# THE CCF EARTH AWARDS

EXCELLENCE IN CIVIL CONSTRUCTION

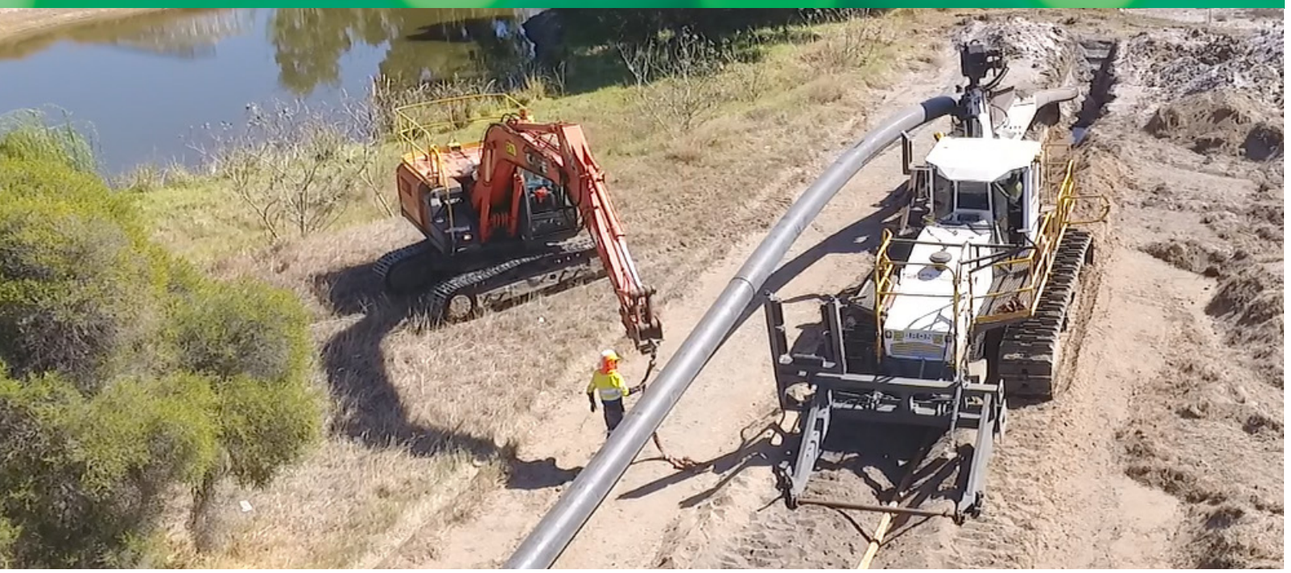
2019

## CCF WA 2019 Earth Awards
# SPECIAL FEATURE

THE CCF EARTH AWARDS
EXCELLENCE IN CIVIL CONSTRUCTION

# WINNER

## EXCELLENCE IN CIVIL CONSTRUCTION: PROJECT VALUE UP TO $2M



# CAPE UTILITIES

## 450MM PE WASTEWATER PRESSURE MAIN UPGRADE

Client: Water Corporation

An upgrade was required to an existing Wastewater Pressure Main. Part of the pipe route was through a section of Ramsar listed, internationally significant and environmentally sensitive Bush Forever land, which necessitated installation with the least impact possible.

The pipeline corridor was situated in an area that becomes inundated with water that feeds a wetland during Winter months. To minimise the need for clearing and disturbance of potential acid sulphate soil within the wetlands catchment, it was determined that the most environmentally-friendly option would be to use Cape's EcoPlough to install the pipeline underground, eliminating the need for conventional trenching methods.

The Bush Forever site was also sensitive to Phytophthora (dieback), which necessitated a stringent clean-down protocol prior to vehicles entering the area, and prevention of soil movement in a Westerly direction along the pipe route.

The impact on the environment if the pipeline failed was significant, with re-works necessitating further clearing, and excavation within potentially acid sulphate soil. Ensuring the quality and integrity of the pipeline prior to, and after burial was a critical factor in proactively protecting the environment from damage due to construction activities.

Cape achieved a first for underground asset installation in Western Australia by installing a large diameter, high wall thickness polyethylene (PE) pipeline with a high degree of accuracy through a highly sensitive ecological community with no environmental damage. The EcoPlough installed the pipeline from start to finish in 3.5 hours, however months of complex machine modifications, and site preparation prior to the installation works was critical to the success of the operation.

While the environmental constraints associated with the sensitive area required careful management, the most significant factor in the success of the project was ensuring that the modifications required to enable the EcoPlough to install a large diameter pipe with a substantial wall thickness were successfully completed. Early recognition of the complexities involved in accurately placing the pipe into the ground while moving a large structure through the soil allowed the extensive engineering and testing processes to be given the priority needed for successful pipe installation.

Significant machine modifications were required to enable the plough to install large diameter PE pipe with a significant wall thickness (PN16). Cape engaged a team of mechanical fabricators to undertake the modifications and procured a site where the plough could be tested, and the modifications streamlined. Initial modifications caused significant drag through the soil, which combined with the resistance of the pipe to bend through the plough's structure exceeded the capacity of the plough to reliably install the test pipe. Several refinements to the EcoPlough and subsequent field testing were critical to ensuring the pipeline was installed efficiently and effectively in the environmentally sensitive area.

Clearing of vegetation was restricted to a maximum of 0.1ha, and a very tight pipeline corridor (5m) restricted Cape's ability to



perform simultaneous activities within the work area, as there were limited opportunities to turn plant, vehicles, and trailers around along the track. For this reason, activities on the site needed to be carefully coordinated to ensure that activities proceeded without the need for works to proceed concurrently alongside each other.

Very loose soft sand made traction difficult; a number of significant modifications to the EcoPlough were made to overcome this, including extension of the track footprint, and modifications to the plough's tail section to minimise friction as it pulls through the ground.

The Client Project Manager stated: "The EcoPlough enabled us to traverse an environmentally sensitive bushland with little or no disturbance. Cape were able to execute the installation of a 450DN PE pipe within an existing firebreak exactly as planned and approved by the Minister for the Environment. With no clearing, open excavation or dewatering required, the EcoPlough fulfilled its purpose of completing the task with little or no impact on the sensitive site. Cape and the EcoPlough are a valuable asset in meeting sensitive environmental challenges."

Cape has demonstrated that it is feasible to utilise the EcoPlough to install large diameter pipe in an efficient manner. Most importantly, by the constant diligence of all personnel involved, the Cape team accomplished the complicated project through a highly important sensitive ecosystem with no environmental damage.

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# FINALIST

## EXCELLENCE IN CIVIL CONSTRUCTION: PROJECT VALUE UP TO $2M

# ASPHALTECH

## RESURFACING OF BARBAGALLO RACEWAY & CONSTRUCTION OF TURN 3 CHICANE

Client: WA Sporting Car Club

In 2004 Asphaltech successfully completed its first resurfacing project for WA Sporting Car Club (WASCC) at Barbagallo Raceway. After 15 years of racing, the asphalt surface needed another resurfacing and after evaluating all the tender submissions WASCC decided to again award the contract to Asphaltech.

WASCC also needed to construct a new chicane at Turn 3 to comply with national safety standards for racing motorbikes. These works were also awarded to Asphaltech.

WASCC could not give Asphaltech possession of site until after December 23, 2018, and needed the track resurfaced as quickly as possible to allow maximum curing time prior to the opening of the race season on March 1, 2019. This meant resurfacing had to be completed in the week commencing January 14.

Asphaltech determined that by working over the Christmas break, all works could be completed in time, although it would be very tight, with challenges including:

325m of kerbing needed to be replaced prior to final asphalt surfacing but ideally after profiling.

As part of Asphaltech's quality obligations under the contract, it needed to carry out roughness testing with a survey vehicle prior to profiling, and the only vehicle available was in the eastern states

The chicane had to be constructed prior to resurfacing of the track to ensure that there was no construction traffic on the newly resurfaced track.

All employees were booked to shut down for Christmas break from the 23rd December 2018 until the 7th January 2019.

The chicane works included construction of a race type Melbourne Kerb. No local concrete or kerbing contractors had done this kerb before.

Subbase material (limestone) was not available between 24th December and 7th January from Quarries nearby.

Asphaltech found some keen employees who were willing to work over the Christmas break, and were able to meet all these challenges through careful sequencing of the works.

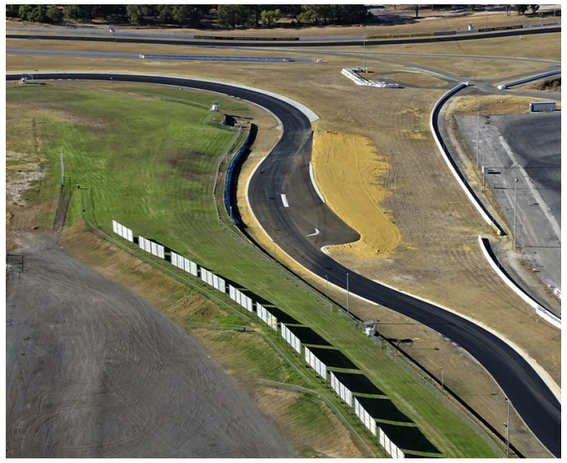
Asphaltech had resurfaced the track in 2004 using conventional 10mm Dense Graded Asphalt (DGA), however this time it offered an alternative innovative mix, its 'Race Spec' 7mm Stone Mastic Asphalt (SMA). This mix was accepted by WASCC and so Barbagallo Raceway became the only racetrack in Australia to have SMA.

Asphaltech proposed using SMA because of its excellent skid resistance (even in the wet), its durability/long life and its high crack resistance.

Having produced and laid over 1 million tonnes of SMA over the past 20 years, Asphaltech knew that SMA was a far superior surface and had complete confidence in its characteristics.

SMA is made using a single size stone (7mm) with a "mastic" which is made up of bitumen, filler and fibre. It has a much higher



bitumen content than DGA. There are only four other racetracks in the world that have a SMA wearing course, and WASCC needed some convincing to use it. To their credit, they were willing to try something different and are now reaping the benefits.

