Civil Engineering Contractor
April 2011

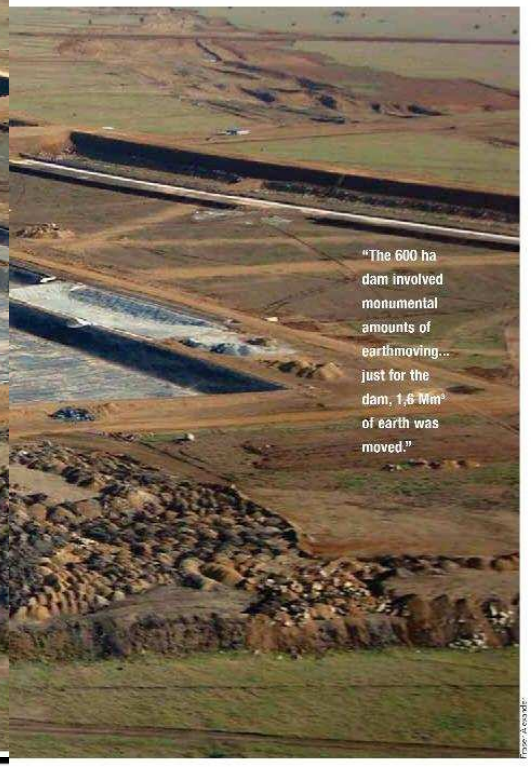
North West 'monster' dam

An upgrade of a tailings-recovery project is expected to quadruple the company's production. *Jason Boswell* looks at the construction of one of the largest new tailings-storage facilities in South Africa.

SA's largest
What is believed to be the largest tailings dam in the country is reaching the final stages of construction. The project is an earthworks project of note calling for careful sequencing of work due to strict and high penalties for late delivery.

on site

Project: tailings recovery
Value: R3,2-billion
Location: North West Province
Start: June 2009
End: May 2011
Main contractor/consultant: Fraser Alexander



"The 600 ha dam involved monumental amounts of earthmoving... just for the dam, 1,6 Mm³ of earth was moved."

Fraser Alexander

Approximately 160 km from Johannesburg is the Mine Waste Solutions (MWS) tailings-recovery project. It comprises 15 historic tailings dams – 12 were acquired from the Buffelsfontein gold mine in 2006 to form the basis of the Buffelsfontein tailings-recovery project.

Over the past four years, the company has completed a R3,2 billion phased expansion project which includes construction of a new 135 klpm uranium plant, and the engineering and construction of a new tailings storage facility to accept the reworked tailings. The upgrade would quadruple production from 450 ktmp to 1,933 Mtpm.

"This increase would make this facility one of the largest reclamation projects in the world," says Ian Matthews, general manager of Mine Waste Solutions. The company, a wholly owned subsidiary of First Uranium Corporation, was acquired in June 2007.

In order to accommodate this vast production increase, the company engineered and constructed one of the largest new tailings dams in the country, adds Matthews.

Tons of earth

George Johnstone, contract manager from Fraser Alexander, says the 600 ha dam is double the size of the previous largest tailings dam he built. The new tailings storage facility (TSF) will contain reworked tailings from the uranium and gold-reclamation projects. This project involved monumental amounts of earthmoving, he adds.

"Just for the dam, our team moved about 1,6 Mm³ of earth within approximately eight months," says Johnstone.

Fraser Alexander utilised a team of six to complete the earthmoving portion of the contract. "We used three scraper teams using Cat 621 bowl scrapers and three ADT teams using a combination of Bell B30 and B25s," says Johnstone. "In total, with some of the smaller dams and roadworks, earthmoving comprised about 3 Mm³ using just six teams."

The contract manager says that, while this was a relatively simple project from an engineering perspective, it was not without challenges.

Civil Engineering Contractor
April 2011

on site

Project: Medupi packages 31 and 22
Location: Limpopo
Value: multi-billion-rand projects
Start: January 2010
End: July 2011
Consulting engineer: SRK
Main contractor: Civcon

Large auxiliaries arise

While work progresses on the construction of Medupi, *Dudley Garner* assesses spin-off projects which support it.

