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Visionary municipality and engineering team drive innovation in water delivery

Two new 10 Ml reservoirs will significantly strengthen water supply to rapidly-expanding areas of Mpumalanga.

These are the first two reservoirs in the country to be built using a new South African precast-concrete water-retaining wall system in combination with a tried-and-tested modular roof technology.

The first reservoir was built in Kwa-Mahlangu and the second is being constructed in Bundu on behalf of the Thembisile Hani Local Municipality.

Both areas fall under the larger Nkangala District Municipality, the economic hub of the province and a rapidly developing area that comprises about 160 towns and villages.

Monde Consulting Engineers & Project Managers is supervising the construction teams and worked closely with Corestruc, a South African precast-concrete specialist, in refining the designs of the two reservoir structures.

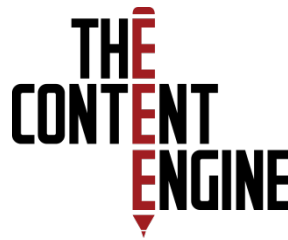
The leading firm of consulting engineers is known for its focus on innovation to assist municipalities significantly accelerate service delivery.

This project is certainly no exception, with both construction sites serving as an important testing ground ahead of the imminent commercial launch of the system by Corestruc.

Sefiso Mdingi, who is directly overseeing the construction works on behalf of Monde Consulting Engineers, says that municipalities will have to embrace new technologies and thinking around construction to attend to the growing backlog in services infrastructure, especially in poor outlying areas of the country.

“While Corestruc’s roof system has been successfully deployed on many other reservoir construction projects, this is the very first time that its water-retaining wall system has been used by any local municipality. The client has demonstrated a lot of faith in the skills and capabilities of its professional team through its willingness to be the first to test new innovation in the construction sector that promises to significantly improve water supply,” Monde Consulting’s civil-engineering technician says.

Monde Consulting Engineers & Project Managers decided to partner a company with an impressive track record designing and constructing precast-concrete structures to mitigate any potential risks associated with the use of new technologies on these critical builds.



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It had also worked closely with Corestruc on other projects and could, therefore, attest to the high quality of the company's workmanship.

Importantly, the engineering team was especially impressed with the extent of innovation that went into ensuring a water-tight structure.

Top-level management of Corestruc, including technical director, Tian de Jager, visited many other countries to garner best international practice in the field and adapted this learning for unique local conditions.

Similar to all of Corestruc's other designs, the precast concrete wall system has been signed-off by the company's own engineers, and this has further allayed any concerns of potential risks by representatives of Thembisile Hani Local Municipality.

Meanwhile, members of the engineering team also visited CoreSlab's factory where the system is manufactured to see for themselves the extensive procedures in place to ensure a consistently high quality level.

"It would be impossible to achieve the same levels of accuracy using traditional *in-situ* methods. The manufacture of the various elements is undertaken in a controlled environment by skilled workers, and far removed from the many variables encountered on a typical construction site that negatively impact on quality, accuracy and productivity. Moreover, we were extremely impressed by the high durability of the company's elements, which all exceed 50 MPa, contributing towards a more robust final structure," he says.

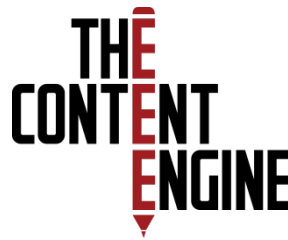
State-of-the-art moulds and forms were manufactured by Corestruc's in-house engineering department to produce the walls, as well as the complex buttresses that reinforce the wall structure, and which contain many computer-numerically controlled milled items.

Many lessons learnt in Kwa-Mahlangu were implemented at the other reservoir construction site in Bundu to further accelerate construction times.

In Kwa-Mahlangu, Monde Consulting Engineers & Project Managers and Corestruc worked alongside Gaby Construction.

The Mpumalanga-based Grade 7 contractor built the eight kilometre pipeline and floor of the structure, while Corestruc's own installation team undertook the construction of the walls and the roof.