The team at WASCC was very happy with the smoothness and rideability of the track. Asphaltech was also keen to hear the feedback from the race car drivers. After all, the main aim for the newly laid surface was for it to be smooth to drive on, have good grip around corners and, ultimately, for the race cars to be able to go faster around the track as this is much more entertaining for the fans.

Several class records were broken on the weekend that the track re-opened. However, the true test of the track's success was to see how it performed with the V8 Supercars on May 2-4.

The V8 Supercars beat the lap record by 3 seconds and the drivers found the track so grippy that they had to adjust their racing to brake at the corners later.

2018 V8 Supercars Champion Scott McLaughlin told *Supercars.com* that his Mustang felt 'like a Formula 1 car' in practice, while teammate Fabian Coulthard added: "It's awesome. I wish every track was like this because you can actually drive the car the way you want to."

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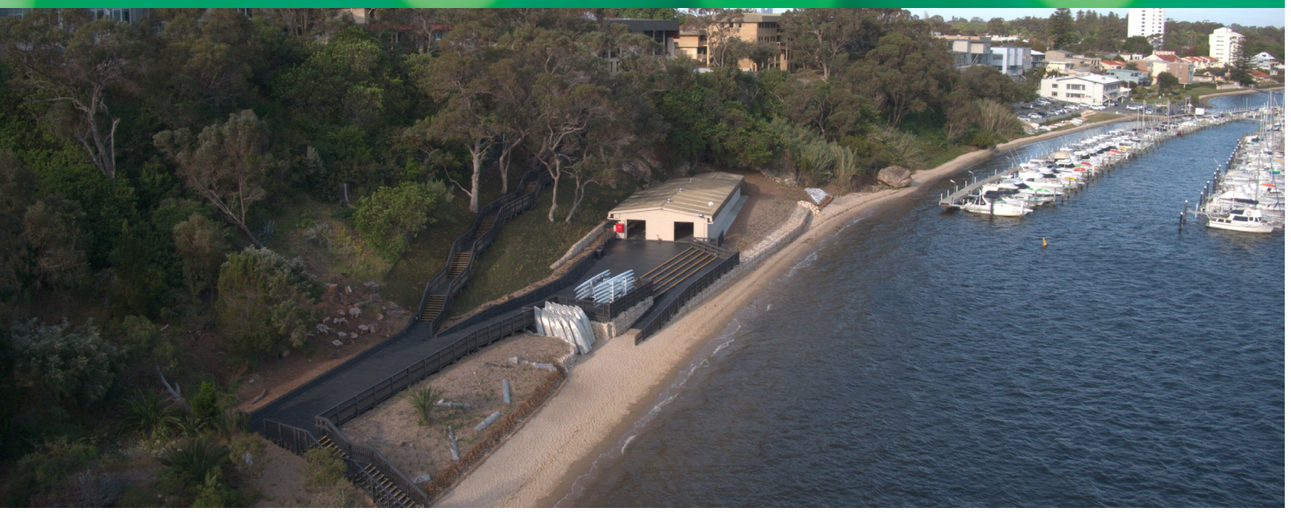


# GMF CONTRACTORS

## CHRIST CHURCH GRAMMAR SCHOOL BOATHOUSE RAMP CIVIL WORKS

Client: Vital Building

Working in a difficult to access and environmentally sensitive area, GMF replaced a steep and narrow limestone/sand bush track with a safe access walkway, service deck, ramp, and landing to Christ Church Grammar School's rowing boatshed on the Swan River shoreline.

The project brought numerous challenges given its location on the Swan River foreshore, adjacent to a steep sandy limestone embankment, and unsuitable access from Queenslea Drive through school property.

All large plant/machinery had to be transported to the Swan River foreshore via barge from Fremantle. Timing and logistics management was critical as loading had to be performed in line with the tides to allow plant and machinery to fit under bridges.

Careful planning and sequencing works had to be undertaken due to the tides. To enable gabion basket, shoreline earthworks and footing construction – some of which was below sea level – GMF installed water barriers, which helped reduce the effects of tidal movements on works by preventing water infiltrating the shoreline, and also enabled works below the sea level at high tides.

Installing water barriers in a location known for strong tides brought numerous potential risks. GMF and Vital Building researched tidal movements and surveyed the river depth meticulously, concluding that the advantages of installation outweighed the disadvantages. Essentially the barriers not only helped control potential environmental impacts caused by tidal movements, but also captured deleterious materials created by the works, which could then be removed safely.

GMF dry hired and installed the 230-tonne water-filled barriers along the shoreline with a 20t excavator and team of ten people working in and out of the water. The barriers were installed on geofabric with over 300 hessian bags (filled on site) to keep the geofabric in position while the barriers were installed.

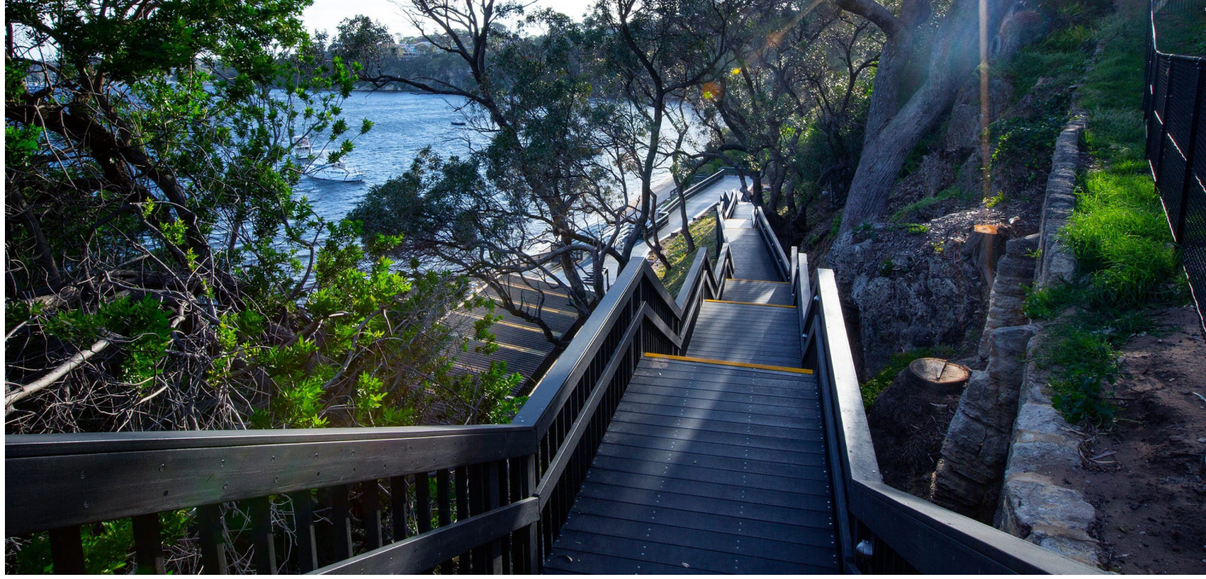
Site dewatering with a sump pump was required during local excavations for the footings and gabion mattresses. GMF came up with a clever enhancement by using the dewatering process to recharge and fill the water barriers to maintain their height and volume.

Early delays encountered during the site mobilisation and water barrier installations had the potential to push out the critical path and overall duration of the project. To mitigate this risk, GMF installed a silt curtain. This enabled the 20t excavator to start demolishing the boat ramp without the water barrier in place. The silt curtain ensured any fines/debris was contained and not washed into the Swan River. Every effort was made to minimise potential impacts to the river and river foreshore.

GMF identified and reused material where possible to support environmental sustainability and to reduce the costs and issues associated with importing material to site due to the difficult location and steep embankment access.

Items recycled included tree mulch and stumps for reuse in landscaping; crushed concrete ramp and concrete pavers for reuse in the gabion baskets; and limestone rock broken down and crushed, also for reuse in gabion basket construction.





Careful planning was required for recycling the crushed concrete and limestone. The concrete was crushed as far away as possible on the lower foreshore. The selected crushed concrete used in the gabion baskets was also washed in a bunded area with silt poly sheet laid to collect the dust and fines.

No allowances were made for the importation of limestone as it had been anticipated that all existing limestone and concrete would be reused for the gabion mattresses and baskets. However, as there was a shortfall, approximately 460t of limestone spalls was required. Delivering the limestone by barge was deemed too expensive and time consuming, so it was delivered to the top of the site. This meant mobilising additional bobcats to slowly track down the steep embankment, making a careful descent of 90m to the foreshore. This necessitated detailed planning and discussions with other subcontractors, as access for workers by foot was needed at all times. Vital Building arranged a temporary scaffold staircase through an old pathway for the safe passage of workers.

This was an extremely difficult project site mainly due to its location down a steep embankment adjacent to the Swan River. Ensuring easy flowing access within site, movement of plant and managing many subcontractors required careful planning and logistics.

