP."

Through new regulations now in place, there is a requirement for industry to undertake timely, open and ongoing engagement with all stakeholders throughout the life of a project.

"There is an increasing level of community interest in resource projects, particularly in relation to environmental and land access issues, so involving all our stakeholders is crucial when planning and developing policies and programs, and this is now being fully integrated across our business," Mr Sellers said.

During the past year departmental staff held public information sessions in the Kimberley, Pilbara, Gascoyne, Mid West, Perth metropolitan area and the South West.

This included meetings with local government representatives, Aboriginal groups, port authorities, State Government agencies, Chambers of Commerce and Industry, farmers groups, development commissions and non government organisations.

Stakeholder engagement activity reports can found at [www.dmp.wa.gov.au](http://www.dmp.wa.gov.au) ■

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*The Lab-at-Rig development team with researchers from CSIRO, Imdex and Olympus. Photo: Greg Adams*

## LAB-AT-RIG TECHNOLOGY CUTS MINERAL ANALYSIS FROM MONTHS TO ONE HOUR

**An innovation that enables fast automated analysis of rock materials directly from drill sites is expected to lead to significant cost and time savings worth millions of dollars.**

The Lab-at-Rig technology developed by CSIRO enables chemistry and mineralogy of rocks found within a drill hole to be analysed within minutes of drilling.

“Lab-at-Rig is an important breakthrough for the industry because of the potentially massive cost savings in drilling, exploration and overall mining operations,” CSIRO Lab-at-Rig project leader Dr Yulia Uvarova said.

The new technology features automated analysis of mineralogy and geochemistry of drill-hole cuttings direct from the drill site, while still offering the relevant sampling methods and quality control processes.

“If mining or exploration companies have real time information about the mineralogy and chemistry in the drill hole they can efficiently plan what to do next – whether that is to drill deeper, drill further holes, try elsewhere, or stop,” Dr Uvarova said.

The Lab-at-Rig system is fitted to a diamond drill rig and includes:

- a sample preparation unit that collects solids from drill cuttings and dries them;
- X-ray fluorescence and X-ray diffraction sensors to provide chemistry and mineralogy of the sample; and
- the ability to upload data to a cloud-based platform where it can be analysed and provided back to the explorer.

The technology will provide an enormous speed advantage over the current system that can take up to three months – and often millions of dollars – to set up the drill sites, drill, extract, sample and log the drill cores, send to a lab for analysis, enter data into a database and, finally, provide information back to the company.

Lab-at-Rig offers a one-hour cycle for the whole process.

“Our ‘light bulb’ moment was in 2011 when a group of researchers were watching a diamond drilling operation and observed the fluid carrying the drill cuttings to the surface,” Dr Uvarova said.

“They asked the question: ‘what if we could analyse the cuttings separated from that fluid in real time?’ ”

CSIRO’s Discovering Australia’s Mineral Resources Program Director Dr Rob Hough said Lab-at-Rig was the product of two years of research and development and a tribute to the successful collaboration of the CSIRO’s research and industry partners.

“The way that Imdex, Olympus and CSIRO have worked together on this through the Deep Exploration Technologies Cooperative Research Centre (DETCRC) has been critical to delivering this world-class technology in such a short timeframe,” Dr Hough said.

CSIRO, Imdex, Olympus, University of Adelaide and Curtin University are now working on the A\$11 million collaborative DETCRC Lab-at-Rig Futures Project, which will build the next generation system to cover new sensor technologies, improved data analysis and processing for decision making, and development of the system for new applications and drilling platforms. ■



*Setting up camp successfully in the Nullarbor's challenging conditions (see box below).*

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# THE EUCLA BASIN: WHAT LIES BENEATH?

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**A drilling program funded by the Department of Mines and Petroleum's Exploration Incentive Scheme (EIS) is casting light on one of Western Australia's darkest and most mysterious corners – the Eucla Basin's Precambrian basement.**

The Geological Survey of Western Australia's (GSWA) Albany–Fraser project team has been working on interpreting the results of new stratigraphic drilling combined with geophysical data.

As well as unlocking doors to understanding the geological formation of south-western Proterozoic Australia, the spotlight on the Eucla basement is revealing important targets for mineral exploration.

A total of eight deep holes were successfully drilled during 2013 and 2014, providing 1560 metres of high-quality basement core, and chips of cover rocks from selected holes.

"The decisions on where to drill came from data collected through the EIS gravity and

magnetics surveys that we've already done out there," GSWA Geoscience Mapping Project Manager Dr Catherine Spaggiari said.

"That's what I used to pick the locations for the holes, otherwise you'd just be looking at a flat limestone plain with nothing else there to guide you.

"The aim was to pick geophysical domains rather than specific targets, as companies would, to find mineralisation.

"We picked bigger areas to get a better understanding of the basement's geology."

The results are still being studied eagerly and their release caused quite a stir among academics and explorers at a special one-day workshop in Perth in September 2015.

Core from the stratigraphic drilling program was made available for public viewing at the Perth Core Library in Carlisle and GSWA officers were on hand to provide information.

"The results announcement day was very successful," Dr Spaggiari said. "We had a lot of good feedback and people were amazed at the amount of work we'd done and the quality of it.

"There was so much to digest that it was hard to cram it into one day. The sheer volume of what we've found and what we've learned from this stratigraphic drilling is amazing and that's partly because we've ventured into a virtually unknown area."

The drilling program investigated the greenfields Madura and Coompana basement provinces that lie between the Albany–Fraser Orogen and the Gawler Craton, beneath up to 500 metres of cover rocks.

"GSWA has also been collaborating with Curtin University's Department of Applied Geology to shed light on the evolution of this younger basin cover, which is itself complex," Dr Spaggiari said.

In the basement, the drilling intersected a broad range of rock types of different ages,



and revealed the potential for volcanic-associated massive sulfide deposits, giant copper-gold deposits like those in the Pacific Rim, nickel and Platinum Group Elements deposits and iron oxide-copper-gold deposits.

Although in minor quantities, sulfides have been found in all eight of the holes, despite the fact that GSWA was not aiming for mineralised targets and the holes were spaced over a very broad geographic area.

After the drilling, GSWA undertook detailed logging and sampling work at the core library, including structural and petrographic analysis, geochemical and isotope studies, as well as geochronology to determine the ages of the rocks.

“We’ve done the bulk of the work,” Dr Spaggiari said. “Now we’re writing it up.”

The work has been summarised in a series of extended abstracts in GSWA Record 2015/10 that are available on the DMP website, and is also being compiled into a detailed report to be released this financial year.

“We’re taking what we’ve learned from the drill cores and putting that into geophysical interpretations,” Dr Spaggiari said.

As part of this effort, Dr Spaggiari is putting together an interpretive map to show what’s below the basin cover.

This is far from the end of the Eucla story because GSWA’s sights are on new geological discoveries in the area.

“This is pioneering stuff,” Dr Spaggiari said. “Next, we’ll be linking up with the Gawler Craton.

“As part of the map production we’re doing now, we’re also working with the Geological Survey of South Australia and Geoscience Australia.

“We’ve run a deep crustal seismic line – the Eucla-Gawler line – and we’ve teamed up with them to process and interpret that data.” ■



*Slabbed core at the campsite.*

## It’s tough going in the Nullarbor

Drilling in the Nullarbor is a challenging prospect, not only because of the remoteness and exposure to the elements, but also because of difficult ground conditions.

Cavernous limestone at the surface is underlain by clay-rich shale and loose sand

– all of which combine to give even the most experienced drillers plenty of anxiety.

“It can be hard going at times,” Dr Spaggiari said. “The Nullarbor can take a bit of getting used to.

“We learned how to set up a good camp – everything blows away in the wind and

tent pegs are difficult to get into the hard ground. We worked closely with the drilling crew and built up a close relationship with them and the Nullarbor locals, and we now know how to plan for, and execute, successful drilling programs in this region.