The breathtaking intricacies of developing a massive new power station such as the 4 800 MW Medupi Power Station struck home forcefully when *Civil Engineering Contractor* visited Medupi at the invitation of Civcontract Civils (Civcon) recently. This visit follows an earlier visit to Medupi for an article which appeared in the May 2010 edition of *Civil Engineering Contractor*.

Although a multi-million rand project and massive, the works tasked to Civcon and JV partner G4 appear dwarfed by the massive multi-billion-rand concrete and steel structures slowly but surely rising from the ground north-west of Lephalale. Yet, on closer examination, without these peripheral works, the power station would not be able to operate at all.

Civcon and G4 are involved in two of the many work packages forming the Medupi project: Package 31 for three dams (for raw, clean and dirty water) and Package 22 (earthworks for the coal stockyard and the incoming and outgoing conveyors).

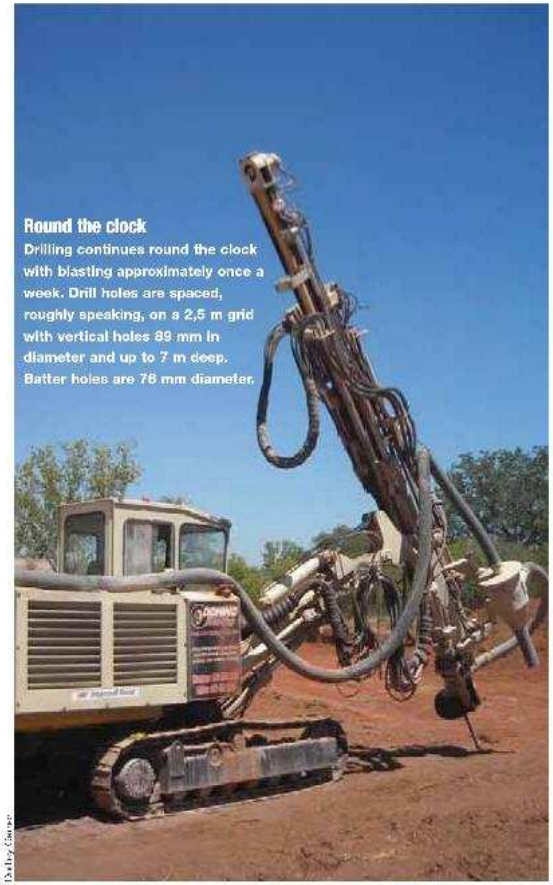
Halfway mark

Andrew Bruce, senior site agent, indicates that Work Package 31 has, more or less, reached the halfway mark. The R102,9-million contract was awarded in November 2009 when work was due to begin. However, planning, programming, drawing up method statements, safety plans and obtaining Eskom approvals took up most of the final weeks of 2009 with the result that first pegs into the ground in the bush for the off-site raw water dam only happened in January 2010. From then on, it was nose to the grindstone, clearing and grubbing, stripping topsoil and then overburden, a relatively thin layer of an almond-like gravel layer, before running into quartzitic bedrock and drilling and blasting operations.

However, this was foreseen and the contract was set up to deal with it, and the blasted material was crushed for G5 material for general use on site in selected layers and so-called improvement strips.

Dudley Garner

100 000 m³ stripped



Round the clock
Drilling continues round the clock with blasting approximately once a week. Drill holes are spaced, roughly speaking, on a 2,5 m grid with vertical holes 89 mm in diameter and up to 7 m deep. Batter holes are 76 mm diameter.

Dudley Garner

Editor's comment

The opportunities that will arise from power-station projects are significant. While *Civil Engineering Contractor* has focused extensively on the main construction works of Medupi and Kusile, it is worth while to explore the ancillary civil prospects which have emerged on the sidelines. It must be noted that it will be a significant time in the next few years as industries geared at supporting the power station and coal-mining activity in the region become established.