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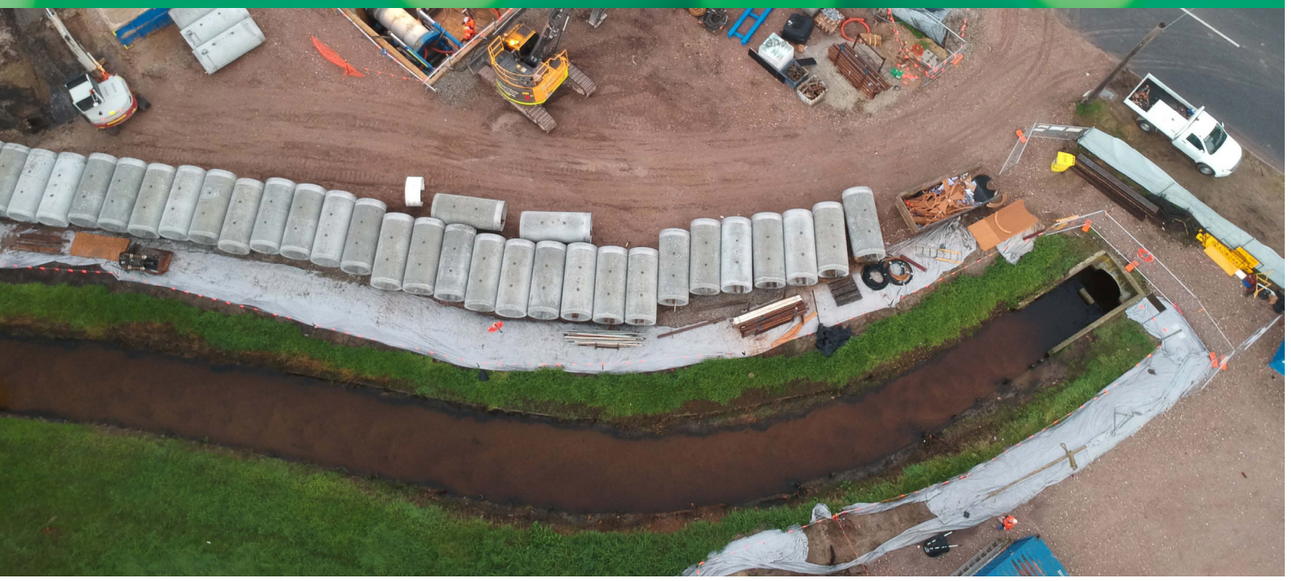

# ROB CARR PTY LTD

## BAYSWATER MAIN DRAIN RELOCATION

Client: Salini Impregilo-NRW JV (SI-NRW) / Public Transport Authority

The Bayswater Main Drain services the stormwater discharge of the Bayswater industrial area, flowing through the Bayswater residential area, the Eric Singleton Bird Sanctuary and ultimately into the Swan River.

These works, on the critical path for the Forrestfield-Airport Link project Bayswater dive structure, allowed the replacement of the Main Drain pipeline underneath the existing Perth-Midland line to facilitate the new dive structure location.

Rob Carr was engaged to perform the following works:

- Two 106m Micro-tunnel drives of DN1100 Reinforced Concrete Jacking Pipe
- Two 26m open cut DN1200 Reinforced Concrete Pipe
- Inlet and outlet structures
- Bypass of DN1200 main drain
- 70m of post and rail shoring driven 8 m deep (excavation 5.5m deep)
- Stabilise power pole
- Decommission existing main drain
- Regrade up stream drainage channels into new inlet structure
- Construct new road drainage on both inlet and outlet sides
- Dewatering of inlet and outlet sides (caisson removed dewatering requirement on inlet side)

A variation was awarded to complete the public safety and site security requirements at both the launch and receival work fronts.

The original design called for a launch pit constructed from sheet piles, requiring dewatering. Rob Carr's proposal to use a caisson presented multiple benefits. It allowed the TBM works to be performed from a dry pit, and it also formed a more integral structure for work and access. Most importantly, the design of the caisson allowed for a conversion from a TBM launch pit to the headwall structure and apron for the new main drain, resulting in environmental, cost and time benefits. Rob Carr organised the design of the required caisson and constructed it within the very short lead-in available.

Not only was the rail closure a set deadline, it required the micro-tunnel boring machine (MTBM) to advance approximately 40m underneath Railway Parade towards the rail corridor prior to making the crossing. Due to the chance of settlement around the pipeline, this pre-crossing work needed to be performed immediately prior to the rail crossing, leaving a very small window to troubleshoot, fault-find or repair if an issue was encountered.

Understanding the critical nature of the task ahead, Rob Carr mobilised a large MTBM crew on both day and night shifts to ensure continuity of works. The first pipeline successfully crossed the rail corridor in four hours of the allowable 24 thanks to the exceptional efforts of the slurry crews and the diligence of all involved in planning prior to the closure.

Immediately prior to the launch of the second pipeline it became apparent that there were alignment issues. Had Rob Carr tunnelled on the design alignment, the pipeline would have




intersected the existing main drain immediately prior to the receival pit. This was remedied by quickly mobilising a crane to site and re-setting the pipe jacks on a narrower alignment to enter the receival pit closer to the first micro-tunnelled pipeline.

The receival area was immediately underneath a wide and congested service corridor. Not only were overhead power and communication lines nearby, but below ground there was communications, water, sewer and gas that became a delicate roof structure to the receival and bypass works occurring below. The required excavation was also adjacent to the footing of a power pole supporting the overhead services.

A post and rail shoring system was used to allow flexibility of support around the services and allow openings for the services and pipeline receival. However, installing a post and rail system was not straightforward. The overhead services combined with the operating envelope of the piling rig restricted the lengths of piles to a primary length of 4m, with following sections limited to 2m and being welded in-situ to reach the required length.

Rob Carr's project team worked closely with the clients to ensure this critical project could be performed within the rigid rail closure window, without compromising the quality of the final asset, or increasing the risk of harm to the environment or personnel.

THE CCF EARTH AWARDS
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# WESTFORCE CONSTRUCTION

## DESIGN AND CONSTRUCT PICTON SUBSTATION ROOF

Client: Western Power

Westforce was contracted by Western Power to undertake a design and construct roof replacement for the existing relay room at the Picton Substation, which supplies power to the Bunbury area. The scope of works included asbestos removal, temporary structural design, permanent structural design and lighting, and low voltage electrical design and install. A key requirement of the job was for works to be completed whilst the relay room and its critical components remained live.

Due to the electrical hazards, the project had to be undertaken meticulously to ensure no damage or incident occurred – which could have been catastrophic for the project and its stakeholders – whilst also meeting strict planned milestone dates for electrical isolations.

The existing substation relay room was built in the late 1970s. The relay room's original timber truss and tile roof was showing signs of structural failure. A collapse would result in extended outages to the area.

The existing building is positioned between 132 kV conductors each side, with a horizontal clearance of less than 4m at each end. Due to the clearance restrictions and high safety risk, each end bay could only be constructed under planned isolations. Isolations must be planned and booked in 8 weeks in advance.

Westforce and its structural consultant PGCS conducted a structural assessment and dilapidation survey on the existing building. The report confirmed that the existing roof structure was past serviceability failure and could not be adequately reinforced for continued use. PGCS was subcontracted to conduct temporary and permanent design to Westforce design criteria. As part of the contract a temporary design was required to be undertaken to protect the existing relay room equipment. The design criteria was based on taking the full load of the roof should the structure collapse due to inclement weather, or instability caused during removal of the roof. Westforce elected to have the temporary design to also be designed as a working platform to eliminate fall potential during roof removal and replacement.

Due to the age of the relay room building, the existing ceiling and eaves were of asbestos sheet construction. In order to mitigate dust, cleaning and asbestos clearance requirements of the computer room access floor, the entire floor was sealed with builders' film prior to asbestos removal works being undertaken.

Asbestos removal was undertaken with external air monitoring on all sides of the building. Sheet fixings were removed to keep sheet sizes as large as possible and to prevent dust generation. Sheets were lowered by hand and placed in plastic lined skips, along with fixings and debris.

Following removal of all asbestos sheets, the building was thoroughly cleaned of any remaining asbestos fragments and dust which included vacuuming with a HEPA filter asbestos rated



vacuum cleaner and wet wiping down all surfaces. The results of the air monitoring taken throughout the removal and cleaning process indicated that dust was managed without issue prior to building clearance being granted.

After building clearance was granted, the timber deck was constructed in preparation for the roof removal. At the same time, steel scaffold was erected on the outside of the building to eaves height up to the allowable approach distance from the live conductors. Due to its conductive ability, the scaffold was earthed back to the substation grid to remove voltage step potential. Flagging was erected as a visual warning of conductor locations and special care via two person lifts during erection was made to ensure at no point could scaffold accidently encroach on a live conductor.

Roof replacement occurred without incident and within the tight timeframes of the two planned isolations.

The project involved multiple high-risk work challenges which were required to be overcome in order to deliver a safe and on time project with minimum disruption to the client. The project was delivered within 23 weeks, on time, on budget and with zero safety, quality and environmental incident. An additional 59 calendar days were granted to complete additional variation works as directed by the client.

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# DEGREY CIVIL

## UTAH ROAD REHABILITATION STAGE 1

Client: Pilbara Ports Authority

The Pilbara Ports Authority operates the Utah Point Bulk Handling Facility (UBHF), a multi-user bulk export facility at the Port of Port Hedland.

Utah Road was constructed in 2009 and provides the sole access between UBHF and the Great Northern Highway. Since opening, the UBHF has been a hugely successful exporting option for junior miners in the Pilbara. The emerging Pilbara lithium industry combined with the existing iron ore and manganese markets meant a consistent and relentless cycling of 170t to 235t road trains through the facility via Utah Road.

The significant increase in traffic loading from that originally envisaged for the road ultimately resulted in the pavement requiring rehabilitation.

The Pilbara Ports Authority decided to carry out this project in six stages. Stage 1 involved a 1.75km section of the road being widened and overlayed with a basecourse layer and a high specification dense-grade asphalt.

The successful delivery of this project would not only require high environmental, safety and quality standards but also the mitigation of any impact on export operations.

Any delays to the program increased the risk of the project extending into the cyclone season. Being pavement works, inclement weather as well as the obvious shut down associated with a cyclone posed a significant potential threat to the quality of the works, the completion date of the project and hence the impact on the operation of the Port.

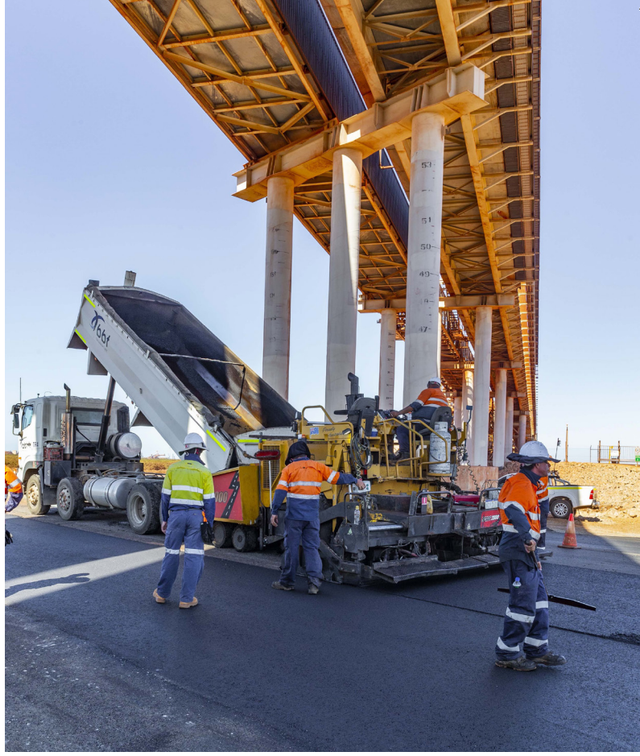
The nature of the traffic, the geometry of the road and the surrounding mangroves and soft ground meant that putting diversions and side-tracks in place was not an option. Traffic had to be carefully managed to allow passage through the works in close proximity to construction equipment.

