GMCE ENVIRONMENTAL SERVICES

ENVIRONMENTAL STATUS REPORT FOR THE PARKHAVEN PAN AND CONSERVATION AREA AT PARKHAVEN EXTENSION 5

NOVEMBER 2012

Compiled by:

Greg Crookes

Environmental Consultant

ANNUAL ENVIRONMENTAL STATUS REPORT

PARKHAVEN PAN STATUS REPORT

1. CURRENT STATUS OF SURROUNDING COMMERCIAL DEVELOPMENTS:

The Commercial developments around the pan have progressed with much of the southern area of the site having been development. A Section 21 Company was established which all the commercial properties as well as landowner contribute towards. The current members are:

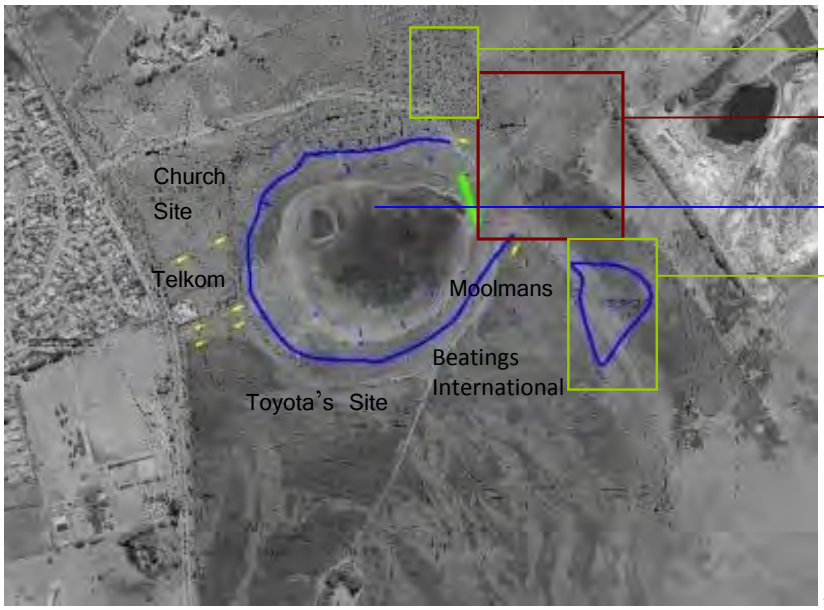
1. Moolmans (part of the Aveng Group)
2. Bearings International
3. Toyota SA
4. British American Tobacco (BAT)
5. Caro Nome Properties (Landowner)

The above businesses contribute a monthly levy to the Section 21 company which is then used to manage and maintain the pan and conservation area. Included in the mandate of the Section 21 is to ensure the long-term sustainability of the protected open space and pan, to undertake the requirements of the rehabilitation and protection of the area as well as ensure that annual status reports be undertaken to determine the environmental status of the Pan and wetland areas. As new companies are developed around the site, so too will they be incorporated into the Section 21 to ensure that as members they are all held liable for the state of the Conservation Area and the continued management thereof.

GMCE Environmental Services were appointed as the environmental consultant in August 2010 and for the last 2 years have carefully monitored the construction activities around the site as well as managed and monitored the implementation of various environmental remedial works on site:

1. Removal of the historic illegal dumping as well as old farm fences (pre-2010 impacts)
2. Implementation of an Alien plant eradication program targeting Kikuyu, Pom-pom weed, Pampas grass and other invasive weed species
3. Rehabilitation of the old dirt roads as well as other negatively impacted areas through removing rubble, ripping compacted areas and removing invasive trees.
4. Construction of the bio-swale within the 10m buffer zone (located along the entire development edge of the commercial properties) which is designed to take all the storm water run-off from the commercial sites as well as provide a natural “cleaning” of the storm water prior to release into the natural environment. The design of the bio-swale included the construction of a filtration system (fine sand, rocks and bidem lining) at the bottom of the swale.
5. Implementing storm water measures (gabions, reno-mattresses, throttle points, etc) within the bio-swale to attenuate and control discharge from the commercial sites. Wetland grasses and plants have also been allowed to re-establish within the bio-swale to act as filters to any potential pollutants or contaminants coming from the surrounding commercial sites and Atlas Road.
6. Providing input and monitoring the Commercial sites to provide recommendations on the type of plants, grasses and trees planted in the Commercial Park to ensure indigenous species are used and eradication programs continue.