“We’re happy to share this information with anyone keen to give it a go.”



# ROYALTIES 101

**The Department of Mines and Petroleum has prepared these answers to commonly asked questions about Western Australia's royalties system.**

**Q: Are royalties a form of tax?**

**A:** A royalty is a purchase price, not a tax. A royalty compensates the community for the removal of mineral and petroleum resources which belong to all Western Australians.

**Q: Who owns Western Australia's mineral and petroleum resources?**

**A:** The State Government owns most mineral and petroleum resources on behalf of the people of Western Australia. Private companies mine, process and sell those resources, and pay royalties to the Government. Ensuring the community receives a fair return for the loss of the State's mineral and petroleum resources is a key element of WA's royalty system.

**Q: How are royalties assessed?**

**A:** Western Australia's three-tiered system applies one of three royalty rates to the value of the mineral depending on the form in which they are sold (ore, concentrate or final form). Specific rate royalties apply as an amount per tonne of production to various low-value industrial and construction materials such as sand, gravel and limestone. Petroleum royalties are generally calculated as a percentage of their "well-head value".

**Q: How long has the current system been operating?**

**A:** The current system for mineral and petroleum royalties has been in place since the early 1980s and has successfully supported the development of a diverse and competitive mining industry that has contributed significantly to State Government revenue – more than A\$5.3 billion in mineral and petroleum royalty payments in 2014-15.

The approach to assessing royalties has evolved over many decades and continues to successfully deliver an appropriate return to the community while providing industry with a system that is straightforward, transparent and predictable.

**Q: How much has been raised through royalties for Western Australia in the past decade?**

**A:** The mineral and petroleum royalty collection stream totalled more than A\$40 billion during that period. To put the significance of royalties into perspective, mineral and petroleum royalties made up almost 20 per cent of total State revenue in 2014-15.

**Q: What areas of State Government expenditure could royalties be used for?**

**A:** Royalty revenue in the 2014-15 financial year of over A\$5.3 billion is more than the State Government's entire annual education and training budget, or 65 per cent of the State's health services budget.

## PROTECTION FOR PERTH'S MAJOR INDUSTRIAL AREA

**The Western Australian Government has released for public comment a draft bill to formalise a Protection Area around one of Western Australia's most important industrial areas.**

The Western Trade Coast comprises the Kwinana Industrial Area, Rockingham Industry Zone, Latitude 32 Industry Area and the Australian Marine Complex.

Western Australian Premier and State Development Minister Colin Barnett released in October a draft of the Planning and

Development Legislation Amendment (Western Trade Coast Protection Area) Bill 2015, saying it would resolve ongoing uncertainties for land owners and industry.

"This bill is intended to provide certainty for land use planning around the Western Trade Coast industrial area, which is a vital driver for the State's economy employing thousands of people," Mr Barnett said.

"It will also protect the Western Trade Coast from encroaching residential development, and help to provide some separation between industrial activities and new sensitive land uses."

The proposal has two parts: draft legislation to amend the *Hope Valley Wattleup Act 2000* and the *Planning and Development Act 2005* to formalise the Protection Area; and proposed regulations to set out classes of prohibited land use with the Protection Area.



**Q: Why has the system remained unchanged for so long?**

**A:** A recent review of Western Australia's mineral royalty system found that it has served us well, having a high level of acceptance in both industry and the wider community, while delivering a fair return to the State. A crucial requirement of the royalty system is for it to be stable and predictable so that it continues to help attract investment in the sector. Western Australia's royalty framework is recognised as having these attributes. Mining projects often operate over many decades, and unpredictable royalties add to risk and uncertainty. Western Australia's stable royalty arrangements contribute to its reputation as a favoured destination for mining investment.

**Q: What about changes to the system?**

**A:** First and foremost, the State Government is committed to ensuring its royalty principles are not compromised. In response to changing practices in industry, the State's royalty regulations were recently

amended to remove any confusion about the appropriate value to be used in royalty calculations – regardless of where or how a commodity is sold.

**Q: How do royalties impact Western Australia's share of the GST revenue?**

**A:** Goods and Services Tax (GST) revenues are distributed between the States, based on their individual capacities to generate revenue and their expenditure requirements. As Western Australia has the capacity to collect significant levels of royalty from the development of its vast mineral and petroleum resources, the Commonwealth takes this into account when distributing GST revenues. The royalties assessed and collected are paid into the State's Consolidated Fund. The Commonwealth takes that into account and reduces Western Australia's portion of the GST distribution. In recent years, the largest influence over the level of GST distribution to Western Australia has been the commodity boom and the impact this has had on the levels of royalty collected.

Because the calculation adopted by the Commonwealth Grants Commission involves three years of past data, Western Australia is currently receiving a significantly diminished share of the GST, reflecting the high level of royalty revenues received in recent years. In 2015-16, the State will only receive GST revenues equivalent to a 30 per cent share.

**Q: What was the outcome of the recent royalty review?**

**A:** The recent Mineral Royalty Rate Analysis (MRRA) was comprehensive, robust and consultative. It found that the current royalty system is successfully delivering a fair return to the community. The findings and recommendations recognise and reinforce the strengths of Western Australia's royalty system. Some anomalies were also identified. A copy of the MRRA report can be found at [www.dmp.wa.gov.au/11857.aspx](http://www.dmp.wa.gov.au/11857.aspx) ■

Planning Minister John Day said a buffer has been contained in planning policy in varied forms since 1992, and was extensively reviewed by the Western Australian Planning Commission prior to endorsement in 2010.

"Following consultation, the Western Trade Coast Protection Area will be formalised in legislation," Mr Day said.

"The proposed regulations would prevent new sensitive land uses like residential housing, short-stay accommodation, hospitals, schools and child care centres within the Protection Area.

"However, this proposal would still allow non-sensitive land uses like business and commercial activities, and would only affect new developments rather than existing approved land uses."

Interested parties were invited to submit their comments by December 4, 2015, with submissions from land-owners, businesses and other stakeholders to help determine the boundaries of the Protection Area and final list of prohibited land uses under the proposed regulations.

It is anticipated the final legislation will be introduced into State Parliament in early 2016.

The draft legislation and proposed regulations are available on the Department of State Development website at [www.dsd.wa.gov.au/western-trade-coast](http://www.dsd.wa.gov.au/western-trade-coast) ■



*Working with core at the Cassini Musgrave drilling rig.*

# NICKEL'S WAITING TO SHINE

**If you had to choose a mineral that typifies the volatility of the resources sector, nickel would be near the top of the list.**

**The biggest use of nickel is as a key alloy in the production of stainless and heat-resisting steels, and this main strength is also its weakness.**

**If economic growth slows, so does the demand for steel, and for the nickel needed to make it.**

**The price of nickel is going through the same slump as iron ore and other commodities.**

**However, many analysts strongly believe nickel prices will turn the corner in 2016 citing the lower Australian dollar, a continuing export ban by Indonesia, and China's urbanisation.**

Western Australia's nickel sector is proving to be resilient and its explorers and miners have enjoyed success.

The shining star was the Nova project in the Fraser Range about 150 km east of Norseman – now owned and operated by Independence Group after its successful A\$1.8 billion takeover bid for Sirius Resources in May 2015.

Nova is expected to begin operating late 2016 with plans to produce 26,000 tonnes of nickel, 11,500 tonnes of copper and 850 tonnes of cobalt a year.

About 350 km west of Nova, Western Areas' Cosmic Boy nickel concentrator set a record in the 2015 September quarter, processing 148,102 tonnes of ore from the company's Spotted Quoll mine at an average grade of 4.7 per cent nickel.

Built in 2009 by Western Australian company GR Engineering, the concentrator will be getting a new lease of life after the company won a A\$22 million contract in July 2015 to take on a recovery enhancement project at the mill.

The upgrade is seen as a big vote of confidence by Western Areas in its core asset, the Forrestania Nickel Project.