Undulations of the existing surface required meticulous management to ensure the depth of pavement was constructed so it would bond with the underlying layer.

The scope also included the importation of roadbase on the live road and control of dust during construction, construction of widenings of the road embankment in soft mangrove conditions and the design and construction of a heavy-duty asphalt pavement suitable to carry the exceptionally high loads.

Generally, Main Roads WA sets the standards in pavement technology, but for this project Pilbara Ports Authority wrote a specification exceeding those normally required by Main Roads and other industry standards – lifting the bar on design criteria and construction compliance to levels not normally seen in WA.





Pilbara Ports Authority chose a Foam Bitumen Stabilised (FBS) basecourse pavement as a solution to the unique circumstances of heavy traffic pavements built on soft mangrove muds in a tidal setting. The FBS gave the pavement the strength it needs to handle the traffic loading and the flexibility to handle underlying movement with 100% MMDD compaction requirement.

The dense grade asphalt design again pushed the Main Roads criteria to the limits, balancing a tight compaction matrix with minimal risk for bleeding by having low voids percentages of the bitumen from within, equating to a 97% MMDD compaction ratio.

A high voltage (HV) transmission cable runs the length of the road providing critical power supplies to the UBHF. The existing records of this piece of infrastructure were not considered accurate enough to rely on and the entire cable had to be located and surveyed prior to works commencing.

The Roy Hill Overpass Structure also straddled Stage 1 works and had to be accommodated by ensuring the equipment employed on the project did not have the potential to strike the overhead structure and concrete footings. At times, machinery was working within half a metre of the structures.

Despite these and other challenges presented, DeGrey Civil completed the project safely, to a high standard, on time and on budget. The PPA's decision to award the subsequent Stage 2 and Stage 3 is indicative of the high level of customer satisfaction achieved with DeGrey Civil's 'can do attitude'.

Managing the program was critical to the success of the project. Tight timelines and sequencing meant it was of vital importance that the tasks were performed when and where they were planned for. To the credit of the whole project team including the subcontractors, the schedule was maintained and crucially the road reopened to full traffic prior to cyclone season.

DeGrey Civil's local knowledge was a key contributor to success of the project. Based less than ten minutes from the project the experienced team had a wealth of information have been involved in many projects on or around Utah Road in the past decade. Of the 11,500 people hours on the project, approximately 24% were indigenous.

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# DOWNER EDI WORKS

## ROELANDS BRIDGES REPLACEMENT PROJECT

Client: Arc Infrastructure

The Roelands Bridges Replacement Project involved the replacement of two existing transom rail bridge structures (90m and 36m spans) and lifting 150m of track between the bridges and at either end of the bridge approaches. The bridge replacements were necessary due to the expected increase in customer train loadings and to relieve temporary speed restrictions on the line.

The careful planning and execution by Downer's project teams, and the vital involvement of many others meant that the replacement of the bridges and all works in the region were completed 21 hours ahead of the planned 114-hour schedule. Works were scheduled with split shifts 24 hours a day to ensure they were completed as efficiently as possible.

Downer's team of key personnel worked tirelessly to prepare all management plans and required project documentation for early submission to and approval of the Client, Local and State Governments. The project was delivered in a high-pressure environment adjacent to the South Western Highway and had a considerable amount of attention from passing motorists, local residents and online rail enthusiasts from around the globe.

Downer obtained the appropriate approvals from Main Roads for the use of the highway, traffic management plans and heavy transport approvals. Downer also managed the coordination of Western Power and the re-diversions of high voltage transmission lines to allow access for the 300t, 450t and the 750t mobile hydraulic cranes used.

Downer self-performed all the rail work, including lifting and packing 150 metres of track up to 180mm in height to tie into the new bridge decks and lifting and packing 50mm each side of the bridges approaches to match new design levels.

Downer's early contractor involvement included Risk & Opportunity workshops with Arc. By optimising engineering and track geometry through our previous project experience, Arc was presented with a methodology that not only saved them money but provided a track alignment that did not require additional maintenance and tamping.

A key component of the project was the provision and management of the support structures required to support the live 150 nominal bore (NB) Water Corporation water main that is underslung to both bridges. The initial design provided by Arc's consultants showed an extensive support structure which required a considerable amount on site fabrication and effort to construct in place. The cost to provide the temporary support structure was in the hundreds of thousands.

Downer ultimately provided a solution that integrated into the temporary scaffolding, using adjustable jack heads that screwed up under the pipe at the same location as the existing pipe supports. The costs for integrating the pipe supports into the scaffold was minimal and did not interfere with the working platform or hinder the operations.




During the tender phase, Arc provided a heavy lift study that required the central section of the five span bridge to be lifted in place with two cranes, one on either side of the Collie River. The bridge section had to be lifted from its initial load out point and placed down onto the banks of the river. Both cranes then had to simultaneously pick up each end of the bridge section and lift into place. Downer undertook an early assessment with Boom Logistics and designed the crane pad, access and lift study that allowed for a larger crane to lift the central bridge span into place in a single lift. This reduced time, mitigated any potential risk to the Collie River and avoided the need for a complicated two crane lifting operation.

Downer encountered many technical complexities, one of which was a rail construction issue known as 'bridge buckling'. This phenomenon is common where standard ballast and track run directly into a rigid structure such as a bridge. Downer proposed that all the jewellery (pads and pandrol clips) be replaced at the time the track sections were being lifted and installed. These items are a significant part of the overall structural integrity of the track, and replacing them ensures the required tension from the track to the sleeper is maintained. Arc was initially hesitant to replace the pads and clips, believing them to be still in useable condition, however they relied on Downer's experience and understood that the benefits outweighed the minimal cost associated with replacement.

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## EXCELLENCE IN CIVIL CONSTRUCTION: PROJECT VALUE $2M TO $5M

# MARITIME CONSTRUCTIONS

## DESIGN AND CONSTRUCTION OF BURSWOOD PUBLIC JETTY

Client: Department of Transport (WA)

The Burswood Public Jetty concept design, provided by the Department of Transport as part of the D&C tender, involved three individual 32m long by 4.8m wide floating pontoon berths connected to onshore concrete abutments by large structural steel members. Restraint could not be provided to the pontoons by driven piles, as would be the case normally for such jetties, due to environmental and heritage concerns.

Throughout the design phase, Maritime Constructions coordinated a number of specialist design engineers, the fabrication yard, the Principal and other stakeholders.

Construction was notably challenged with a site with essentially zero land-based footprint and laydown area, the presence of many sites and other contractors in the area with competing interests, and a mud 'bow wave' created by constructing the revetment prior to jetty works.

The Optus Stadium and Matagarup Bridge projects were already putting pressure on the limited land area available and the interface with the public as the adjacent public bike lane had to remain open. The constraint placed on Maritime Constructions included minimum impact to the public and other contractors occupying the pathway and access to multiple sites on the Burswood Peninsula.

Addressing this constraint was achieved by creating a pathway for all material delivery by water – using the 'Blue Highway'. This also required the design, planning and execution of the entire works to take in consideration this "minimum land impact" approach.

The three jetty floating pontoons were braced back to abutments on shore due to the "no piling" design approach. This no-piling method also allowed for a more mobile telescopic-boom type crawler crane to be placed on the main construction barge, rather than a heavier lattice boom type crane. This plant selection decreased mobilisation efforts and costs and increased barge mobility and work efficiency on site.

Controlling the forces being imparted on the abutments were a complicated part of this D&C contract. To overcome this constraint, the design of the interface between the bracing arms and the concrete abutment adopted a very low friction, high wear 'Orkot' brand bearing material. This type of bearing required the arm connections and pontoon lugs to be line-bored to achieve the 50-micron tolerance for installation. The Orkot bearings were cooled in liquid nitrogen to enable installation into the connection housing tubes.

Maritime Constructions also introduced adapter vertically adjustable plates cast into the abutment, where the pin connection between the support arms and abutment meet. If extreme settlement is experienced, the Department of Transport will be able to move the connection elevation vertically up by a maximum of 400mm with no additional construction work and only minor lifting equipment required to make the adjustment.



The river re-profiling works required constant water quality monitoring to ensure marine flora and fauna were not adversely affected by these works. For example, a sustained plume of silt could drop oxygen levels in the river that may cause distress to marine life. A Water Quality Monitoring Program (WQMP) was developed by project environmental staff and independently audited by an external consultant, with trigger points for each parameter and actions to be taken in the event those trigger points were exceeded. The completed WQMP was forwarded to the Principal for final approval before work commenced.

Maritime Constructions follow a strict waste minimisation policy on all our sites. This policy extends to recycling materials as far as possible. Project crews implemented these guidelines strictly on site. Wooden crates and waste rubber matting were sent back to the yard to be re-used as packing materials and waste metal products were sold to a licenced recycling facility, for example.

The on-water pontoon installation and the riverbed re-profiling works were completed quickly with due environmental safeguards. No environmental incidents were reported, and, river water quality safe limits were not exceeded throughout the whole project.