Willie de Jager, managing director of Corestruc, explains that, by constructing the walls and roof in this manner, the critical path of the programme runs through the earthworks and floors.



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“The construction of the floor slabs overlaps the installation of the walls and roof on the works programme. We are able to construct the walls and roof in as little as three months on site, while the manufacture of the structure takes place at our factory during the earthworks and construction of the foundations,” De Jager says.

The structure at Bundu was designed to be built using a modular system right from the outset.

Conversely, the initial design of the reservoir at Kwa-Mahlangu was based on traditional in-situ construction technologies and later modified to incorporate precast-concrete technologies to deliver the reservoir in an extremely short timeframe.

Corestruc, therefore, only mobilised to the Kwa-Mahlangu site once the floors and bases had already been completed.

Being involved early on in the design phases for the structure at Bundu also provided Corestruc the opportunity to work closely with Monde Consulting Engineers & Project Managers to determine the most optimal construction sequence.

Work started with the construction of the foundation and bases by the main contractor, Mbako Projects & Trading, to accommodate the precast-concrete columns that support the beams and hollow-core slabs that make up the roof of the structure.

The roof structure was completed by Corestruc’s team in just under a week in September, and Mbako Projects & Trading then commenced with the precise construction of the ring-beam, ahead of the arrival and installation of the precast-concrete wall slabs.

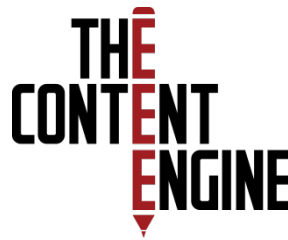
They will then be post-tensioned to keep the joints compressed and, in so doing, ensuring that the reservoir is stressed vertically and circumferentially.

The work sequence will end with the construction of the floor and grouting of the precast-concrete wall slabs to create a single monolithic slab structure.

Corestruc also oversees the timely delivery of the various precast concrete elements to site from its state-of-the-art factory using its own specialised trailers.

Moreover, the company uses its own crane and operator to safely and efficiently lift and place the various components of the system.

At the Bundu reservoir construction site, a total of 60 wall panels, each weighing about eight tons, and about 10 m long, two metres wide and 170 mm thick, were lifted and placed to complete the wall structure.



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The rigger and crane operator were supported by a skilled and efficient team, also comprising a project manager and surveyor.

Mdingi says that this approach replaces the erection of tons of scaffolding, in addition to the co-ordination of various teams, including shutter hands, steel fixers and concrete gangs and, in so doing, also greatly assisted the professional team in maintaining impressive safety levels on site.

“The main contractor is also working alongside a number of emerging contractors and unskilled members of surrounding communities as part of a typical Expanded Public Works Programme. They have had ample opportunity to work on various components of the project, such as the pipeline, while the specialised work at heights has been restricted to an experienced team,” he says.

The most time consuming aspect of the reservoir construction programme is the preparation for the grouting of the joints between the walls.

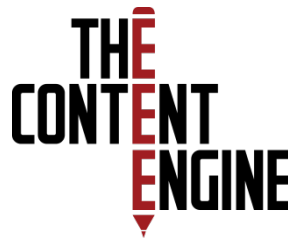
About 6,6 km of PVC post-tensioning ducts and cables are installed by hand between the joints of the wall panels, before the grout is pumped around the circumference of the reservoir.

It takes just more than a full shift to fill the joints with a specially-designed medium, which reaches a compressive strength of 100 MPa in as little as four days.

The team then inspects the internal and external walls, and fills any voids by hand to further safeguard against leakages.

As a further measure, Corestruc even brought its own water to site to ensure the same reaction it achieved during the testing phases of the grouting material.

De Jager concludes that he is proud of Corestruc’s association with Monde Consulting Engineers & Project Managers, which continues to unlock new opportunities for precast-concrete technologies in municipal infrastructure delivery programmes. He also lauds the client for its willingness to respond to national government’s call to explore alternative technologies to bring services to the poor, and its proactive approach to managing contractors on its projects!



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Images & Captions:

[Image-4520]:

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[Image-WA0005]:

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