At Kambalda, Mincor Resources NL has boosted the life of its Miitel nickel mine with the discovery of the northern Burnett lode.

The company also plans new mining at its Durkin North operation, utilising the infrastructure of the former Otter Juan mine.

There's more promise with Cassini – Mincor's new discovery in the established Kambalda nickel district – and the release of a maiden resource estimate for the company's Voyce discovery near its Mariners mine.

Earlier in 2015, Mincor Managing Director David Moore said the first drilling results at Cassini identified intersections of rare quality.

"In Kambalda, they almost always result ultimately in the development of a mine," he said in a company statement.

"Obviously there is still a long way to go before we can be sure of that at Cassini, but we are increasingly confident that we have made a significant new greenfields discovery – the first in Kambalda for many years."

Poseidon Nickel is putting nickel back in business nearly a half century after prospector Ken Shirley discovered the famous Mt Windarra deposit that sparked the nickel boom of the late 60s.

Poseidon Chairman Chris Indermaur believes there will be a continuing demand for nickel “driven by a desire by China and India for a first world standard of living”.

Writing in the company’s annual report in October 2015, Mr Indermaur said: “They will need stainless steel in their domestic products and nickel is an irreplaceable component.

“We, at Poseidon, along with most commodity analysts, have been surprised at the slump in the nickel price and the duration of that slump. We are confident, along with the same analysts, that the nickel price will rebound.”

Poseidon bought two other Goldfields mines – Black Swan and Lake Johnson – from Norilsk Nickel in 2014 and is developing plans to bring these two mines back into operation, along with Mt Windarra.

Lake Johnson and Mt Windarra were scheduled to start operating next year, producing nickel at the Black Swan concentrator. Poseidon has put the Lake Johnson restart on hold, but has told media outlets that it would only take four months to get the mine working once a decision is made to go ahead.

Rox Resources Limited has built on its 2012 discoveries (most notably nickel sulphides at Camelwood) at Mt Fisher East with two high-priority prospects – Sabre and Cutlass.

The company has more than doubled the inventory at its Mt Fisher East project 500 km north of Kalgoorlie, with the announcement of a maiden resource estimate of 2.1 million tonnes at 1.8 per cent nickel at its Musket discovery.

In a statement to the Australian Stock Exchange in August, Rox Resources Managing Director Ian Mulholland said: “Fisher East is undeniably a new nickel sulphide province in Western Australia, similar to Kambalda, Leinster, and Forrestania.”

Late in 2015, Duketon Mining Limited confirmed the discovery of the high-grade Nariz prospect at the company’s 2,000 square-kilometre Duketon nickel project about 100 km north of Laverton.

Duketon has completed a full data review of the Nariz discovery, including drilling, geophysical and geological components, and the maiden drilling program has revealed high-grade intersections for nickel.

Panoramic Resources Limited announced a major upgrade of resources late in 2015

for the company’s Savannah project in the East Kimberley and has released an interim resource for its Savannah North prospect of 3.15 million tonnes at 1.75 per cent nickel.

The company also discovered a new high-grade zone below the Schmitz ore body at its Lanfranchi mine about 40 km north of Kambalda.

Managing Director Peter Harold told media outlets in October 2015 that the expanded potential footprint of the Savannah North mineralisation, along with the resources upgrade, suggests a significant extension of mine life at Savannah.

Cassini Resources continues to undertake pre-feasibility studies on the Nebo-Babel nickel deposits — the first major nickel sulphide find in the West Musgrave region.

Cassini acquired this project from BHP Billiton in 2014 and is moving towards production.

Cassini believes its Succoth copper project about 13 km north-east of Nebo-Babel can be developed in conjunction with the Nebo-Babel deposits, enhancing economic returns through shared processing and mine infrastructure.

In addition to Nebo-Babel and Succoth, Cassini’s West Musgrave project offers early-stage prospective exploration targets with known mineralisation, including the Yappsu and Esagila nickel-copper targets which have been the subject of preliminary drilling.

Buxton Resources has high hopes for its early stage Double Magic nickel copper project about 150 km north-east of Derby. The prospect lies within a similar tectonic setting in King Leopold Orogen to Panoramic Resources’ Savannah mine in the Halls Creek Orogen.

The company has concluded an intensive technical program of results assessment, field mapping, on-ground geological assessment and several types of geological surveys including down-hole electromagnetic surveys.

Reverse circulation and diamond drilling is under way as part of phase two of the project. ■



*Chips from Rox Resources' Camelwood prospect.*

## Nickel facts

- Nickel is a versatile mineral with low thermal and electrical conductivity, high resistance to corrosion and oxidation, excellent strength and toughness at elevated temperatures, and it is capable of being magnetised.
- It is used in more than 300,000 products for consumer, industrial, military, transport, aerospace, marine and architectural applications.
- Nickel also plays a major role in our everyday lives – from food preparation equipment to mobile phones and power tools.
- In the 2014-15 financial year, a total of 183,083 tonnes of nickel was produced in Western Australia, valued at A\$3.2 billion.
- A\$78.5 million was spent on nickel exploration in the State during the 2014-15 financial year.
- Nickel is the fifth most important commodity for Western Australia, which has almost all of Australia’s economic nickel resources.
- Total nickel resources in Western Australia are estimated at 38,884 thousand tonnes of contained metal with an average grade of 0.7 per cent nickel.
- Malaysia was Western Australia’s largest export market for nickel in 2013–14, taking 36 per cent of our product. China took 30 per cent, followed by Singapore with 12 per cent, and Japan with 9 per cent. Other export markets included the United States, Norway, Brazil, Taiwan, Sweden and the Netherlands.



L-R: Dr Marnie Leybourne, Chamber of Minerals and Energy of Western Australia CEO Reg Howard-Smith, Dr Phil Gorey, Premier Colin Barnett, Jane Hammond, Dr Tim Griffin and Sarah Bellamy.

# MRF ACKNOWLEDGED FOR DEVELOPING THE ECONOMY

**Western Australian Premier Colin Barnett has recognised the Department of Mines and Petroleum's (DMP) Mining Rehabilitation Fund (MRF) for its contribution to economic development in Western Australia.**

DMP received the Premier's Award for Excellence in Public Sector Management for developing the economy.

DMP Deputy Director General Dr Tim Griffin accepted the award on behalf of the department and said it was extremely pleasing that DMP's efforts to deliver better environmental outcomes, and stimulate jobs and the economy, had been recognised.

"The MRF has found wide acceptance across Western Australia's mining industry and encourages companies to undertake progressive rehabilitation, providing the best and most cost-effective environmental outcomes," Dr Griffin said.

"The MRF replaced the previous system of holding environmental bonds securities over tenements with a world-first, online system that enhances the State's ongoing capacity to manage and rehabilitate legacy mines.

"Bonds did not cover the full cost of rehabilitation, discouraged investment by tying up significant funds that could be used for developing a mining project, and could not be used to address the problem of legacy mines.

"This introduction of the MRF removed the State's A\$4 billion potential contingent liability, injected more than A\$1 billion into the industry as bonds were retired, and encouraged early and ongoing rehabilitation.

"There have now been two compulsory MRF reporting periods and the value of the fund will approach A\$60 million once the 2015 levies have been collected."

Dr Griffin acknowledged the high level of engagement and support from the mining sector to progress the MRF model and resolve issues.

Premier Colin Barnett said the standard of finalists in the awards was extremely high and congratulated all entrants for their innovation and creativity in the delivery of services to the Western Australian community.

"Awards programs such as these, promote the public sector as an employer of choice, promote the collaborative work of the public sector and the benefits to the WA community, and increase awareness of outstanding bodies of work recognised for excellence in public sector management," Mr Barnett said.