GMCE has also used the services of various specialists during the past few years to provide input on rehabilitation plans and the eradication program. A recent site visit was conducted with Mr Clayton Cook (Faunal specialist) who compiled an independent Ecological Status report on the pan. This report, dated September 2012, is attached in **Annexure A** below and gives further feedback on the current status of the pan. Mr Cook highlights the improvements that are visible within the pan and open space areas as a result of the work undertaken by the Section 21 company to improve the status of the area.



- taken from 2008 ECO report.

Figure 1: Aerial photo of Parkhaven Ext 5 – the pan, special open space, sensitive "no-go" areas and the new Commercials sites

2. PREVIOUS NEGATIVE IMPACTS – LAST 5 YEARS

When the original EIA was conducted for the property and the positive Environmental Authorisation received in November 2006 the status of the Pan was poor. Illegal dumping has occurred and was escalating as there was no fence around the site, no management in place to rehabilitate or protect the pan and conservation area.

With receipt of the positive Authorisation the landowner commenced in 2007 with an initial clean-up and removal of the illegal dumping (as seen in the images below) and constructing the storm water bio-swale in an attempt to minimize and attenuate high peak flows off Atlas Road as well as start protecting the pan from potentially contaminated run-off from hard surfaces.

Then in 2008 the landowner commenced with erecting a palisade fence around the property to restrict access to the open area and pan as cars were regularly seen using the existing dirt roads as short cuts and on weekends clear signs were found of quad bikes and motorbikes being driven in the pan and wetland areas. With the new fence and access restricted, cars stopped crossing the site however bikes still continued to use the area as no development was occurring around the Pan.

Towards the end of 2008, the construction of the Moolmans site commenced which resulted in a presence on site and since then the Pan has been allowed to rehabilitate itself with help from the Section 21 company. In 2009 the new Bearings International warehouse project commenced while Toyota started with a new Distribution Warehouse in August of 2010. This

was when GMCE first became involved on site both with the monitoring of the construction activities, interacting with the general public and Authorities, as well as appointing a landscape contractor to implement the eradication program as well as rehabilitate the open space and sensitive pan areas.

As of the date of this report, **November 2012**, the 4 commercial businesses listed above have been completed and currently there is no construction occurring around the Parkhaven Pan site.

3. SPECIALIST REPORTS CONDUCT SINCE 2010 - 2012

In September 2010, a baseline water quality analysis was conducted by Clean Stream Scientific Services to determine the dry season water quality of the pan. The sampling was conduct at the end of the dry season as there had been little rainfall or flooding of the pan which could have potentially diluted any contaminants or pollutants that might have been in the water bodies. The Clean Stream report, dated October 2010, is attached in **Annexure B** and gives all the results as to the quality of the pan and wetland area in 2010. This report provides a baseline from which to monitor conditions going forward.

Samples were taken from 5 locations both around the site and within the pan itself to provide a general cover analysis of both the water quality of the inflows to the site, the standing body of water in the pan itself which is influenced by any dumping, spills or even the high concentration of the exotic Grey Headed Gulls who nest in the pan over the winter and then the downstream watercourse which the pan feeds into.

Results:

The samples taken were tested for a range of variables and compared against the various Department of Water Affairs (DWA) water quality guidelines for domestic use, livestock watering and aquatic ecosystems. Except for a few metal concentrations which exceeded the DWA guidelines (see full result tables in **Annexure B**), the water quality conditions can be described as **good**. The high metal concentrations are suspected to be due to suspended matter in the water, as the alkaline water quality conditions would rather precipitate metals than induce solution thereof.

It is recommended that another water quality survey be conducted in January or February 2013 to determine the current state of the pan's water. The wet season should however give an indication of "fresher" water quality conditions in the Pan and surrounding rivers after an influx of cleaner rain water.