THE CCF EARTH AWARDS
EXCELLENCE IN CIVIL CONSTRUCTION

# WINNER

## EXCELLENCE IN CIVIL CONSTRUCTION: PROJECT VALUE $5M TO $10M

# DOWNER EDI WORKS

## MURDOCH HEALTH AND KNOWLEDGE PRECINCT STAGES 1A AND 1B CIVIL WORKS

Client: Landcorp

The Murdoch Health and Knowledge Precinct Project included the development of six commercial lots within the Fiona Stanley Hospital Precinct. The project was undertaken in a highly visible and heavily congested brownfields environment, which presented a wide range of environmental, safety and stakeholder management constraints.

Downer's scope included the management of all utility providers for the relocation of all existing services and installation of new services. The management of utility relocations and their accredited contactors was key to the successful delivery of the service relocations and new installs. Only after the service relocations, cutovers, removals and new installs were complete could the remaining surface works be undertaken.

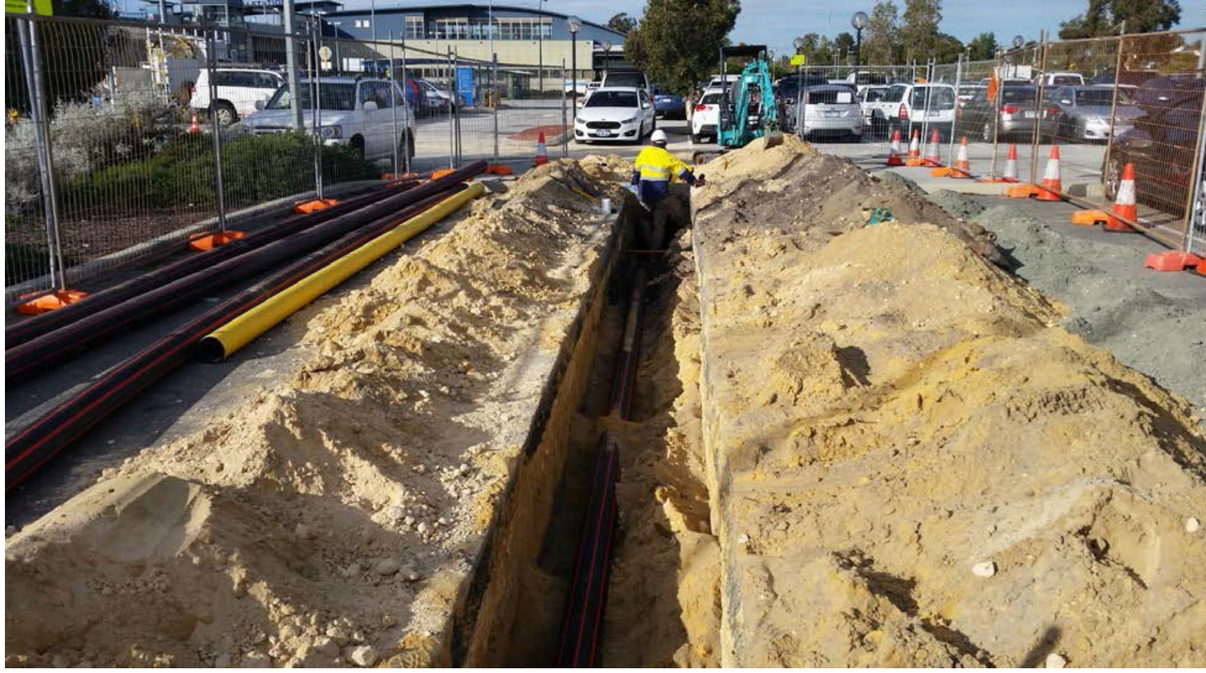
Relocation of all services meant a number of deep excavations adjacent and into South Street were required. To minimise any disturbance of South Street, Downer set up a system of trench boxes. Within the trench boxes Downer installed drainage pits and watermains and used stabilised sand for backfill to expedite the reinstatement and minimise disturbance of the live road. Heavy rains risked the undermining of South Street. Protection by water diversion on the surfaces and steel plates acting as piles behind the trench boxes mitigated the risk of damage to the existing road.

Following the successful cut over of new services, the redundant services had to be removed. The biggest challenge was the redundant 760mm watermain, which was 80m long, 4m deep, coated in asbestos tar and cut directly through the middle of the site. Realignment of the watermain was a carefully planned and executed task. This involved the laying of 70m of new watermain on the revised alignment pre-shutdown. On a 24-hour shutdown, the existing main was drained of millions of litres of water and new bends welded into place to connect to the existing main. This was all done in trench boxes at 4m deep around the clock. Following completion, the existing main was cut into 10m sections, removed and disposed of appropriately.

Downer's works were intersected by the PTA's designated bus lane on Barry Marshall Parade. Works affecting Barry Marshall Parade included stormwater drainage, water services, HV power, gas, streetlights, asphalt and concrete barriers. As the buses were tightly scheduled, detours and delays were not possible and detailed scheduling of the works to align with the buses was required. This included night works after bus lane hours and designated traffic management to allow the buses to continue past the works.

As a heavily pedestrian trafficked route, clear and safe access was always required. To ensure this was communicated as effectively as possible, bespoke wayfinding signs were manufactured showing the designated access to all major areas surrounding the site. Temporary widenings of the existing footpath on Barry Marshall Parade allowed works adjacent to the path to continue.





Due to changes in the stormwater catchment area, the existing freeway drainage storage basin required extending. Access to the basin was the most difficult aspect of the works as it is bordered by the freeway and South Street off ramps, with barriers protecting the entire site and minimal room for the loading of trucks for the removal of excess material.

Access was gained by the removal of freeway safety barriers and fencing and the pushing in of an access track to the near-full drainage basin. Soaked material was stockpiled to dry and the height of the top of the basin was increased where possible, allowing Downer to minimise excess material and the requirement for trucks.

The impact of the complexities and challenges that arose on the project was significantly minimised in part due to strong communications, planning and relationships. The collaborative approach between all stakeholders created a project that saw everyone well informed, allowing decisions to be made collaboratively and on a best-for-project basis. This, along with a positive approach to environmental, quality and safety management and a dedicated site project team, resulted in the successful completion of the project within the assigned Practical Completion date and within the Principal's contract sum.

THE CCF EARTH AWARDS
EXCELLENCE IN CIVIL CONSTRUCTION

# FINALIST

## EXCELLENCE IN CIVIL CONSTRUCTION: PROJECT VALUE $5M TO $10M

# WA LIMESTONE CONTRACTING

## HMAS STIRLING STAGE 3A REDEVELOPMENT – MARITIME STRUCTURES REMEDIATION

Client: Doric Group, Managing Contractor on behalf of Department of Defence

The HMAS Stirling Redevelopment Stage 3A on Garden Island, Western Australia included broad range of works upgrading and refurbishing key infrastructure and facilities. The project comprised 25 works elements, with WA Limestone Contracting (WALC) being awarded the Maritime Structures Causeway Remediation element.

The Maritime Structures Causeway Remediation package required the importation and placement of over 100,000t of rock onto the 4km long Causeway structure. WALC achieved its programme target completion date, while also increasing its scope of repairs on the structure by 40%, which was a formidable accomplishment.

The workmanship of the rock wall installation was of such a high standard that numerous high-ranking Defence officials and the Design Consultants have provided positive feedback. The works were completed and accepted into service by Defence without any re-work or defect.

Significant challenges and technical complexities included the lack of work laydown areas and strict work times available to complete the works, difficulty in moving rock safely to and from the worksite, and dealing with unexpected latent conditions.

The lack of work area was solved by adopting a new 'side on' construction technique which utilised the space to the side and diagonally from the work front, while also ensuring that traffic could safely pass the excavator while working.

This is not the conventional way of constructing seawalls – usually the excavator sits perpendicular to the work face – but was necessary to ensure that one lane of traffic was open on the Causeway at all times. It was complicated by the fact that the area was covered by asphalt which was required to remain trafficable at the end of each work shift. Given the weight of the excavator and the depth of the track gauge, any unprotected movement by the tracks on the asphalt would have damaged it beyond repair, so a worker was deployed to move rubber mats around in front of the excavator tracks.

The lack of work time was resolved through efficient traffic management and construction techniques to ensure that time at the work front was maximised between peak traffic periods each day. Crews and road furniture would be ready and waiting to quickly implement and take down the lane closures as close as possible to the time curfews imposed, and rock trucks would be waiting at the laydown area ready to deliver rock to the site as soon as the traffic lane was closed. In addition, Saturdays were utilised as no curfews existed due to lower traffic volumes. This allowed for works to be carried out for a full day, which helped WALC to meet weekly productivity targets.




Tipping and transfer of rock to and from the project also had to be carefully considered, as the two conventional techniques of end tipping and side tipping had their disadvantages. End tipping of the trailers creates a hazard through hoisting the trailer in a high wind location (increasing the risk of the trailer falling over), and the risk of rock fragments creating rock chips which may strike passing cars and cause damage. Side tipping of rocks avoids these issues but requires a space for the rocks to fall into; otherwise damage can be caused to the trailer if the tipped rocks fall back into the trailer. A solution on the site was devised by utilising the side tipper and excavating a hole in the ground where the rock could fall into, before being handled and placed by the excavator into the rock wall. Trial and error to modify this technique was used to ensure the best construction and rock placement outcome.

Latent conditions of the original limestone rock structure meant that rock placement in certain areas was impossible due to incompatibility between the survey data and the physical structure. Liaison with the client and a modified redesign which involved the importation of additional rock into the structure was implemented to ensure that the wall could achieve its original design intent, while mitigating the negative effect of this unforeseen issue.

THE CCF EARTH AWARDS
EXCELLENCE IN CIVIL CONSTRUCTION

# WINNER

## EXCELLENCE IN CIVIL CONSTRUCTION: PROJECT VALUE $10M TO $30M

# BMD CONSTRUCTIONS

## BOW RIVER BRIDGE UPGRADE

Client: Main Roads Western Australia

BMD Constructions delivered the Bow River Bridge Upgrade project in the Kimberley region of Western Australia. Jointly funded by the Australian Federal and State Governments as part of the Northern Australia Roads Programme, the Bow River Bridge Upgrade project saw the replacement of the existing bridge over Bow River built in 1965.