Further details of the finalists and winning projects announced on 28 November 2015, are available at [www.publicsector.wa.gov.au/news-events/premiers-awards](http://www.publicsector.wa.gov.au/news-events/premiers-awards) ■



# PLANNING BEGINS ON MRF PILOT SITES



*The Pro Force site near Coolgardie.*

**Initial planning is under way for rehabilitation at two of the first four mine sites recommended for gazettal as legacy mines under the *Mining Rehabilitation Fund Act 2012*.**

The four pilot sites are Black Diamond in Collie, the Pro Force site near Coolgardie, Elverdton near Ravensthorpe, and a legacy tailings storage facility at Bulong, east of Kalgoorlie.

Announcing the gazettal recommendation in late 2014, Mines and Petroleum Minister Bill Marmion said that gazetting the sites was the first step in being able to rehabilitate them using interest earned on the Mining Rehabilitation Fund (MRF).

Planning was undertaken in September to identify stakeholders and evaluate their interest for the Black Diamond site. Similar planning for the Coolgardie site will occur before the end of 2015 so that the Department of Mines and Petroleum (DMP) can engage with all relevant parties when developing a plan for the future of the site.

Stakeholders, including neighbouring landholders, the Shire of Collie and the Department of Lands, will be consulted before any rehabilitation work starts.

A public auction of abandoned plant at the Pro Force site was held in Kalgoorlie in November 2015.

Plant for sale included hoppers, tanks, metal plates, scrap metal, grating walkways, earth moving equipment tyres, and a tin shed.

DMP Executive Director Environment Dr Phil Gorey said that before the MRF's introduction, the State had no funding source to address the issue of legacy mines like the pilot projects.

"Thanks to the MRF, the State now has a dedicated funding source available to address some of the safety, environmental and aesthetic issues that legacy mines present," Dr Gorey said.

"The bond system that was in place before the introduction of the MRF had a number of benefits for industry, government and the community, but it also posed considerable challenges.

"One of these challenges was that because they were tied to individual tenements, unconditional performance bonds could not be used to address the problem of legacy mines or any off-tenement rehabilitation that was required.

"As the bonds system wasn't introduced in Western Australia until the 1980s, more than a century of mining activity prior to its introduction also resulted in many legacy mine sites across the State with no bonds attached to them."

Of the four pilot sites to be gazetted, Bulong and Elverton had bonds held against them that have been called in and will be used for rehabilitation work.

DMP has developed a Legacy Mines Policy to support decisions about prioritising, managing and rehabilitating Western Australia's legacy mine sites.

As the value of the Mining Rehabilitation Fund grows, it is important to have a robust framework in place to support decisions regarding the State's legacy sites," Dr Gorey said.

"The policy will ensure a consistent approach is available to collect legacy mine site information, prioritise sites for gazetting, and manage and rehabilitate legacy mine sites.

The Abandoned Mines Policy, which was endorsed in November, was one of the final milestones in the department's environmental reform framework. ■

# ROADSHOW LOOKS AT RISKS FROM HEIGHT



*Workers from Atlas Iron at the Port Hedland session of the 2015 Mines Safety Roadshow.*

**The risks associated with working at height were the focus of a Mines Safety Roadshow which travelled throughout Western Australia during October and November 2015.**

The Department of Mines and Petroleum (DMP) annual event is one of the department's most important proactive strategies targeting mines safety.

State Mining Engineer and DMP Director Mines Safety Andrew Chaplyn said it was vital to make safety the top priority wherever people worked in the mining industry.

"Whether you are a worker or a contractor, an executive, part of an industry group or a mines inspector – we all play an important role in making mining operations safe," he said.

The roadshow featured an update on what is happening in mines safety and health in Western Australia from regulatory as well as industry perspectives.

"We also had a presentation on the recent serious injury analysis conducted by the department," Mr Chaplyn said.

"However, the main focus was the risks associated with working at height and the selection of appropriate controls.

"This topic is not just about working at height, but also falls from height (both high and low), rock falls and fall of ground."

As part of the roadshow, the department screened two new safety videos on falling from height as part of its 'Know Your Hazards' video series (see box right).

This was followed by a workshop on preventing falls from height.

"The workshop looked at how these risks can be controlled to ensure workers are safe," Mr Chaplyn said.

"As highlighted in one of our videos, a fall from height may last only seconds – but the effects can last a lifetime."

This was the first roadshow to follow an independent review of the event format coordinated by the department.

"We wanted to make sure that the format of the roadshows provided the best possible engagement with industry to share safety concerns and learnings," Mr Chaplyn said.

"The recent 10<sup>th</sup> anniversary was a fitting time for Resources Safety to review the roadshow format and assess its effectiveness at engaging with industry.

"The review identified some areas for improvement and resulted in modifications to the format of this year's roadshow.

"It also saw an increase in the number of sessions to ensure group sizes were more manageable.

"This made it easier to interact and exchange ideas during the roadshow's workshops."

The review also highlighted the importance of continuing to support additional engagement with industry.

"This year we held our first Registered Managers Forum, which gave us an

## Videos highlight risks of falling from height

Following the success of the first three 'Know Your Hazards' videos released in 2014, the Department of Mines and Petroleum has produced two new videos on falling from height – a major cause of injuries and fatalities in the mining industry.

Most mines in Western Australia have locations where people are required to work at height, or where there is a risk of falling from equipment or an underground mine level, or into openings.

The first video explains why falls from height – whether a stumble of a few centimetres or a fall of metres – can have serious outcomes.

The perception of what heights are "safe" is challenged and the effect on the human body is explained.

The second video explores the potential social ramifications of a fall from height on a person's career, relationships, hobbies and mental health, as well as their family and friends.

Three people affected by the consequences of a fall from height at work generously shared their stories to raise awareness of the impact of workplace accidents.

The videos were screened at the 2015 Mines Safety Roadshow, in conjunction with a presentation to support the understanding of the physical concepts featured.

opportunity to target safety information to a specific audience," Mr Chaplyn said.

Now in its 11<sup>th</sup> year, the roadshow attracted more than 700 people to 14 sessions held in Geraldton, Bunbury, Port Hedland, Karratha, Newman, Kalgoorlie, Mandurah and Perth. ■



L-R: WABS I inaugural Chair, Mike Poole; Premier Colin Barnett; and WABS I Interim Steering Group Chair, Alan Robson. Photo: UWA



Premier and Science Minister Colin Barnett. Photo: UWA

# NEW BIODIVERSITY INSTITUTE FOR WESTERN AUSTRALIA

**Western Australia will soon be home to a new institute that will bring together the multiple organisations which have a stake in the State's unique flora and fauna.**

The Western Australian Biodiversity Science Institute (WABS I) is a collaboration between government agencies, research institutions and industry groups.

Biodiversity is a key priority for the State Government's science strategy released earlier in 2015.

The main drivers of the State's economy – urban development, agriculture, mining, oil and gas – all interact with the State's biodiversity.

Exotic plants and animals and environmental change all put Western Australia's unique biodiversity at risk. The institute will improve coordination and connect the researchers to the users.

WABS I was launched by Premier and Science Minister Colin Barnett at a function at The University of Western Australia on 15 October 2015.

Launching the institute, the Premier said that WABS I would cement Western Australia's status as an international leader in biodiversity research.

"WA is home to one of the world's richest diversities of plant and animal life, including eight of Australia's 15 terrestrial biodiversity hotspots," Mr Barnett said.

"Science is crucial to ensuring our rich and unique biodiversity assets are here for future generations to enjoy. At the same time, the main drivers of our economy – mineral exploration and processing, broadacre agriculture and tourism – intersect with the State's biodiversity, as does urban development."

Mining companies often hold valuable information about flora and fauna in some of the more remote areas of the State.

Through WABS I, this information will become centralised and be accessible to government policy makers, industry, land managers and other stakeholders, removing duplication of survey work, reducing costs and allowing better decisions.

The institute will manage more than A\$60 million of current, fully-funded research, and will aim to attract significant new research funding to WA, including from the Australian Government.

