BLACKWATER
D I V I N G

DIVE INSPECTION REPORT

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DATE: 14-07-2017

COMMERCIAL DIVING SERVICES

PROJECT NAME: SETTLERS DAM AND HOWIESONS POORT, GHT

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Executive summary

Blackwater Diving was appointed by **Stimele Bosh Consulting Engineers** to provide commercial diving services for the client, **Makana Municpality**. The task was to inspect the **outlet works of Settlers Dam and Howiesons Poort.** The objective was to provide a report and recommendations regarding the status of the outlets and possible intervention to make additional water supply to the towers available and refurbishment of existing works.

Blackwater Diving conducted a **Level 1 Survey** and underwater inspection of the oulet systems above the debris and silt level.

Diving supervisor and experienced 'blackwater divers' who are certified DOL commercial diver Class 2 were used for the survey. The diving supervisor and divers hold a CSWIP 3.2U and 3.1 U Inspection Tickets.

SETTLERS DAM:

Date Inspected 12-07-2017 Current Dam Level 24%

Access to worksite (outside intake tower) is by boat. Inside of intake tower, dry.

Familiarisation and Lockout Tag Procedure completed and signed off.

HOWIESONS POORT:

Date Inspected 13-07-2017

Wet Intake Tower – outside and inside inspected

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Photographs - provided on flash stick

Introduction

Blackwater Diving conducted a Level 1 inspection of the outlet works.

Blackwater Diving made a proposal to restore the condition of the intake towers at Settlers Dam and Howiesons Poort to make them operational and allow for maintenance from the surface as per original design.

Location and details of structure

Settlers Dam, Grahamstown

Howiesons Poort Dam, Grahamstown Dam Custodians: Makana Municipality

Inspection procedure and dive report

The divers are competent in 'blackwater diving' ie low to nil visibility conditions underwater, and are familiar with dams and intake tower.

All suction intakes were shut down for a few hours – Lock Out - Tag Procedure.

Physical measurements and photographs of the outlet system were taken where underwater visibility allowed. Where visibilty did not allow, a Level 1 "swim-by" /feel method was used.

Diving was done from a tender boat at Settlers dam wall and from the shore at Howiesons Poort.

The Method

The mode of diving selected was surface supply with underwater communications. This allowed for safe and effective communication between supervisor and the diver doing the work. Depth recordings were taken by pneumofathometer.

The method used to carry out the inspection was visual and physical measurememnts with voice communications to the supervisor. Tools used included a steel wire brush, steel rule, measuring tape and sliding vernier. Underwater photographs were taken.

SETTLERS DAM

Findings

Outlet System: *See photographs and Schemmatic Diagram

Datum – water depth with reference to current level as indicated of depth guage plates is 7.3 meters.

The height of Outlet #2 is 1.8 meters above the current water level.

Dam level 24% as at 12-07-2017

There are 3 Inlets and one scour.

Photographs of the top two sieve and inlets were taken above water. Close up (due to water turbitiy) underwater photographs were taken of the third inlet and trash rack for the scour. Measurements and inspection was completed via underwater voice communication and use of a pneumo fathometer.

The sieve was removed to investigate the inlet pipe and bellmouth and replaced afterwards.

Inlet #2 was cleared of mud build up *See photographs

Inlet #3 is clear of debris but has a build up of silt around it.

The seive is in place but is NOT secure as three of the four guides are broken off at the base.

There is a build up of silt at the level of inlet #3 as shown in the attached schemmatic diagram. This level of abstraction will certainly affect the quality of the water drawn at the intake.

The trash rack for the scour was in place and clear of debris besides silt/mud at the level of the base.

Pneumofathometer readings:	Natural Bottom	8.8 m
	Inlet #3	8.2 m
	Trash Rack/Scour	9.1 m

The sieves are stainless steel and in an acceptable structural condition but are in need of maintenance. There is a build up of growth blocking up to 50% of the seives. Cleaning of the #3 seive was done by scraper by the diver.

Further cleaning of the #2 seive and #1 seive is needed as access by a ladder and climbing harness is required.

The chains to all three sieves are severley corroded and broken.

The chain to the trash rack is severley corroded and broken.

The sieve guides are corroded and broken. Only on guide pole remains on inlet #3.

*Details and drawings of the strainers (seives) and guide bars can be found in the drawings as supplied by Bosh (Horizontal Section B – B). The reducer is also shown.

Recommendations for Settlers Dam

Inlet seives are stainless steel and in an acceptable condition. The seives are however in need or further cleaning of growth which may obstruct possible full flow. This can be achieved by removing to the shore temporarily and given a vigorous wire brushing or HP spray.

