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Old sand quarry makes way for golf estate

IN THE PAST years there has been some controversy surrounding the development of certain residential golf estates in South Africa. It is often argued that these estates are developed at the expense of the natural environment and that the developers are only focused on making profit rather that sustainable development. One project illustrating that the development of these types of estates can be to the benefit of both the developer and the environment is the Ebotse Golf and Country Estate in Benoni, Gauteng.

Ebotse is fast developing into a prestige residential estate on the East Rand. This, the first golf estate in Ekhuruleni, boasts some stunning residential stands along an 18-hole golf course surrounding the Rynfield dam in Benoni.

A few years ago, however, this now pristine site was not nearly such a sought-after property. A large portion of the estate is being developed within the property of a decommissioned sand quarry. Before rehabilitation the site consisted of a large final void, split into a eastern and western compartment, several smaller holes where sand were mined out, and a large slimes dam, all covered with wattle trees. The slimes dam comprised 975 000 m^3 of kaolin clay material (the clay fraction of the sand that was washed out of the sand when the quarry was still in operation).

SLIMES DAM REHABILITATION

Gauteng-based consulting firm African EPA was appointed by the developer to carry out the opencast rehabilitation design of the site. The slimes dam had to be removed entirely to make place for residential stands. Several methods of moving the slimes were investigated with the idea of filling part of the final void. The method of hydrosluicing was chosen as the preferred option. This entailed the washing down of slimes by means of high-pressure water jets. The slurry material was then captured and gravitated or pumped to its final position in the void. Water for the hydrosluicing was pumped from the final void and recycled through the process. In order to create sufficient force to wash down the dry slimes material the water had to be pressurised to 3 000 kPa by using a number of centrifugal pumps connected in series. Once the bulk of the slimes had been removed through the hydrosluicing process, the footprint of the slimes dam was cleaned by removing the material by conventional construction equipment and disposed to the final void by end tipping.

Before filling the final void a separation wall was constructed in between the eastern and western compartments. This had to be done whilst the void was filled with water and the base of the separation wall was constructed by end tipping of rock fill material. Once above water level the wall was built up with gabion boxes to provide sufficient capacity to allow for the expected rise in water level due to the filling of the void with slurry. The idea was to fill the eastern void entirely and displace the excess water into the western void in the process. Surplus slimes material was used to partially fill the eastern void and thereby creating the fairways for the golf course.

Because the voids were filled with water before construction commenced, the slimes material could only be placed in a slurry state. This resulted in a very long settlement time as the water contained in the slimes material had to be expelled to the surface. Although a large percentage of the settlement occurred within a short period of time, it was calculated that 90% consolidation settlement would only be reached after about three years. As a result no permanent structures could be constructed on top of the slimes material placed into the void. Part of the golf course was therefore designed on top of the filled void with residential stands positioned alongside the original perimeter of the void.

The slimes dam rehabilitation took almost two years and was completed in June 2006. The total cost of the project was R15 million. Impacts that where identified and controlled during the construction were noise and dust from hydrosluicing and trucking operations, air pollution and the spillage risk into the nearby Rynfield dam.

HIGHWALL REHABILITATION

A further challenge encountered by the developers was that the sand-mining operations has left a large quarry with a steep highwall along the western boundary of the estate. This meant that no stands could be developed in this area, and it was also unsightly. After considering various alternatives it was decided to develop this slope into a number of terraces separated by retaining walls, thereby providing additional development space for residential stands as well as an access road.

The construction of a 6 m high soil nail

1 *Final void before rehabilitation*
2 *Booster pumps for hydrosluicing*
3 *End tipping of material. The bulk of the void has already been filled by hydrosluicing*

retaining wall should commence in the near future providing a unique housing platform with access from the road level situated two stories above the housing platform level. Stands will be located on a 30 m wide platform and the portion of the highwall in between the housing platform and the final void will be reshaped and vegetated. The steep grade of this slope also required engineering inputs to prevent erosion of soil. To prevent a slope with the appearance of an engineered slope such as gabion steps or concrete facades, it was opted to shape the highwall to a 1:3 slope and vegetating with trees and grass for erosion control.

A WORD ON ENVIRONMENTAL ENGINEERING

As illustrated in this project, environmental engineering is not a loose-standing concept which can be regarded as a separate entity from civil engineering, or any other field of engineering for that matter. nor is it a term reserved only for the reduction of waste and the development of pollution friendly process plants. This project illustrates clearly that by channeling the planning process along environmentally friendly development, clever solutions can be found in applying everyday engineering principles. From the rehabilitation of the old quarry, to the 'tidying up' of a potential site for criminal activities, to the use of local labour and the upliftment of property values in the surrounding areas this project illustrates that environmental engineering entails a holistic approach that should form part and parcel of all aspects of engineering, not only in the design but also as part of the construction process.

Whilst all forms of activities that may cause harm to the environment such as mining and industry can not be avoided, this project illustrates that rehabilitation can form a sustainable part of development. Present legislation requires that any form of mining activity be rehabilitated after completion. However, South Africa is scarred with the remains of past activities and innovative ways need to be identified in which these areas can be mended. With potential development land in Gauteng and other areas in the country fast becoming a scarce commodity projects like these will need to be implemented on a broader scale, giving new life to areas that cannot be utilised at present. □

Source:
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