The initial funding comprises A\$40 million from national and international sources, A\$15 million from industry and A\$5.5 million from the State Government.

WABS I will initially focus on landscapes in the Pilbara, Kimberley, South West and the Western Desert Lands.

The Department of Mines and Petroleum (DMP) has already sought the support of WABS I to develop two new environmental guidelines around rehabilitating mined landscapes.

DMP Executive Director Environment Dr Phil Gorey said the guidelines will enhance the level of biodiversity achieved in the rehabilitation of mine sites.

"By improving understanding of the completion criteria development process and appropriate monitoring regimes, and by documenting case studies to provide insight into acceptable rehabilitation standards, companies will be able to attain better biodiversity outcomes," Dr Gorey said.

"DMP has undertaken a significant review of mine site rehabilitation in the Pilbara region which will form a baseline for potential future research into any improvements in rehabilitation that arise post publication of the proposed guidelines."

DMP is a founding member of WABS I and Deputy Director General Michelle Andrews has been appointed to the Board.

The eight other founding members are the Botanic Gardens and Parks Authority, CSIRO, Curtin University, the Department of Parks and Wildlife, Murdoch University, the Office of the Environmental Protection Authority, and the Western Australian Museum. ■



# STICKING TO THE FACTS

**When a serious accident occurs in the resources industry, Colin Boothroyd's team of investigators is tasked with finding out exactly what happened and why it happened.**

Dr Boothroyd heads up the Department of Mines and Petroleum's Investigations Services Branch and tells Prospect how the investigation process has changed in recent years.

Before Dr Boothroyd joined the Department of Mines and Petroleum (DMP) in 2011, there was no central investigation branch at the department. Investigations were split between the Resources Safety, Environment and Mineral Titles divisions.

Further complicating matters, resources safety investigations were undertaken by mines safety inspectors, petroleum safety inspectors or dangerous goods officers.

"They wouldn't necessarily follow the same procedure and they wouldn't always have the ability to focus on the investigation because of their other inspectorate duties," Dr Boothroyd said.

Due to these issues, investigations were sometimes taking right up until the three-year statutory limitation for starting a prosecution.

"The variations in how people were approaching investigations also meant there wasn't a standard report that went for review by the State Mining Engineer or Chief Dangerous Goods Officer," Dr Boothroyd said.

"With the development of the Investigation Services Branch we have established investigation policies, procedures and hierarchies."

The hierarchy ranges from low-level incidents, where sites may conduct their own investigations, to incidents resulting in serious injuries or fatalities.

"Where there is an incident involving serious harm, or the potential for serious harm, then public interest dictates that we would launch an independent investigation," Dr Boothroyd said.

When detailing the investigation process, Dr Boothroyd is clear about the role of the department's investigators.

When we complete our investigation we produce a factual report. The report is based on what we find out through the investigation process," he said.

"It doesn't have any opinions from the investigators, it is purely factual.

"It may have opinions expressed by people we interview regarding the incident, but not ours.

"That way, when we put the report together, we're able to say that based on the facts presented to us this is how the incident happened.

"This independence is vital. The report can be used in court not just by us, but it can also be used by an employer or employee in a civil case," Dr Boothroyd said.

"What our current processes and procedures allow us to do is to conduct investigations against a set standard in a consistent way.

"Having a dedicated Investigation Services Branch also ensures our focus can remain solely on investigations."

It also ensures the department has the resources to fulfil community expectations regarding compliance.



The additional capacity has seen an increase in the number of investigations completed by the Department of Mines and Petroleum, as shown above.

“When things go wrong there is an expectation the incident will be thoroughly investigated and the causes identified,” Dr Boothroyd said.

“This may or may not result in a prosecution depending on what the investigation finds.”

Any decision to prosecute comes from independent analysis of the investigation report.

“The key objective in any investigation is to establish what happened in order to improve safety outcomes and deliver knowledge back into the industry,” Dr Boothroyd said.

“From time to time it will be necessary to prosecute, but ultimately we are investigating to find the root cause of an incident.”

The branch has also been examining historical reports and industry statistics to establish key causes for fatalities as part of its proactive work to improve safety.

“There has been a view that a serious injury is a potential fatality, but for microseconds or millimetres,” Dr Boothroyd said.

“The work we have done has shown there is a strong correlation between what we call high-impact serious injuries and fatalities.

“The next step is to examine the occurrence data.”

Occurrence data looks at incidents where there is no injury, and some occurrences have similar causation factors to incidents that resulted in serious injuries or fatalities.

“Tragically, we have between three and four deaths a year in our mining industry. However, that doesn’t give us a lot of data we can use,” Dr Boothroyd said.

“We do have a lot more injuries and occurrences, so if we can analyse that data we can identify key hazards and risks, and provide that information to industry.”

The aim is to establish some golden rules that may prevent people from getting hurt and people getting killed.

“If you look at fatal incidents, some of them happen because employees do the wrong thing, and some of them happen because the employers do the wrong thing,” Dr Boothroyd said.

“What they do have in common though, is that nobody thinks that what they are doing will cause a chain of events that could lead to a serious injury or a fatality. They are not aware of the possible consequences of their actions.”

The data, provided by every site in the State, is captured through DMP’s online Safety Regulation System (SRS).

“All we’re doing is taking data the industry is giving us,” Dr Boothroyd said.

“Nobody else has access to that information. Employers can look at their own sites, but they can’t look at all the sites across the State – DMP can.”

However, it is not just the department that is analysing the data.

“We want to take the data we used for our serious injury report, cleanse it so there are no identifying details and provide it to university researchers,” Dr Boothroyd said.

“We will then see if they can produce different results, different insights and different knowledge from what we produced.”

And that is the ultimate goal of the Investigation Services Branch – to increase knowledge and help make the industry safer. ■



*KCGM tackles a fire-fighting scenario at the Chamber of Minerals and Energy's annual Surface Mines Emergency Response Competition.*

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# COMPANIES HONE EMERGENCY RESPONSE SKILLS

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**The ability of mining companies to respond in emergencies was put to the test during 2015 when mine emergency response competitions were hosted in the Goldfields and Perth.**

Representatives from the Department of Mines and Petroleum's Resources Safety Division were on hand to provide support for all three competitions.

The State Mining Engineer and Director Mines Safety Andrew Chaplyn said the competitions were designed to test industry's emergency response capabilities.

"The department is proud to support these annual competitions and encourages industry to participate," he said.

"This year, the department sponsored events, provided adjudicators for several scenarios and compiled a photographic record of the competitions."

Mines and Petroleum Minister Bill Marmion said that Western Australia had recognised the importance of such events for more than 100 years.

"They give invaluable experience, especially for the teams who also provide vital

emergency response capacity in Western Australia's remote and regional communities," Mr Marmion said.

The Chamber of Minerals and Energy Western Australia organises two of the three annual events.

Chief Executive Reg Howard-Smith said that the events focused on training industry personnel to respond to hazards present in the resources sector.

"Our people work hard in challenging conditions and we want to make sure they go home safe and healthy every day," Mr Howard-Smith said.

"The event prepares teams to respond to any emergency situation, while sharpening the skills they hopefully never have to put to use." ■



*Fortescue VEST tests the emergency response team's readiness at Perth's Langley Park, the venue for the annual Mining Emergency Response Competition held in November.*



*Stefano Caruso (fourth from left) at MRIWA's scholarship awards ceremony in April 2015. With him are, (L-R) Dr Tony Bagshaw, Dr Mark Bush, Dr Marco Fiorentini, and Cam Adams, who is also a MRIWA PhD scholar at The University of WA's Centre for Exploration Targeting.*

# SCHOLARSHIPS LEAD TO GOLDEN OPPORTUNITIES FOR WA

## **Scholarship research through the Minerals Research Institute of Western Australia (MRIWA) is targeting sulphur in an attempt to make gold exploration more efficient and productive.**

The sulphur isotope mapping program, conducted by PhD student Stefano Caruso, is part of the massive Distal Footprints of Giant Ore Systems project examining the Capricorn region between the Yilgarn and the Pilbara Cratons.