4. PHOTOGRAPHS OF THE PAN – TAKEN FROM 2010 TO 2012

Below are a number of photographs of the site, dating back to the illegal dumping of 2007, then more recently the rehabilitation and transformation of the pan from **August of 2010** until **November 2012** which give an indication of the rehabilitation projects undertaken to address storm water from the commercial sites, eradication of invasive plant and grass species and the rehabilitation and hydro seeding of exposed or damaged areas to reinstate to previous conditions.

HISTORICAL CONDITIONS OF THE PAN AND OPEN AREAS (2007/2010)	
	
Historic Dumping on the site **(2007)**	Litter and Rubble at northern side of the pan area **(2007)**
	
	
Old dirt road through the site prior to new perimeter fence **(2010)**	Site access is now restricted by a palisade fence **(2010)**

<u>CURRENT CONDITIONS</u> OF THE PAN AND OPEN AREAS (2012)	
	
Looking east across the pan **(October 2012)**	Looking south-east across the Pan **(2012)**
	
View across to the new Toyota Distribution Centre **(2012)**	The rehabilitated bio-swale. Subsequent photo's below will show the change from 2010 to current **(2012)**

STATUS OF THE STORM WATER MANAGEMENT PLAN

5. STORM WATER MANAGEMENT MEASURES

A bio-swale was constructed around the pan (as seen in Figure 1 above) in 2008 however changes to the bio-swale were undertaken in 2010 to "improve" the aesthetic look of the attenuation throttle points (stone clad berms) as well as construct spillways at each of these throttle points. The spillways (as depicted by the yellow arrows) were implemented so that when the 10yr or above flood occurs the throttle points will force high flood events into the pan and provide the additional attenuation required to ensure that flooding from the Parkhaven Ext 5 site does not influence the flooding of the downstream areas.

From an ecological perspective it is importance that the 'natural' hydrological regime, current seasonality and water levels as well as water quality of the pan are maintained. A water quality assessment was conducted in 2010 by Clean Stream Scientific Services to determine the baseline quality of the Pan (see **Annexure B**). The results of the assessment indicate that the quality of the water within the pan was good. Due to the measures implemented, the bio-swale and the correct Storm Water Management Plan (SMP), water flows into the pan are being more correctly managed to ensure there is variance in the water levels and quality.

Constant flooding of the shallow margins (Eulittoral zone) of the pan may alter the vegetation (*Leersia hexandra*) and ultimately the habitat suitability of the pan. If the pan becomes a permanent water body the presence of permanent predators such as fish (Mosquito Fish *Gambusia affinis*, Bass *Micropterus salminoides*, Carp *Cyprinus carpio*, and Barbel *Clarius gariepinus*) may negatively affect remaining faunal species, especially frogs, which breed or live in the pan. From a water quality perspective, the optimal situation is for the pan to desiccate or "dry up" or "flood" fairly frequently. The drying out of the pan basin also encourages the growth of plant species which utilise the accumulation or build-up of nutrients and thus "purify" the pan before it becomes inundated again. Flooding, essentially "purges" the pan by flooding and forcing water out of the closed system along the artificially created eastern drainage furrow. From a water quality perspective the worst case scenario is a perennial pan/dam where little variation in water depths occurs. The present drying out of the majority of the pan can be considered as a natural phenomenon and **a positive impact on the pan's vegetation and water quality**. It also illustrates that the storm water spillways is functioning correctly.

The design of the throttle points was to ensure that anything up to the 5yr flood would be retained within the bio-swale and not be directed into the Pan. The smaller flood events (5yr floods) are generally more polluted with higher concentrations of contaminants as the pollution is not being diluted as greatly. The high flood events, over the 10yr flood, are more dangerous for the downstream users and "cleaner" when assessing water quality. If the attenuation of the bio-swale and specifically the dissipation points (gabions, throttle points, reno mattresses and vegetation) are able to contain and reduce the surface flows and minimize downstream flooding of the communities then the bio-swale is performing as designed.

The water quality of the pan will also improve and hopefully be maintained to further improve the status of the Pan.