The single lane low-level bridge was frequently over-topped by flood waters, cutting off the only sealed access between Broome and Wyndham. BMD constructed a 249-metre-long, ten-span and two-lane concrete bridge, approach embankments and road, improving safety for road users and enhancing flood resistance of the Great Northern Highway between Warmun and Wyndham.

Originally anticipated to be delivered over two dry seasons, BMD innovatively provided an alternative solution to condense the work to within one season over seven months. BMD fast tracked construction, constructing multiple bridge columns at one time. By carefully planning the delivery of 30 T-Roff bridge beams weighing 60 tonnes each over 3,000 kilometres from the manufacturer in Perth, BMD ensured the project was completed prior to the start of the 2018 wet season.

The project is a significant example of engineering best practice, with BMD overcoming unique conditions of an extremely remote location, and a tight program with an immovable end date due to the onset of the wet season.

There were a vast number of variables that were overcome including high temperatures, fatigue, road safety, wildlife and road conditions. Working over, and within, an active river carried inherent risks associated with working at heights, working over water and working in a flood prone environment with specialised and expensive plant.

Due to the significant volume of concrete required to construct the bridge, BMD set up a concrete batch plant just minutes from the site. Due to limited availability of local materials suitable for road pavement, pavement material was transported 140 kilometres to the site using triple trailer road trains.

The risk of the project extending into the wet season and the catastrophic effects of flooding on the project was the single greatest risk managed by the project team. BMD mobilised additional resources towards the end of the project to ensure completion prior to the wet season.

The bridge abutments on either side of the river were constructed early, with heavy rock armour applied as a way of protecting the sub-structure of the bridge in the event the wet season came early.



Ultimately, BMD set new benchmarks in community engagement, training initiatives and safety performance in an extremely remote part of Western Australia. The project is a cultural and social success due to BMD's focus on meeting unprecedented targets for Indigenous engagement by supporting reconciliation and making valuable contributions to leave a lasting legacy within two Aboriginal communities, Warmun and Doon Doon. The project sourced 30% of the workforce from the local Indigenous community, spent 6.7% of the total contract value with local Aboriginal businesses, and one third of the contract with a local Kununurra business. This delivered value in the short-term through injecting money directly into the community, and in the long-term through upskilling of a community which otherwise would not have access to opportunities of this nature.

Completely unique to a project of this nature, and testament to the positive relationships established within the community through early engagement, BMD left 80% of the 1965 bridge in place as a memorial, due to the community's connection to the original bridge.

THE CCF EARTH AWARDS
EXCELLENCE IN CIVIL CONSTRUCTION

# HIGHLY COMMENDED

## EXCELLENCE IN CIVIL CONSTRUCTION: PROJECT VALUE $10M TO $30M

# WATER CORPORATION, GEORGIOU GROUP AND BG&E

## ELLENBROOK WATER TANK

Client: Water Corporation

The 80 million litre Ellenbrook Water Tank – built by Georgiou Group - has a 100-year design life and is the first (and largest) of three proposed water tanks adjacent to the Hanson Sand Quarry. The largest tank ever commissioned by Water Corporation and in the southern hemisphere, the Ellenbrook Tank has an external wall diameter exceeding 91-metres and a total height of approximately 13-metres.

The main tank structure, designed by BG&E, is a prestressed concrete construction and includes an in-situ bi-directionally post-tensioned base slab with precast prestressed wall panels. A lightweight steel roof is supported on 13 internal precast columns (7.5 tonne each) and encloses the structure. A combination of precast and in-situ pre-tensioned and post-tensioned concrete was chosen as the most economical and durable containment solution. The project also incorporates some 6km of large diameter water main to connect the tank to Perth's water supply and the fabrication of a chlorination and dosing building.

Works also included coordination of other key design packages which were part of the scope of works which included SCADA and electrical, civil, structural steel, chemical treatment and voltage mitigation.

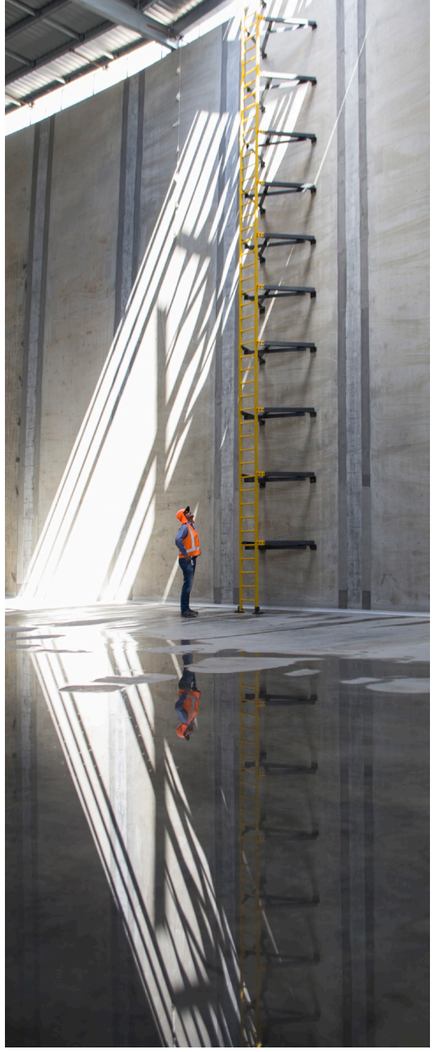
The size of the structure and post-disaster design requirements placed high demands on structural integrity and serviceability, requiring the development of innovative details and construction solutions. By utilising knowledge from previous projects delivered by Georgiou (Harvey Summit and Denmark water tanks) and implementing innovative design ideas during tender, the team was able to save six weeks on the programme and circa $500,000 in costs, whilst still maintaining a high-quality end product. Early involvement during the design stage allowed value engineering options to be realised.

In a first for Water Corporation, the Ellenbrook Tank incorporates a vertically tapered tank wall, enabling improved material utilisation without compromising on durability or functionality. Some 80 precast panels were stitched in-situ and circumferentially post-tensioned to form the tank wall. All precast panels were constructed in-house by Georgiou. The team had to redesign the de-stressing system to allow for the curvature and tapering of the panels, with a custom mould commissioned early in the project to accommodate for an accelerated programme.

Construction of the tank base was heavily influenced by a challenging project schedule. The base slab was constructed in a monolithic 92-metre diameter pour with the continuous placement of concrete over an 11-hour period involving 110 personnel, four concrete pumps and 30+ concrete trucks on turn around. Specialist equipment including laser screeds and ride-on trowel machines were used to improve productivity and efficiency of the works.

Robust curing processes and the correctly timed early post-tensioning of the tank slab were critical to mitigate the risk of early

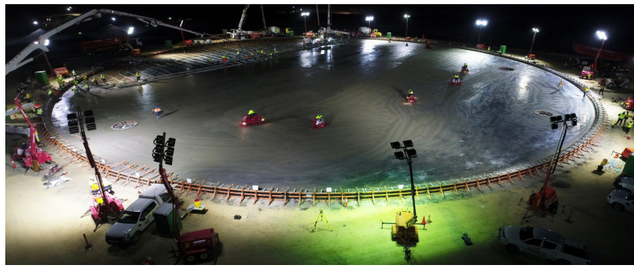





thermal and shrinkage cracking, particularly given the elimination of reinforcement from the main slab. Maturity testing of the concrete was employed to accurately understand the strength gain characteristics of the slab. Post-tensioning began prior to pouring completion (on the opposite side of base slab) to ensure no cracking occurred.

Through effective pre-planning and early staging of the post-tensioning, the team successfully completed the pour on time with no thermal or shrinkage cracking.

Specially designed concrete mixes were of the utmost importance in achieving the desired project outcomes, and consequently, several mixes were developed for different applications within the project. In-situ stitch pours were required to join the 12.67m tall precast segments, which were prone to cracking due to their thin sectional width and presence of circumferential prestressing ducts (which act as crack inducers). This was overcome by using concrete mixes containing both shrinkage reducing and crystal growth type waterproofing admixtures, in combination with high flow concrete which enabled the placement of the concrete within heavily congested reinforcement without voids or honeycombing. As anticipated by crack modelling conducted during final detailed design, cracking of the stitch pours occurred over the prestressing ducts with some initial leakage occurring during the first tank filling, however full autogenous healing of seeping cracks occurred within 14 days of tank filling.



THE CCF EARTH AWARDS
EXCELLENCE IN CIVIL CONSTRUCTION

# FINALIST

## EXCELLENCE IN CIVIL CONSTRUCTION: PROJECT VALUE $10M TO $30M

# THE HIGHWAY CONSTRUCTION/ALBEM OPERATIONS JV AND MAIN ROADS WA

## NEC3 GREAT NORTHERN HIGHWAY UPGRADE (PITHARA SECTION)

Client: Main Roads Western Australia

GNH Pithara is part of a $348 million program of works to upgrade the Great Northern Highway between Muchea to Wubin.

Significantly, this project was the first time the NEC3 contract was to be used to administer a major infrastructure development contract in Western Australia. NEC3 represents a new way of thinking between the contracting parties, requiring a more proactive project management approach and 'buy in'. Pricing is based on a priced bill of quantities with target costs incorporating painshare/gainshare outcomes to spread the risk, similar to an alliance contract. For GNH Pithara, the implementation of the NEC3 form of contract has resulted in the delivery of a better value for money asset for Main Roads and fixed margin profitability for HAJV.

The project's start date was delayed by close to six months whilst awaiting federal environmental approvals. To make effective use of the downtime, Main Roads and the HAJV developed and agreed an Early Works Management Plan (EWMP) to source high-risk, long-lead time materials. The strategy was driven through lessons learned by both Main Roads and HAJV personnel on other contracts in the area and resulted in:

- Development of a sustainable water management strategy overcoming issues over scarcity of water for construction in the region; and
- Sourcing of suitable gravel material, which led to an innovative pavement blend solution.

Forty-six per cent of the project's alignment was designed to be built in cut, so whilst it strived to achieve a cut-to-fill balance, there was a further risk of program delay should any poor in situ material be encountered.