Ore samples from northern Western Australia are being analysed for sulphur concentrations, considered to be "fingerprints" for gold.

The project under way at the University of Western Australia is being funded through a A\$90,000 scholarship awarded to Mr Caruso.

It is one of 10 MRIWA research scholarships awarded in 2015 with subjects including a cost-saving method of nickel ore processing, and deep mining technology.

"The State Government and industry have invested more than A\$50 million in MRIWA-endorsed research," MRIWA Project Manager Dr Penny Atkins said.

"By next year, the institute will have invested about A\$1.3 million in scholarships."

Dr Atkins said that scholarships were vital in encouraging researchers to come up with the ideas and technology needed to make new mineral discoveries in Western Australia.

"Exploration targets are now deeper and harder to get to," Dr Atkins said.

As part of MRIWA's scholarships program for PhD candidates and final-year Honours students, 10 outstanding students were awarded scholarships in April 2015 worth a total of A\$565,000.

Through the Department of Mines and Petroleum (DMP), the State Government also funds Western Australian School of Mines (WASM) science and technology scholarships.

In 2015, DMP awarded scholarships with an annual value of A\$6000 to eight full-time students enrolled in an undergraduate Bachelor of Engineering or Bachelor of Science course at WASM.

The scholarships are renewed annually and are maintained through the four-year undergraduate course, as long as the student maintains satisfactory grades.

Since its introduction in 1985, the WASM scholarship program has provided more than A\$1 million in funding to support future mining leaders. ■



*Mines and Petroleum Minister Bill Marmion presents Stefano Caruso with his scholarship.*

## AGRICULTURE

**East Kimberley – Ord – Ord/East Kimberley Expansion Project****WA STATE GOVERNMENT**

The State Government has invested \$322m to construct irrigation channels, roads and off-farm infrastructure on the Ord lands in the East Kimberley Region. A Development Agreement has been signed with Kimberley Agricultural Investment (KAI) for the lease and development of 13,400ha of irrigation land in the Goomig and Knox Plain areas. KAI, a subsidiary of China's Shanghai Zhongfu Group, proposes to establish a sugar industry in the Kununurra region and has begun its first round of cropping on the Goomig land. The State is also currently working towards the release of approximately 5,000ha of Ord West Bank and Mantinea lands via a Request for Proposal process.

Expenditure: \$322m.

## HEAVY MINERAL SANDS

**Keysbrook – Heavy Mineral Sands Mine****MZI RESOURCES LTD**

The Keysbrook Mineral Sands Project, located near the township of Keysbrook approximately 70km south of Perth, commenced heavy mineral concentrate (HMC) production on 29 October 2015, three weeks ahead of schedule. The project involved the construction of a new mine and wet concentration plant, and upgrades to the existing mineral separation (MSP) plant owned by Doral Mineral Sands in Picton, near Bunbury. Secondary processing of approximately 110,000tpa of Keysbrook HMC commenced at the Picton MSP plant in November 2015, with first sales targeted for late December 2015. The project is expected to produce 67,500tpa of leucoxene products and 28,700tpa of zircon concentrate, which will be exported from the Bunbury Port. The Keysbrook deposit has a mineral resource of 90.3Mt at an average grade of 2.2 per cent total heavy mineral (THM) and an ore reserve of 670,000t THM, which underpins the first 5.5 years of operations. Based on the total mineral resource estimate, the potential mine life could be more than 15 years.

Expenditure: \$70m.

Employment: Construction: 100; Operation: 50

## IRON ORE PROCESSING

**Pilbara – Cape Preston – Sino Iron****CITIC PACIFIC**

The Sino Iron project is located at Cape Preston, 100km south west of Karratha. When completed, it will be the largest magnetite mining and processing development in Australia, with a mine life of more than 25 years. The first shipment of magnetite concentrate to China occurred in late 2013. Since then, optimisation of the first two production lines has occurred. Line 3 is currently in load commissioning, with Line 4 to follow shortly. Commissioning of the final two lines will commence in 2016. On completion, the project will comprise in-pit crushers, a 29km slurry pipeline, a pellet plant and annual capacity to produce up to 24 million tonnes of magnetite concentrate. The downstream processing facility has required significant investment in dedicated supporting infrastructure including a new port facility, a 51 giga-litre desalination plant and a 450 megawatt combined cycle gas fired power station.

Expenditure: \$11.1b.

Employment: Construction: 4000; Operation: 1000

## OIL &amp; GAS DEVELOPMENTS

**Kalgoorlie – Tropicana Gas Pipeline Project  
ANGLOGOLD ASHANTI/APA GROUP JOINT VENTURE**

APA Operations Pty Ltd, a subsidiary company within the APA Group (APA), has commenced construction of a \$140m 294km high pressure natural gas pipeline to convey gas from the Murrin Murrin gas lateral pipeline (licence PL 36) to the Sunrise Dam Gold Mine and to the Tropicana Gold Mine. Both gold mines are operated by AngloGold Ashanti Australia (AGA). The pipeline is called the Eastern Goldfields Gas Pipeline (EGP) and all licences and government approvals are in place. Construction on the pipeline commenced in May 2015 and is expected to be completed by January 2016 with first gas delivery planned for early 2016. A pipeline licence (PL 108) was granted on 29 January 2015 under the *Petroleum Pipelines Act 1969*.

Expenditure: \$140m.

Employment: Construction: 250

## AMMONIUM NITRATE

**Pilbara – Burrup Industrial Estate Site D – Yara  
Pilbara Nitrates****YARA INTERNATIONAL ASA**

Yara Pilbara Nitrates Pty Ltd (YPNPL) is an incorporated joint venture between Yara International ASA (Yara), Orica Limited (Orica) and Apache Corporation (Apache). YPNPL has executed an Engineering, Procurement and Construction (EPC) contract for the construction of a world class circa 350,000tpa Technical Ammonium Nitrate (TAN) plant to be located on the Burrup Peninsula. Ammonia feedstock will be supplied from Yara Pilbara Fertilisers Pty Ltd (YPFPL), which operates its facility directly adjacent to the proposed location for the new TAN plant. Yara will be the operator of the TAN plant and Orica will manage the product sales and distribution of the TAN product. Yara and Orica each have a 45 per cent interest in the joint venture and Apache the remaining 10 per cent. It is intended that all manufactured product will be sold into the Pilbara region. Work on the project has commenced and it is expected that the new plant will be commissioned in late 2015, with nameplate capacity production rates expected by the end of 2016.

Expenditure: \$800m.

Employment: Construction: 500; Operation: 65

## IRON ORE

**PILBARA – ROY HILL IRON ORE MINE &  
INFRASTRUCTURE****ROY HILL HOLDINGS PTY LTD**

Roy Hill Holdings is a private company which is majority-owned by Hancock Prospecting Pty Ltd, and also has key international investment partners with strategic steel-making interests. It is developing the Roy Hill iron ore project located 115km north of Newman. This project is expected to come into production in 2015 and will produce 55Mtpa of iron ore for 20 years following ramp-up. The project includes mine development, mine processing infrastructure, a new heavy-haul railway, and significant new port facilities at Port Hedland's inner harbour. All primary environmental and other approvals have been secured. Construction of the 344km heavy haul railway is completed and construction of the mine, port infrastructure is considerably advanced with the project passing 92 per cent completion in July 2015. Contractor and Owner/Operator mining is underway with more than 12Mt of ore stockpiled. Roy Hill secured the world's largest ever debt financing package for a mining project of US\$7.2b in March 2014.

Expenditure: \$10b.

