

MECHANICAL & ELECTRICAL WORK FOR PREEKSTOEL BIOFILTRATION PLANT, HERMANUS OVERSTRAND MUNICIPALITY

SUMMARY OF WORKS	
Type of Works	Water Treatment Works
Location of Works	Western Cape
Size of Works (Mℓ/D)	10 ML/D
Date of Award	1 January 2012
Date of Completion	March 2016
Completion Value (Including VAT)	R 13 993 000.00
Client	Overstrand Municipality
Conditions of Contract	GCC 2004

In order to increase its water supply capacity, Overstrand Municipality has increased its ground water abstraction facilities to source water from the surrounding area, which must be treated to deal with the relatively high concentrations of iron and manganese.



Removal of iron and manganese is typically achieved by chemical oxidation, which can be expensive both from a capital and operating cost perspective. An alternative process is biological treatment which is a cost effective and innovative solution.

The key to biofiltration lies in creating an environment conducive to oxidising iron and manganese rich waters by controlling dissolved oxygen levels and the pH of the incoming water.

For this purpose, the project entailed the equipping of seven new boreholes as well as the construction of the new 10 ML/day biofiltration plant at the site of the existing Preekstoel Water Treatment Works.

Equipment Room



The key treatment areas are:

- Flow measurement and control
- pH and DO control for facilitation of iron removal
- Direct filtration through two filters (Iron filters each measuring 2.4 m x 4.8m)
- pH and DO control for facilitation of manganese removal
- Direct filtration through two filters (manganese filters each measuring 2.4 m x 4.8m)
- Disinfection

The plant consisted of the following key equipment:

Boreholes

There are seven new boreholes in the Hemel-en-Aarde well field that will supply water to the biofiltration plant. These boreholes are HAV1, 2, 3 and 4 and T4/1, T4/2 and T4/4 and supplement the existing Gateway well fields. The pumps are speed controlled in order to maintain acceptable levels within the boreholes.

Raw water inlet

Raw water is fed to the plant from two sources, these being the existing Gateway well-field and the new Hemel-en-Aarde well-field. Flow from each of these well-fields is measured on independent mag-flow meters, the flow then combines into a common pipe that feeds the biofiltration plant.

Chemical dosing equipment (Sodium Hydroxide better known as Caustic Soda)

There are two caustic soda dosing points in the biofiltration plant, the first being in the vertical leg on the main inlet pipe, the other in the horizontal leg of the iron filtrate discharge pipe.

Each dosing point is equipped with a dosing skid complete with two pumps (duty/ standby) and associated equipment, both skids draw caustic soda (45% solution) from the two bulk storage tanks positioned to the eastern side of the biofiltration plant. Each skid is equipped with 1x pump capable of delivering a maximum of approximately 10 l/hour whilst the other pump is capable of delivering a maximum of approximately 45 l/hour

Iron and Manganese Filters

The iron and manganese filters are designed to accommodate bacteria which can convert iron and manganese to a precipitate form that will accumulate on the filter media.

Equal flow passes through the two filters, each with filter floor dimensions of 2.4M wide x 4.8M long.

The filters are of the PCI monolithic type and have been installed comprising of pre-manufactured "cast-in-situ" floor panels and nozzle sleeves. The floor panels are supported by an array of columns & beams located at the base of the filter, which also allows uniform distribution of air and water during the filter backwashing sequence. The sleeves are equally spaced at 150mm centres, and have sufficient height adjustment to ensure all nozzles are installed at the same level across the entire filter floor.

The following design characteristics apply to the filters (two filters in operation):

- Filtration rate at 10MI/day (417 m³/hr) - 18.08m/hr
- Filtration rate at 5MI/day (208.3 m³/hr) - 9.04 m/hr (approximate rate during seeding)
- Backwash rate during combined air-scour and backwash: 30 m/hr = 345.6 m³/hr
- Backwash rate during rinse 50 m/hour = 576 m³/hour
- Air-scour rate: 75 m/hour = 864m³/hour

Iron Filtrate Pumps

The iron filtrate pumps, pump from the iron filtrate sump up to the inlet channel of the manganese filters. The pumps are VSD controlled in order to maintain a set level within the iron filtrate sump and have a maximum duty of 414 m³/hr @ 7.98 m head.

Manganese Filtrate Pumps

The manganese filtrate pumps, pump from the manganese filtrate sump to either the clearwell of the existing works or the sedimentation tank of the existing works.

The pumps are VSD controlled in order to maintain a set level within the manganese filtrate sump and have a maximum duty of 414 m³/hr @ 6.78 m head when pumping to the clearwell or 414 m³/hr @ 12.06 m head when pumping to the sedimentation tank.

Chlorination System

There are two chlorine motive water pumps positioned in the existing main plant equipment room which are fed from the existing MCC.

The chlorine gas building is equipped with an automatic chlorine gas leak detection system and shut off system.

In the event of chlorine gas leak being detected by the chlorine gas sensor the system will low level alarm on the SCADA and the strobe light will flash.

In the event of a high level gas leak, the system will high level alarm on the SCADA, the siren will sound at the chlorine building and the solenoid valve will open thus closing the two emergency shut-off actuators which in turn will close the chlorine gas cylinder valves.

The chlorine building is supplied with two chlorine controllers, one for the main plant dose, the second for the biofiltration plant dose. The main plant dose range is 0-4kg/hr whilst the biofiltration plant dose range is 0-600g/hr.



Electrical and Control System

Automation of the new works is by the use of a Programmable Logic Controller (PLC) that is located in the Motor Control Centre in the machine room of the biofilter plant. Automation of the borehole pumps is by way of telemetry stations and MCC's situated at each specific borehole.

The control of the works is from the centralised control room located in the existing WTW (with SCADA system) and a Human Machine Interface (HMI) located at the MCC in the biofilter plant. The complete works can also be controlled manually from the MCC.

The Contract was awarded to PCI early 2012 with Practical Completion by March 2015 and Final Completion achieved on March 2016.

The final contract sum was ZAR 13.993 Million, with the end of the defects liability period being January 2015.