Impala Platinum Mines Refinery Pond

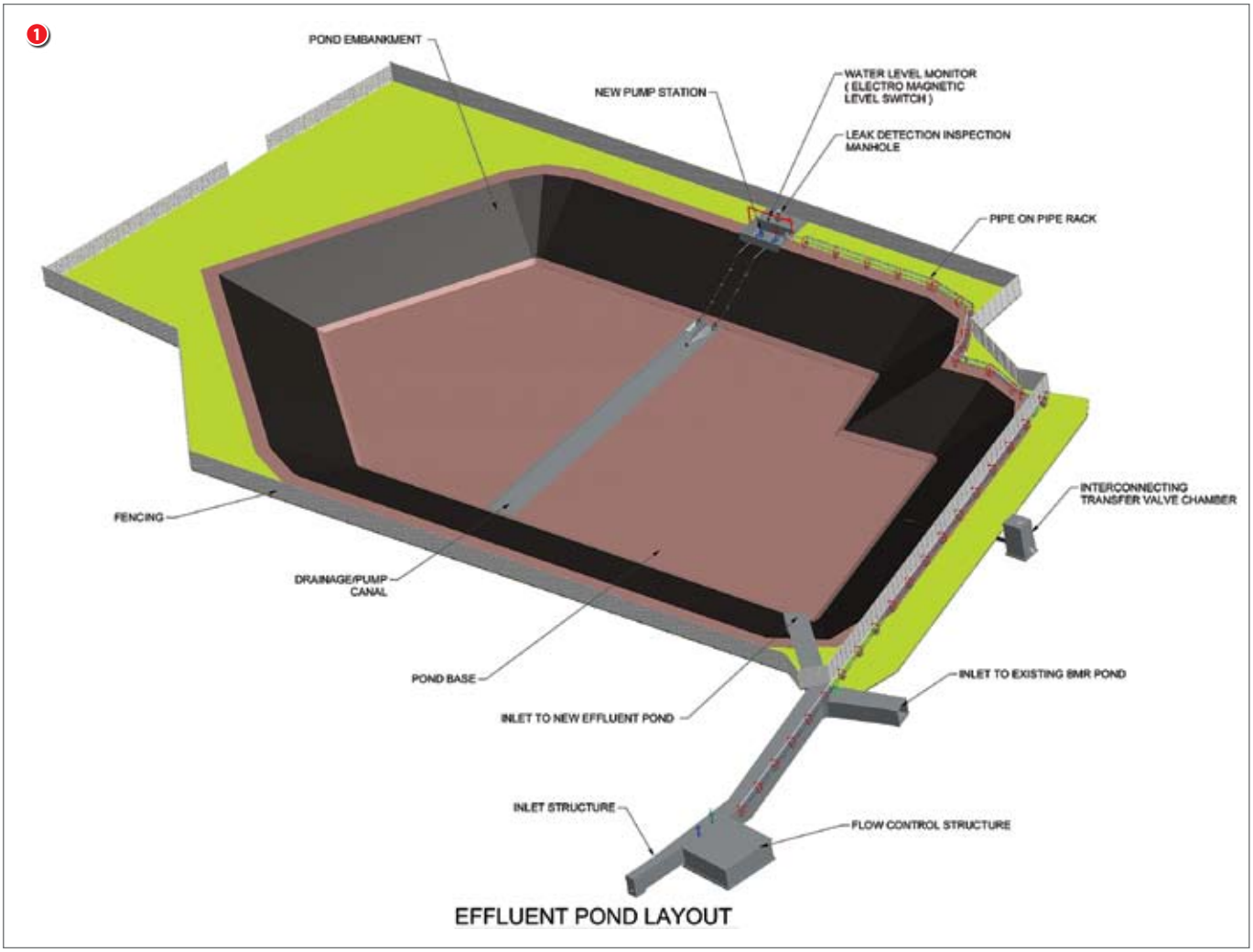
Using software and experience to find solutions

AURECON, SOUTH AFRICA'S largest consulting engineering company, was awarded the R1,5 million contract for the review of the conceptual and detail design, and site supervision of the new 20 000 m^3 Base Metal Refinery (BMR) pond complete with associated capital equipment for Impala Platinum Limited. The total capital value of the project, estimated at R15 million, forms part of Impala Platinum's plans to increase its production of nickel, platinum and other precious metals.