Employment: Construction: 5300; Operation: 2000

## OIL &amp; GAS DEVELOPMENTS

**Carnarvon Basin – Greater Western Flank  
Phase 1****WOODSIDE ENERGY**

The Greater Western Flank Phase 1 Project will develop the Goodwyn GH and Tidepole fields, via a subsea tie-back to the existing Goodwyn A Platform. The project remains on schedule for start-up expected in early 2016.

Expenditure: \$2.5b.

**Carnarvon Basin – Persephone Project****WOODSIDE ENERGY**

Woodside Energy Ltd, as operator of the North West Shelf Joint Venture is developing the Persephone gas field. The development involves two subsea wells and an 8km subsea tieback to the existing North Rankin Complex. Fabrication activities and offshore brownfield work has commenced, with start-up expected in early 2018.

Expenditure: \$1.2b.

**Carnarvon Offshore Basin – Barrow Island –  
Gorgon Project****GORGON JOINT VENTURE**

The Gorgon Foundation Project on Barrow Island, now in its sixth year of construction, is a three train LNG development with a nameplate capacity of 15.6Mtpa and includes a domestic gas plant capable of delivering at least 300TJ/d of gas to the mainland. Cost estimates for the project construction have been reassessed at \$55b (US\$54b) following a cost and schedule review conducted by Chevron in December 2013. The project involves the processing of gas from both the Gorgon and Jansz/lo gas fields and includes potentially the largest commercial CO<sub>2</sub> geosequestration project in the world. Train one start up and first shipments of LNG are expected toward the end of 2015 with trains two and three being commissioned in 2016.

Expenditure: \$55b.

Employment: Construction: 8000; Operation: 300

**Pilbara – Wheatstone LNG Development****CHEVRON AUSTRALIA PTY LTD**

Chevron Australia Pty Ltd as Operator of the Wheatstone Project is currently working towards the construction of two LNG trains, a domestic gas plant and port facilities at the Ashburton North Strategic Industrial Area near Onslow. The Project will initially produce 8.9Mtpa of LNG and have a 200TJ per day domestic gas plant connected to the Dampier-to-Bunbury Natural Gas Pipeline. The construction schedule is approximately 60 per cent completed. The first export of LNG is scheduled for late 2016.

Expenditure: \$29b.

Employment: Construction: 6500; Operation: 400

## POWER STATIONS

**Boodarie Industrial Estate – South Hedland  
Power Station****TRANSALTA**

In July 2014, TransAlta Energy (Australia) Pty Ltd announced it will build, own and operate a 150 megawatt power station in South Hedland's Boodarie Industrial Estate. The plant will consist of a combined cycle gas plant, which is a reliable, highly-efficient, low-cost and clean process of generating electricity, featuring both natural gas and steam turbines. The \$570 million investment will help meet the future energy needs of the region through



a 25-year agreement with both Horizon Power and Fortescue Metals Group. The plant is being designed to allow for expansion and there is a possibility that other customers may be added in the future. Construction commenced in February 2015 and is expected to create up to 250 jobs. Full commissioning is expected to be complete mid-2017.

Expenditure: \$570m.

Employment: Construction: 250; Operation: 20

## AGRICULTURE

### East Kimberley – Project Sea Dragon

#### SEAFARMS GROUP LIMITED

Seafarms Group is a Queensland-based producer of farmed prawns. Seafarms proposes to invest up to US\$1.45b over the next eight years in Project Sea Dragon, a large scale, integrated, land based aquaculture project to produce black tiger prawns for export markets in Asia. The aquaculture component of the project will be located in the Northern Territory and is planned as a staged development commencing with 1,000 hectares of ponds and supporting infrastructure. In Western Australia a processing plant is proposed for Kununurra, export facilities in Wyndham and a founder stock centre in Exmouth, creating approximately 600 direct jobs when fully operational. A Final Investment Decision on Stage 1 of the project is expected in mid-2016 and financial close by the end of 2016.

## AMMONIA/UREA

### Shotts Industrial Park – Collie Coal To Urea

#### PERDAMAN CHEMICALS AND FERTILISERS PTY LTD

Perdaman Chemical and Fertilisers Pty Ltd is proposing to develop a \$3.5b coal to urea plant at the new Shotts Industrial Park, near Collie. The plant will use proven coal gasification and fertiliser production technologies. Around 2.7Mtpa of coal will be used to produce approximately 2Mtpa of urea, primarily for export. The urea will be transported to Bunbury Port by rail. The company has received all its environmental and all other approvals from both the Western Australian and Commonwealth Governments. The project is on hold as the company is still seeking to finalise a suitable domestic coal supply arrangement prior to achieving its financial investment decision.

Expenditure: \$3.9b.

Employment: Construction: 2000; Operation: 200

## HEAVY MINERAL SANDS

### Shark Bay – Coburn Zircon Project

#### STRANDLINE RESOURCES LIMITED

Strandline proposes to develop the Coburn zircon project, located south of Shark Bay and approximately 250km north of Geraldton. It contains total ore reserves of 308Mt at an average grade of 1.2 per cent heavy minerals, all of which lie within the portion of the project area that has received government environmental approvals for mining. At a mining rate of 23.4Mtpa, the project is expected to produce 49,500tpa of zircon, 109,000tpa of chloride ilmenite and 23,500tpa of a mixed rutile-leucocoxene over its 19 year mine life. The company has secured all of the approvals required to commence mining and processing operations at Coburn, and is continuing to pursue discussions with parties interested in becoming a strategic partner in the project.

Expenditure: \$173m.

Employment: Construction: 170; Operation: 110

## INFRASTRUCTURE

### Bunbury – Multi-User Bulk Terminal Facility – Port of Bunbury

#### LANCO RESOURCES AUSTRALIA PTY LTD

Lanco Resources Australia Pty Ltd proposes to construct a 15Mtpa multi-user bulk terminal facility located at the Berth 14A site within the inner harbour of the Port of Bunbury. The facility will include ship loading for up to 85,000 tonnes, fully covered and dust suppressed conveyor galleries, a storage shed, with internal stacker reclaimer, up to 750m LOA, 140m wide and 40m high. The train unloading and rail loop load in facility will be able to accommodate coal, iron ore, bauxite and other bulk ore materials. The Terminal will have capacity to expand. Environmental approvals have been obtained with construction expected to commence by early 2017 ready for operation in 2020.

Expenditure: \$400m.

Employment: Construction: 750; Operation: 100

### Dampier Peninsula – Browse LNG Precinct

#### WA STATE GOVERNMENT

The State Government is developing the Browse Liquefied Natural Gas (LNG) Precinct approximately 60km north of Broome. By focussing development at a suitable location, the Precinct will minimise the environmental footprint of gas processing and any social impacts in the region while maximising opportunities for the local community to benefit from development of the Browse Basin gas fields. The Precinct will have the capacity to accommodate at least two LNG processing operations, with a combined capacity of up to 50Mtpa. The State Government has acquired the land for the Precinct and will secure all relevant approvals to ensure the Precinct is 'project ready'.

### Pilbara – Anketell – Anketell Port and SIA (Strategic Industrial Area)

#### WA STATE GOVERNMENT

The Anketell project involves the establishment of a multi-user, multi-commodity deep water port and associated strategic industrial area (SIA) at Anketell, located 30km east of Karratha on the Pilbara coast. The port and associated infrastructure will be a proponent-funded but State controlled Port which will be managed and operated under the *Port Authorities Act 1999*. The strategic industrial land will fall under the jurisdiction of the Western Australian Land Authority (LandCorp). During its initial phase, it is expected that Anketell will be an iron ore export facility and that, at its peak capacity, not less than 350Mtpa will be exported to customers, mainly in Asia. A number of iron ore producers with mining assets in the Pilbara have expressed interest in using the planned facilities at Anketell. It is likely that the Port will be developed in stages to accord with the development of the various mining operations which are located throughout the Pilbara. The Anketell Port Master Plan was released in June 2014 and a downloadable copy can be obtained from the DSD website.