To reduce this risk, the HAJV and Project Management Team (PMT) pre-planned a process to manage the identification, testing and subsequent treatment of poor strength in situ material on site, where solutions could be developed and implemented collaboratively as they were encountered.

The location of services and presence of a significant amount of rock in the Pithara townsite was likely to affect stormwater drainage installations later in the project. To manage this risk, the HAJV worked with the PMT to "prove up" the underground services at each potential clash location through careful hand/machine excavation to expose services (prior to the services going



live). They were then surveyed before being backfilled with sand. This created a far better safety risk profile, minimised the risk of disturbance by rock movement, and eliminated any potential damage to services during the stormwater drain installations.

Given the significant issues encountered in the townsite, the engagement of a culvert crew under a subcontracted schedule of rates was identified as unfair, due to the risk transfer to the subcontractor and potential for conflict and claims. Instead the HAJV adopted a mixture of hourly hire and piecework rates for concrete supply to provide joint management of culvert and stormwater project risks. This led to a positive working relationship with the supplier, and delivery of the works to the expected budget.

The HAJV worked with the PMT and Integrated Project Team to develop a new technical specification suited to blending crushed rock with natural gravels, that can now be used as a benchmark on future Main Roads works, particularly given the increasing scarceness of compliant pavement materials in rural areas.

A suitable material to produce crushed road base (CRB) was sourced during the EWMP in an old gold mine close to the Pithara site, which had granite rock in stockpile.

In addition to supplying CRB for the basecourse blend, the granite rock waste material was used for culvert rock protection and subsoil single sized aggregate trenches throughout the Project.

The initiative to blend mine waste to produce basecourse was a highly collaborative effort to produce a positive commercial and sustainable outcome, whilst maintaining a high standard of quality. This outstanding sustainability outcome contributed significantly towards the rehabilitation of the mine site area and reduced the visual impact of the waste stockpile.

Importantly, using natural gravel would have required an additional 8Ha of pristine farming land to be disrupted and disturbed.

Local Aboriginal engagement was designated a critical project objective by Main Roads to support broader State Government and Federal policy. The HAJV outperformed in all areas of Aboriginal engagement and earned a project bonus, an achievement of which it is particularly proud.

THE CCF EARTH AWARDS
EXCELLENCE IN CIVIL CONSTRUCTION

# FINALIST

## EXCELLENCE IN CIVIL CONSTRUCTION: PROJECT VALUE $10M TO $30M

## RJ VINCENT & CO

### SHENTON PARK HOSPITAL REDEVELOPMENT/ MONTARIO QUARTER

Client: Landcorp

The Shenton Park Hospital Redevelopment Project forms part of a master plan to transform the old hospital site into a thriving new urban precinct, the Montario Quarter, comprising about 1,500 new apartments and townhouses and a village shopping precinct with more than 5,000 sq.m. of floor space.

Following a competitive tender process, RJV was engaged by LandCorp to complete:

- demolition of nominated buildings;
- remediation of site contamination; and
- construction of civil engineering infrastructure including earthworks, sewer reticulation, stormwater drainage, retaining walls, road construction, water reticulation, gas reticulation, underground power and communications.

High levels of asbestos and synthetic mineral fibre contamination, coupled with other unique contaminants within the buildings and foundations contributed to the Project's multiple challenges, which also included the protection of two significant heritage buildings.

Significant testing was undertaken to determine full remediation requirements, with works carried out under the direction of our environmental consultants, RPS, engaged directly by RJV.

Earthworks commenced following remediation, with cut to fill and import fill operations undertaken.

The civil works package that followed was designed to provide a very high-level finish to the estate. It included a significant upgrade of the Selby Street / Nash Street intersection from a traffic-light-controlled T-junction to a four-way roundabout, constructed under live traffic conditions.

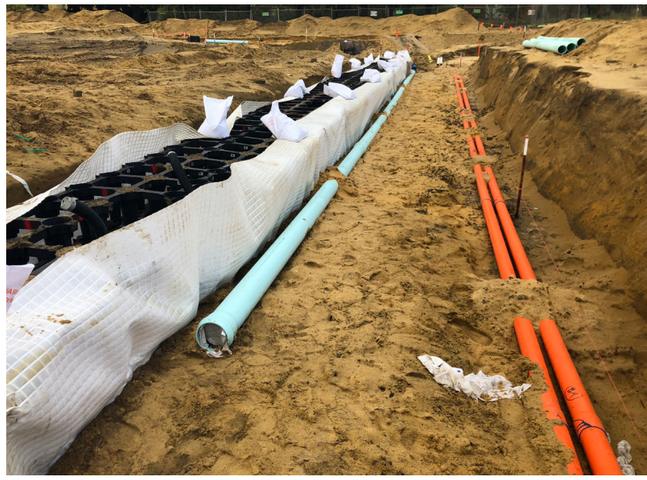
The intersection upgrade presented the most challenging aspect of project works, as it required construction under live traffic at a busy intersection handling more than 15,000 vehicles per day.

RJV's solution involved the development of a six stage Traffic Management Plan creating separable portions of work that would allow traffic to continue flowing. RJV's innovative proposal to construct a bypass road within the project site proved the significant deciding factor in alleviating concerns over potential traffic disruptions.

Given the 100-year history of the Shenton Park Hospital, a detailed process for Unexpected Finds was developed, with 165 registered unexpected finds including asbestos sheeting and pipe, numerous underground services and structures, and waste.

A 685mm reinforced concrete sewer main running through the site needed protecting. The sewer was about 8m below ground level, however three manholes extended up to 2m above ground level to allow for the system to surcharge. With the system designed to operate under surcharge, proactive consultation was required with the Water Corporation to plan and execute the disconnections. Through this consultation it was identified that the optimum time for works to be carried out was 3AM, when the system was at its lowest. Shoring boxes were also prepared for additional protection of the manholes and the disconnections were successfully undertaken in one shift.





Protection of the two heritage structures within the site area (A and G blocks) was of critical importance. Planning was essential in developing a strategy to ensure the buildings were protected from unnecessary vibration, debris or other damage, particularly during demolition works to remove adjacent buildings. RJV's protection process was implemented successfully, with both heritage buildings handed back to the client with no damage.

The B Block building could not be demolished until the bitumen coating on the topside of roof slab was fully removed. RJV's inventive solution entailed lifting a mini excavator onto the roof slab to remove the bitumen in situ. A full methodology and JSA was then developed to ensure each aspect of the operation could be carried out safely.

Some large, mature trees were maintained and protected by means of tree protection zones and structural root zones. Additionally, stratavaults were constructed under verges and car bays to promote and manage tree root growth during the civil construction stage of the works. Stratavaults create a structural cell that spreads applied loads whilst allowing for installation of a soil mix to aid organic growth. Irrigation and aeration pipes were installed and filled with a soil mix, wrapped in bidim cloth and slabs placed on top to enable pavement construction.

The Project achieved a prestigious Environmental Green Star Rating, with 98 per cent of all demolished building materials recycled and diverted from landfill.

THE CCF EARTH AWARDS
EXCELLENCE IN CIVIL CONSTRUCTION

# FINALIST

## EXCELLENCE IN CIVIL CONSTRUCTION: PROJECT VALUE $10M TO $30M

# WBHO INFRASTRUCTURE & SRG GLOBAL (MRPR JV)

## MARGARET RIVER PERIMETER ROAD STAGE TWO

Client: Main Roads Western Australia

Main Roads WA designed and commissioned the construction of a perimeter road around Margaret River allowing for an alternative bypass route for transit vehicles and trucks. Works were programmed in two stages. Stage One involved the construction of a 1.8km section of the Perimeter Road. Stage Two allowed for a further 5.2km of the Perimeter Road and a new 2.3km section of John Archibald Drive to complete the connection between the new Perimeter Road and the town. This stage also included a 96m three-span bridge across the Margaret River as well as a pedestrian bridge across Darch Brook.

The construct-only contract for Stage Two was awarded to the MRPR JV, a joint venture between WBHO Infrastructure and SRG Global in July 2017.

While rock at the project was expected, the rock strata shallow levels, extents and physical properties varied significantly from initial expectations. During the earthworks, multiple sections of granite cap rock was discovered which was too hard for mechanical removal and required blasting.

Unfortunately, some areas to be blasted had a depth less than 2m, and rock blasting would have resulted in over-blasting. This would then require the blasted material to be removed and replaced with compacted fill. In order to eliminate this, the MRPR JV decided to use expanding grout in areas where the depth for blasting was low. The grout is placed by a specialist contractor in a reduced blast pattern and the special grout is pumped into the drilled holes. The grout then expands and cracks the rock enough for it to be removed by an excavator or dozer.

As there was a shortage of client-supplied rock for subsoil drainage and rock linking of drains, the solution was to crush the blasted rock rather than use in the deep fill. A specialist crushing subcontractor was engaged to produce the required 20mm drainage aggregate and 150mm rock.

The main bridge pier foundations included 12 piles with rock sockets with minimum required embedment in the rock layer of 8m. The physical properties of the rock resulted in multiple issues with the piling works requiring revision of a number of design and scheduling details.

The rock strata also presented significant difficulties in the completion of the pedestrian bridge foundations. A combination of the rock levels, hardness and fractured nature, necessitated the construction methods to be constantly modified to suit. The JV team implemented a drill then grout method for the individual rock anchors.

The bridge structures at the project presented the most technically complex planning challenges. For the main bridge lift, a combination of a 650t crawler crane and a 350t mobile crane was implemented to replace the practically unachievable 650t



crawler with 110m boom design concept. Tailored crane platforms ensured the lifts could be safely completed in close proximity to the completed bridge abutments and wing walls. Furthermore, the pedestrian bridge installation was synchronised with the main bridge lifts to utilise the 650t crawler crane to allow the use and lifting of a shallow displacement barge and pre-assembly of the pedestrian bridge truss. The 650t erection support crane was also planned with a view of its size and capacity, allowing it to be used for the installation of the pedestrian bridge from the trail in the forest.

Another alternative implemented was the utilisation of two truss towers for the main bridge girders. These towers were designed and supplied by Coates, utilising Systems 15, 30 and 60 equipment and used to temporary support the incomplete bridge girders whilst allowing for jacking, alignment and access to the necessary splice plates at the connection points.