The guide frames and bases are broken and should be removed and replaced.

The current instability of the guides allows for the sieve to be displaced and the DANGER OF A SWIMMER BEING SUCKED INTO THE OPEN INLET EXISTS!

The chains should be removed and replaced with new, stainless steel for future maintenance as per design.

The trash rack should be removed and replaced with new and stainless steel chain attached. The existing rack can be brought to surface and accurate measurements taken and replaced same time while a new rack is being fabricated.

The level of silt build up is currently being suctioned via the inlet number 3 causing a poor qaulity of drinking water. Blackwater Diving recommends airlifting (two days) the surrounding area to base level, 10 meter radius. The silt discharge will be deposited 40m towards the far wall from the inlet, **on the scour side.** This will act as a measure to prevent the silt from blocking inlet #3.

Alternative Option:

Furthermore, it is noted that the inlet #3 has a flange at its base and this would allow for an installation of a flexible suction – delivery pipe if required. This would allow for abstaction of water from a level apporoximatley 2 meters (or desired depth) below water level and result in a high quality water delivery.

Blackwater Diving has installed many such floating intakes and will supply diagram and details on request.

***Daily Record Sheets, Surface Supply Dive Logs, Tool Box, daily Report, Lock Out Form available on request

HOWIESONS POORT DAM

Findings

<u>Outlets on Dam Side * See photographs and Schemmatic Diagram</u>

There are 4 outlets

Outlets have guides for trash racks. The channel iron completely corroded on all four guides.

Outlet #1

- currently at the water level of the dam 0.0 m
- cleared of mud and debris by diver
- measurements taken
- grid broken – removed

Outlet #2

- bellmouth at 3 m current water depth
- grid broken and missing debris free to enter inlet
- debris level 4.6 m below, mostly branches and reeds, massive build up
- partial blockage of bell mouth by reeds – cleared by diver

Outlet #3

- Buried under braches, reeds, mud – level 8.8m, therefore cannot be accessed!

Outlet #4

- grid broken, held up by rope, almost completely disentigrated
- oulet clear of debris
- debris level below outlet 9.8m, branches, reeds and mud

*There are no flanges on outside outlets # 1,2,4 (#3 unknown)

*The outlets bellmouths face vertically upwards and the elbow is built into the concrete abutment

*The elbows are heavily encrusted and corroded

*The debris, which is mostly branches and reeds, is heavily built up around the tower, at an approximate 45 degree angle into the dam and towards the shore side. Debris include broken off steel.

<u>Outlet Works Inside the Tower * See photographs</u>

- The top landing on the tower is completely corroded and dangerous.
- The access ladder is comlpetely broken – own ladder used.
- All the spindles and stand offs as well as landing braces are completely corroded
- All the valves are completely seized and corroded/broken
- The base of the tower is heavily built up with mud, stone and steel debris
- The area is a confined space and potentially dangerous to divers in its current state of disrepair

Outlet #1

- At current water level 0.0 m
- Open position

Outlet #2

- At 3m water depth
- Open postion
- Elbow facing upwards, severley corroded

Outlet #3

- 12.2m depth (therefore 3 – 3.5m build up of debris outside tower!)
- Open/closed? Unkown as buried under debris – could only access top of the valve
- Buried under mud at top of valve

Outlet#4

- Spindle broken off, top of valve housing broken off
- Open position

*All valves have a stand off from the wall and flanged connection

Recommendations for Howiesons Poort

The intake tower is the primary means of controlling the flow of water and the level of abstraction which determins water quality.

The tower is currently not operating, and any maintenance on downstream pipeworks and pumps is comprimised.

The hazard of debris being sucked into the tower from the outside exists as there are no trash racks in place.

The heavy debris build up on the outside of the tower blocking the #3 Outlet consists mainly of large and small branches and reeds and dredging by means of airlifting is not feasable. Blackwater Diving recommends using a grab and basket and use of liftbags and wire debris basket to be winched onto the shore. We estimate that to unblock and clear the surrounding access to the # 3 Oulet would take 3 days.

The hazard of debris (including broken steel) exists at the bottom **inside** of the tower.

The tower landing is unsafe.

All valves and spindle are non functional.

The outlets have no trash racks and a SUCTION HAZARD TO SWIMMWERS EXISTS!

Blackwater Diving recommend a complete refurbishment of the tower, outlet works, spindles, valves, trash racks etc

*It is noted that there is a standoff and flange which connect the valves on the inside of the tower. These flanges could be utilised if the client wishes to supply an alternative connection to the tower inlets at current low dam levels. A suction-delivery pipe could be connected to a floating intake sieve.

Blackwater Diving has completed tower intake refurbishments and references of work done is available on request.