## IRON ORE

### Pilbara – West Pilbara Iron Ore Project

#### API MANAGEMENT PTY LTD

The Australian Premium Iron Joint Venture is proposing to develop the West Pilbara Iron Ore Project. Stage 1 of the project is based on the production of 40Mtpa of direct shipping iron ore from deposits, including Red Hill and Mt Stuart deposits, located 35-80km south west of Pannawonica. The ore will be transported by a

new heavy haul railway for export via the proposed multi-user 350Mtpa port at Anketell. Subject to the successful completion of feasibility and environmental studies, and receipt of government regulatory approvals, the company anticipates construction to commence following a decision to proceed by the joint venturers and completion of funding arrangements. State and Federal environmental approvals for the mine, rail and port elements of the project are in place.

Expenditure: \$7b.

Employment: Construction: 3500; Operation: 1000

## NICKEL

### Mt Windarra – Windarra Nickel

#### POSEIDON NICKEL NL

Poseidon Nickel Ltd has submitted a project development proposal for assessment for the redevelopment of the Mt Windarra underground nickel mine and associated project infrastructure at Mt Windarra.

Expenditure: \$12m.

Employment: Construction: 50; Operation: 100

## OIL & GAS DEVELOPMENTS

### Canning Basin – Buru Canning Basin Tight Gas

#### BURU ENERGY

The Buru Energy/Mitsubishi joint venture (JV) has recently completed its Laurel Formation Tight Gas Pilot Exploration (TGS) Program to test the commercial potential of the Laurel Formation, a large onshore natural gas resource located in the Canning Basin. This program involved the hydraulic stimulation of two wells on and near Noonkanbah Station in the Canning Basin. This follows the successful test hydraulic stimulation of the Yulleroo 2 well in 2010. During the most recent program, up to 100 people were involved in the works including more than 30 Traditional Owners from nearby Yungngora (Noonkanbah) community. Tests of the wells are ongoing to determine gas flows from the target reservoir. Preliminary results from the tests are encouraging. A groundwater monitoring program has been ongoing throughout the program and confirmed there have been no impacts of the program on groundwater. Should the resource prove to be commercially viable, gas from the Canning Basin will provide energy security to WA domestic and industrial markets. Under a State Agreement the JV, upon proving up sufficient reserves, is obligated to supply into the WA domestic market at least 1,500 petajoules of gas.

Expenditure: \$40m.

Employment: Operation: 30

## URANIUM

### Northern Goldfields – Yeelirrie –

#### Yeelirrie Uranium

#### CAMECO AUSTRALIA PTY LTD

Cameco Australia proposes to develop the Yeelirrie project in the North-eastern Goldfields, near Wiluna. The project entails open cut mining of shallow deposits of uranium ore, treatment in a plant to be established at the site, and development of associated infrastructure. The project will process up to 2.4Mtpa of uranium ore over about 17 years. The resultant uranium oxide will be transported to South Australia by road for export to overseas markets. The environmental assessment process has commenced. Cameco will advance the project at a pace aligned with market conditions.

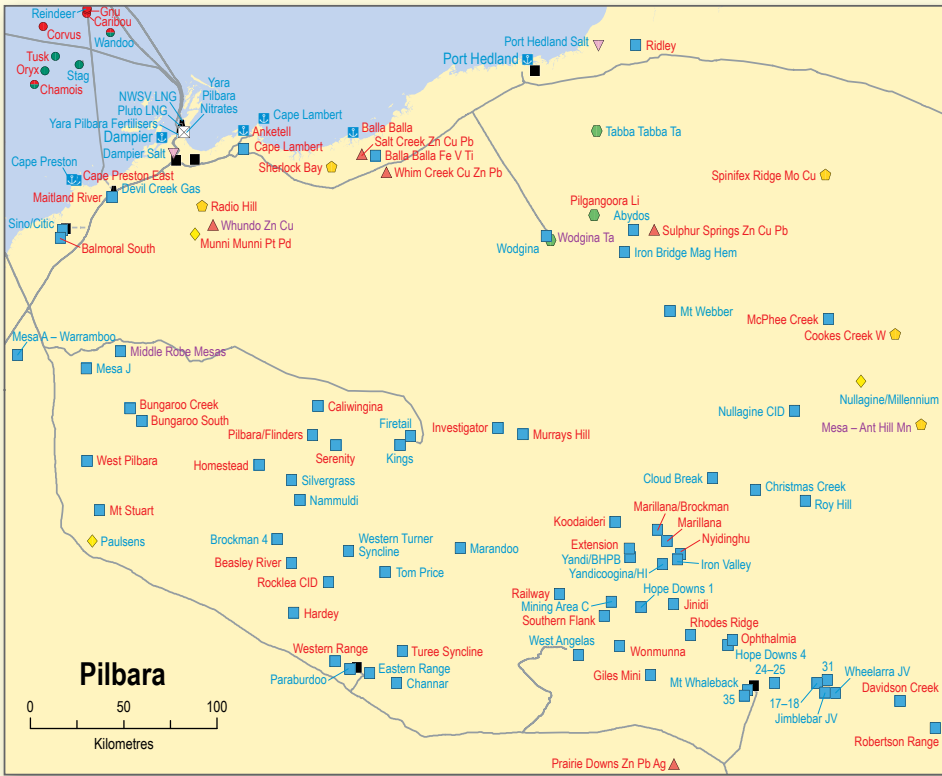
Employment: Construction: 500; Operation: 225





# Major Resource Projects

December 2015



Mineral symbols	Commodities
◆ Precious metal Au (or as shown)	Ag..... Silver
◆ Steel alloy metal Ni (or as shown)	Al..... Alumina
◆ Speciality metal Ti-Zr (or as shown)	Au..... Gold
▲ Base metal	Chert..... Chert
■ Iron	Cu..... Copper
■ Alumina All sites are bauxite	Fe..... Iron
● Coal and lignite	Hem..... Hematite
▽ Industrial mineral	K..... Potassium
◊ Processing plant	Kln..... Koolinite, Kaolin
Petroleum symbols	Li..... Lithium
● Gas field	LNG..... Liquefied natural gas
● Oil field	LPG..... Liquefied petroleum gas
● Oil and gas field	Mag..... Magnetite
◊ Significant gas discovery	MgCO <sub>3</sub> ..... Magnesite
▲ Processing plant	Mica..... Mica
— Oil / gas pipeline, operating	Mn..... Manganese
- - - Oil / gas pipeline, proposed	Mo..... Molybdenum
Infrastructure	Ni..... Nickel
■ Power plant	Pb..... Lead
▬ Irrigation / water / desalination	Pd..... Palladium
■ Port	Phos..... Phosphate
	Pt..... Platinum
	REE..... Rare earth elements
	Sisd..... Silica sand
	Ta..... Tantalum
	Tic..... Talc
	Ti..... Titanium
	V..... Vanadium
	W..... Tungsten
	Zn..... Zinc
	Zr..... Zirconium

Data for offshore Commonwealth controlled waters is up-to-date as of December 2013. Enquiries for latest information for Commonwealth controlled waters is available from the National Offshore Petroleum Titles Administrator (NOPTA) at <info@nopta.gov.au>



### Project labels:

Projects operating or currently under development with an actual or anticipated value of production greater than A\$10 Million are shown in blue

Proposed or potential projects with a capital expenditure greater than A\$20 Million are shown in red

Projects under care and maintenance are shown in purple



Kwinana-Rockingham	
☒	Alumina refinery
☒	Ammonium nitrate
☒	Bulk terminal
☒	Cement and lime
☒	Chlor alkali
☒	Desalination
☒	Fused alumina
☒	Fused zirconia
▲	LNG
▲	LPG
☒	Nickel refinery
▲	Oil refinery
☒	Power station
☒	Sodium cyanide
☒	Titanium pigment
☒	Zirconia