IMPALA PLATINUM PHASE II

The BMR Phase II expansion has necessitated the installation of a new double-lined leak detection pond and effluent pump at its Base Refinery located in the Enstra industrial area of Springs in Gauteng.

Aurecon's project manager on this project, Viren Gajathar, says, "The Base Metal Refinery has to have an additional pond installed to increase its water storage capacity, ensuring that the plant will be able to collect the run-off generated from this new area. A new pond is



furthermore required to allow the BMR to replace the single-liner in the existing BMR pond."

The conceptual design of the new pond was undertaken in a prior contract between Impala Platinum and the then Africon (before it merged with Connell Wagner and Ninham Shand to form Aurecon).

DESIGN AND GEOLOGY

Viren, who has led the design on the Impala Platinum project, noted in his 2009 Design Report that the size of the proposed new dam would be limited due to the land available for development and the topography of the area.

The area selected for the new effluent pond site lies east of the existing one on a location previously used by Afrox. Following the demolition and removal of the old foundations, Aurecon carried out a geotechnical investigation, the results of which showed the presence of dolomites. As part of further investigations, five exploratory percussion boreholes were drilled to determine the subsurface conditions. These were evenly distributed across the site to be representative of the site conditions.

The boreholes/test pits excavated during the investigation indicated fairly good material to a depth of 5 metres. Although the Council for Geoscience and Aurecon's geotechnical team suggested that the excavations should be limited to about 3 metres, Viren says this was not an option because of the storage capacity requirements of the new pond.

"Two alternatives were considered – the dynamic compaction of the base of the dam material, or over-excavation. It was decided to over-excavate the poor material between the 5 metre depth and solid bedrock, and compact suitable material available between the ground level and 3 metres deep in 300 mm layers to the final design level."

According to Viren, the soil mattress would prevent any settlement that may compromise the liner integrity and provide an impervious horizon that will prevent water ingress into the bedrock in the event of any spillage or leakage from the pond.

CIVIL ENGINEERING SOFTWARE, CONSTRAINTS AND CALCULATIONS

Viren, who used the software package Civil Designer to calculate all the earthworks, is an avid user of Knowledge Base software. He says, "I started off with Stardust from the beginning and was really pleased when Knowledge Base took over the development of AllyCAD and improved it further."

"The pond was designed with 1:2 side slopes and 1:100 base slope," Viren continues. Because the size of the pond would be limited to the old Afrox site boundaries, a trapezoidal-shaped gravity-fed earth embankment design was agreed upon. "The base slope will slant from the base edge towards the middle of the pond and the flow will be forced to the pump sump of the pond. The lining components will follow the slope of the pond."

The lining, designed according to the minimum requirements for *Waste Disposal by Landfill*, published by the Department of Water Affairs and Forestry, is composed of several layers with leak detection lining layers that all come together into a leak detection sump. This is then transferred to a leak detection manhole which will be inspected regularly for leaks.

FLOW CONTROL

The inlet canal to the new effluent pond will connect to the existing canal at the point where the existing canal bends at a 90° angle to enter the existing BMR pond. A channel gate will be installed in the new canal and in the existing canal immediately downstream of the y-section where the new canal splits off.

A flow control structure will be constructed along the eastern side of the existing canal, beginning approximately 10 m downstream of the manhole. According to Viren the purpose of this structure is to bring the velocity of the flow to 0,4 m/s to allow grit to settle out, and oil and grease to rise to the surface so that these can be removed from the flow control structure before it enters the ponds.

The flow control structure will be an 8 m x 8 m x 3 m concrete basin with a horizontal floor and a dividing wall to force the flow in a U-turn. Similar to the canal, this structure will be set in the ground and the top of the walls will be at ground level. The depth of the excavation will therefore be 3 m, which is within the limit advised by the dolomitic surface assessment.

Construction on the project was scheduled to start in February or March 2010 and is expected to be completed by September 2010.

1 Layout for new 20 000 m^3 Base Metal Refinery effluent pond
2 Inlet canal

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