Due to the shallow rock profile of the site, just less than 100 000 m³ of overburden required stripping but nearly 800 000 m³ of rock had to be blasted. Drilling and blasting is undertaken by Domino Blast under a subcontract to Inzalo Crushers and Civcon.

Huge excavations

Shaun du Plessis of Domino Blast is using two single-tine Ingersoll Rand track-mounted hydraulic drill rigs. Apparently, two additional rigs are coming to site shortly. The drilling-and-blasting work has been set up to excavate to basin level in two stages. For blasting, a two-component blasting emulsion is used with drill holes charged directly from the delivery trucks through the on-board computer-controlled auto mixer. No explosives magazines have to be established and maintained on site. The two emulsion components come in on the same truck but they are housed in well-isolated compartments.

After each blast and subsequent safety inspection, mucking starts in earnest with blasted rock carted and stockpiled at the crushers on site by Inzalo Crushers. Civcon is using 8 x 30 t and 35 t ADTs to this end and three Hitachi excavators in the 30 t to 47 t range. Blasting is scheduled for completion by the end of August 2011 and the dam is due to be completed by November 2011.

Significant plant complement

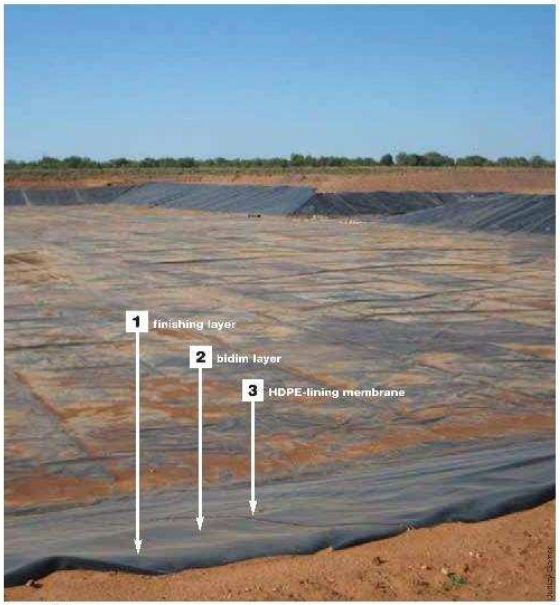
For the construction of the dam embankments, Civcon is using a 140 Mitsubishi grader (M530), two bulldozers (a D4 and a D6), two padfoot tamping rollers and 3 x 140 000 ℓ water bowsers as main plant. In total, the raw-water dam construction is offering work opportunities to approximately 140 people.

In contrast to the raw-water dam, Civcon took over a fairly advanced work situation at the side-by-side clean and dirty water dams. The bulk of the earthworks had been done by others in terms of an earlier contract and the main emphasis was on lining the dams and doing the concrete-inlet works.

A dual stormwater drainage system is being constructed at Medupi and at Kusile; separating stormwater from areas where the risks of contamination with materials such as oils and fuels are high versus stormwater from other areas, such as roofs, not exposed to risk. Stormwater from the coal stockyard is another matter altogether and forms a third system which is tackled separately.

Civil Engineering Contractor
April 2011

Dewatering prioritised



2 mm thick
A 150 mm-thick membrane acts as a finishing layer. A bidim layer is then placed and an HDPE-lining membrane which is 2 mm thick.

On handover of the site, one of the first tasks Civcon had to tackle was the dewatering of the two dams which had filled up over time since their much earlier construction. This was followed by reinstatement of the embankment and excavation faces, construction of a membrane protection or finishing layer, laying down a bidim layer and then thick black HDPE lining membrane.