During construction of the main bridge, impact to the water body was mitigated with silt curtains and traps on both sides of the river, dry sheet piling adopted for the piers construction avoiding the need for continuous pumping of water, continuous water monitoring, oil and silt traps installed across the river downstream of the main works, as well as utilising a floating pontoon bridge across, therefore avoiding a temporary causeway.

THE CCF EARTH AWARDS
EXCELLENCE IN CIVIL CONSTRUCTION

# WINNER

## EXCELLENCE IN CIVIL CONSTRUCTION: PROJECT VALUE $30M TO $75M


# CIVMEC

## MATAGARUP BRIDGE ARCHES AND DECKS FABRICATION, PAINTING & TRANSPORTATION

Client: Alliance with Main Roads Western Australia and York Rizzani JV (YRJV)

In 2017 Civmec was awarded the subcontract for the fabrication and modularisation of the Matagarup Bridge by The York Rizzani JV. This contract was originally awarded and subsequently started by an overseas fabricator in 2016, however due to unforeseen circumstances the fabrication was required to be completed locally putting significant pressure on schedule given significant time had been from the first award date. the back. With the project at significant risk, Civmec's highly skilled and dedicated workforce were engaged to deliver the works within an extremely challenging delivery timeframe.

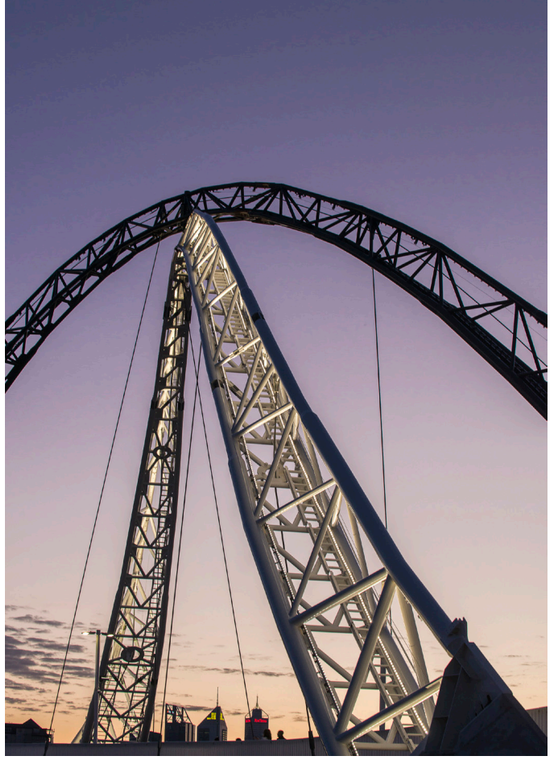
Civmec's specialist expertise was employed to undertake the steel fabrication, painting and transportation of the Matagarup Bridge's arches and decks, utilising several local fabricators and various other associated subcontractors. The complex scope undertaken by Civmec included:

- Review and checking of the 3D model and production of 2D shop drawings.
- Procurement of all materials required to undertake the scope of work.
- Fabrication of arch and deck modules, including secondary steelwork, inclusive of stairs and walkways, pins, guides, connection cleats, deck edge cladding and balustrade.
- Design and fabrication of all jigs, fixtures and transportation frames required for the fabrication, and the assembly, loading and transport of arches and decks to the site.
- Painting and powder coating to meet anti-graffiti requirements in specified areas.
- Trial assembly.
- Loading and transportation to nominated delivery points.

Coming into the project as a key partner so late in the piece, and given Civmec's principal role, establishing a central base from which to manage the scope and facilitate an effective communication flow between the delivery partners was critical from the outset. On this basis, the Swan River Bridge Alliance was established, with a Board including representatives from the partner organisations. Throughout delivery, the SRB Alliance worked collaboratively with the State Government to ensure targets and key deliverables could be met.

Being able to undertake design review and validation and fabrication of the bridge components locally within Civmec's Henderson facilities ensured the project team was able to engage and communicate more effectively to manage issues and approve solutions.





The modelling/detailing subcontractors were also mobilised to Civmec's facility to work directly alongside the project team and designers. Model reviews were completed daily and drawing change requests could be agreed and resolved instantly.

Civmec's established relationship with steel suppliers allowed the sourcing of all non-standard overseas materials with reputable suppliers who knew Civmec and therefore worked to ensure delivery targets were achieved.

In November 2017, the WA Government approved a new design for the bridge, with the new WA- made steel arches being brought to the forefront of the structure's design. The design modifications meant the bridge would not be covered by a black and white fabric, as originally planned, but instead a decision was made to improve its structural capacity and showcase the bridges unique architecture. This meant the steel was now visible and therefore required more detail to steel finishing, reconfiguration of the symmetry of the arches and achieving more complex architectural finish with walkways, handrails, lighting fixtures and the paint system.

The complexity of the structure and curvatures made it impossible to manually perform dimensional checks during fabrication.

All references, diversion and verifications were achieved with full-time survey assistance. Therefore, managing surveyors and fabrication sequence was critical.

Transporting the fabricated steel components from Henderson to the project site at Burswood represented a significant challenge, considering the massive size of the arch modules. Over 70 individual loads of steel, materials and equipment was delivered to site in total. The transportation process had to undergo careful and methodical planning to ensure deliveries to site aligned with scheduled installation activities.

THE CCF EARTH AWARDS
EXCELLENCE IN CIVIL CONSTRUCTION

# FINALIST

## EXCELLENCE IN CIVIL CONSTRUCTION: PROJECT VALUE $30M TO $75M

# MACA CIVIL

## GRUYERE GOLD PROJECT: SITE BULK EARTHWORKS, ACCESS ROADS, AIRSTRIP AND TAILINGS STORAGE FACILITY

Client: Gruyere Management Pty Ltd (GRM) - a wholly owned subsidary of Gold Fields

Gruyere is a new gold mine, east of Laverton in Western Australia's goldfields region. MACA's construction contract was for mine site infrastructure development, with all major bulk earthworks for the gold mine including a 19km upgrade of Mount Shenton Road, 27km of site access roads, process plant pad foundations, tailings dam, airstrip and all minor access roads. The scope included earthworks, roadworks, drainage, pavements, and lighting.

MACA's original site access was via a small exploration airstrip and minor exploration tracks. By completion, the greatly expanded workforce of all contractors was now accessing the site by the new airstrip constructed by MACA, suitable for jet planes, and the new site access roads constructed by MACA for all-weather access. The site grew from a flycamp with MACA as the primary contractor on site, to a large and well-developed camp with many contractors. MACA worked with GRM and other contractors on site to manage this transition of the working environment, as each new work stage brought new challenges to be worked through together.

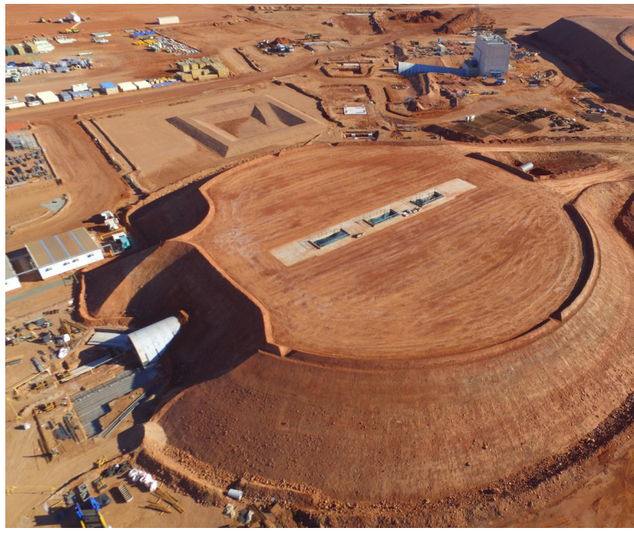
The most significant challenges faced were borrow material availability and the impact of inclement weather.

MACA's investigations (with GRM) did not yield sufficient quantities of saprolite clay in the mine pit overburden. This clay was required for the wedge of fill on the TSF's interior to maintain integrity of the embankment when inundated. GRM (with Coffey) resolved this by redesigning the TSF with a geosynthetic clay liner and HDPE liner. MACA and GRM resolved the issue of prolongation due to redesign by splitting the contract into Stage 1 and Stage 2 works. MACA was ultimately also awarded the Stage 2 works and constructed the redesigned aspects of the TSF. This approach also allowed for additional time for GRM to receive regulatory approvals of the redesign and to procure liner materials for the redesign.

The site was in a non-cyclonic area and on the edge of a desert, however it was still subject to severe storm events. Roadworks were severely impacted during these heavy rainfall events, however MACA's creation of float within the programme allowed the impact to be mitigated.

The TSF underdrainage designs included megaflo filter drains and HDPE outlet pipework. This extensive drainage crossed the haul roads within the TSF that MACA used for the TSF embankment construction. To progress the drainage works and avoid delay, MACA proposed installing most of the drainage works whilst the haul routes were still operational. MACA proposed and gained approval from GRM/ Coffey to utilise electrofusion HDPE pipe couplers in lieu of HDPE butt welding. MACA set out the drainage so that the coupler locations for the megaflo and HDPE allowed





the sections of drainage crossing the haul roads to be omitted during the main runs of the drainage install. The short joining segments of drainage were installed later as the haul roads became redundant as areas were progressively completed. This improved the construction programme and allowed for work continuity for the key drainage subcontractor.

For the TSF underdrainage works, MACA and its drainage subcontractor introduced a novel selection of plant for hauling and placing the filter aggregate that covered the megaflo and HDPE drainage lines. Small 9t swivel-tray dump trucks were used. The ability of the tray to run-out material to the side of the truck meant that hauling and placement of the filter media could be carried out with one piece of plant rather than two.

As a remote mine site, the project was relatively isolated from its neighbours. GRM and MACA was mindful to engage with local community and seek positive outcomes wherever possible. MACA donated a school bus to the local school children of the Cosmo Newberry (Yilka People) community and employed members of the community in various roles.