150 mm-thick membrane

A herringbone pattern of subsurface drains has also been installed in the dam basins to prevent any risk of uplifting of the liner due to high groundwater tables or to collect any seepage from leaks which may occur over time. All drains lead to a strategically placed drainage collection chamber for monitoring. Any drainage or leakage can be pumped back to the dams. The HDPE liner is being installed by Engineered Linings under a subcontract to Civcon. The HDPE is imported in rolls from an Arabian source in 6 m-wide strips which are heat "welded" together at the seams to form a continuous impervious membrane. At the top of the embankments, the liner is folded into a special 400 mm x 450 mm trench which is anchored with sandbags. The trench is backfilled and compacted.

Instructions have not been received about the final finishing off of the top of the embankment but the external embankment faces will be hydroseeded. The nature of the seed mixture has not yet been determined.

Because of the very large footprint of the power station, the two dams have to be large in order to accommodate the environmentally prescribed 1:50-year flood design. The resulting dam sizes at basin invert level are 200 m x 180 m in the case of the clean-water dam and 80 m x 180 m for the dirty-water dam.

Expensive construction
Work is forging ahead on the project despite the value of the contract nearly doubling.

Inlet structure

Civcon obtains concrete for the inlet structures and other work from the central mixing plant operated by the MPS JV, the contractors on the main civil works at Medupi, as well as the local MPA Concrete Solutions batch plant. The quantity of concrete involved in the work package of approximately 8 000 m³ did not warrant the establishment of a plant.

Good progress is being made with the concrete works on the two dams and this was also the case with the lining required for the dams and approach canals when a flash storm caused a lot of damage to the works in December 2010. At that stage, lining of the clean-water dam was completed with lining of the associated approach canal in hand. Batter faces not covered were scoured and a lot of dirt was washed onto the already laid membrane. As a result of this, Engineered Linings has temporarily left site and is scheduled to come back to complete the work during the upcoming winter months; giving Civcon adequate opportunity to repair the earthworks damage. When all is eventually done, approximately 142 000 m² of membrane lining will have been installed in both dams.

Contract value doubles

Also included in Civcon's work at Medupi are the excavations for the recovered water pumphouse to be situated centrally between the two spillways immediately east of the two dams. It is the intention to pump recovered stormwater from both dams to the raw-water dam approximately 5 km away. The pumphouse has been tasked to Stefanutti Stocks. To ensure dam safety in the event of larger floods than 1:50 years, or a succession of 1:50-year floods following closely on each other, both dams have engineered spillways and spillway discharge channels leading into the adjacent bush. In discussions with Monique Bruce, site quantity surveyor, it was established that scope changes, particularly with respect to the raw-water dam, have more than doubled the final estimated contract value of the package. It now stands at R225-million. The new completion date is July 25 2011 for the clean- and dirty-water dams and six months later for the raw-water dam. Expenditure to date on the work package amounts to R109,9-million.

"There are glitches, information delays and scope changes but these are part and parcel of fast-track construction, particularly in a project of this magnitude."

Asked about particular challenges or difficulties encountered, as well as contractual relationships, Bruce mentioned scope changes, as in the case of the raw-water dam, as very challenging in terms of reprogramming, staffing and servicing. A fast-track construction approach, as followed at Medupi, also involves the risk of construction pulling ahead of design or decision-making with concomitant difficulties in timeously obtaining information and the need to reschedule work with information pending. Contractually, the FIDIC General Conditions of Contract with Eskom amendments seem to fit the bill. Payments are promptly received on presentation of certificates. The consulting engineers are SRK for the raw-water dam and Gibb for the clean- and dirty-water dams. Eskom's package construction supervisor is Kallie Strydom.

On leaving the site, the overall impression is one of awe at the magnitude of elements forming the overall project, the amount of detail that goes into each element as well as the ability of the construction industry and engineering fraternity to stay on top of it all. Certainly, there are glitches, information delays and scope changes but these are part and parcel of fast-track construction, particularly in a project of this magnitude. What is encouraging is the way that the contractors tackle and manage it all in stride. A second impression is that the project proceeds, thanks to everyone doing their jobs, according to a totally integrated process. Morale appears to be high and an unspoken conviction to reach goals can be discerned. ■