Overflow design with low spillway to direct the high rainfall events into the pan to minimize downstream impacts

Revised design, with lower spillway for the 10yr or greater flood as well as barriers to restrict access to pan area (arrow)

Bio-swale has improved significantly and the eradication program continues to remove exotics **(2012)**

Spillway of the attenuation structure, as detailed above, shows the rehabilitation and progress of the spillways **(2012)**

Low attenuation structures and gabions within the bio-swale. A subsoil drain was installed to feed the wetland **(2010)**

Regrowth of vegetation around the gabions within the bio-swale. The vegetation has re-established well **(2012)**

Commencement of storm water attenuation measures in the bio-swale to manage run-off from the Commercial site **(2011)**

Additional rocks were placed on either site of the reno mattress to further minimize erosion in the bio-swale **(2012)**

Bio-swale after rainfall – water pools within the bio-swale and creates new habitat **(2010)**

Bio-swale showing good establishment of the wetland grasses and sedges and the new clear-vu fence **(2012)**

Design of the storm water outlets act as silt traps and litter traps. Vegetation will establish in outlets and gabions **(2011)**

Gabion storm water structure with dissipation barrier from the commercial site **(2011)**.

STATUS OF THE REHABILITATION AND ERADICATION PROGRAM

6. REHABILITATION PLAN & ERADICATION PROGRAM

A survey was conducted in October with the specialist (Mr Clayton Cook) to look into the state of the pan and wetland areas as well as the current condition of the rehabilitation work. The specialist letter is attached (**Annexure A**) and further supports the **vastly improved and very good state** of the pan and conservation area.

As part of the rehabilitation work, a contractor landscaper was appointed by the Section 21 company to undertake the eradication program as required in the Environmental Authorisation. Through this program, a number of exotic invasive plant species have been targeted especially the removal of Kikuyu (*Pennisetum clandestinum*), Chinese Elm (*Ulmus parvifolia*), Common Thorn Apple (*Datura stramonium*), Giant Reed (*Arundo donax*), Black Wattle (*Acacia mearnsii*), Pampas Grass (*Cortaderia selloana*), Black Locust (*Robinia pseudoacacia*), Sisal (*Agave americana*) and Pom-pom Weed (*Campuloclinium macrocephalum*).

These invasive alien plants can completely alter the functioning of the pan and wetland ecosystem. Generally alien vegetation infestations form dense, monospecific stands which dominate, overtop or replace the natural vegetation of the area, thereby completely altering its nature and functioning. Most of the indigenous wildlife is directly dependent on indigenous vegetation for survival using plants for food, cover, nesting sites and general refuge. Loss of indigenous vegetation and replacement by alien plants can therefore lead to local extinctions or a range of habitat-specific wildlife species. Alien invasive plants may be trees, shrubs, creepers, grasses, herbs or even water plants and are called 'invaders' to draw attention to their ability to spread aggressively and cause rapid and often irreversible changes in the landscape.

Objectives of the Alien Vegetation Control Program:

- The objective is to try prevent the further spread of invasive alien plants into un-infested areas and to isolate the dense infestations within a landscape that is otherwise maintained free of alien plants. The complete eradication of alien plants would be an ideal objective but it is seldom a practical and achievable approach to the alien plant problem. This has to be an on-going program by the Section 21 Company.
- Realistic goals for controlling alien plants on the site especially around the Parkhaven Pan have been undertaken by the ECO to try manage, and thereby minimise, the spread of the exotic plant species.
- A practical objective for any area infested with alien plants is to control or clear the plants starting with the least infested areas and working through the various degrees of infestation, starting with light and ending with dense.

List of Indigenous Grass Species Used to Hydro-seed the Bio-swale and embankments around the pan:

- Mat-forming grasses (e.g. *Digitaria eriantha, Chloris gayana)*
- Tufted grasses (e.g. *Eragrostis curvula, Panicum sp, Urochloa sp)*
- Couch grass (*Cynodon dactylon*) – used as the creeping grass.
- Cotton wool grass (*Imperata cylindrical)* – good in the vleis and bio-swale.

(Common names of above grasses– Common Finger Grass / Love Grass / Buffalo Grass / Herringbone Grass / Couch Grass / Cotton Wool Grass)

All of the exposed embankments along the bio-swale were covered with Hessian material and pegged to provide suitable stabilisation of the soil and the improvements in the bio-swale over the last 3 years have been significant. The photographs below show the rehabilitation work undertaken and the significant improvement of the pan over the past 3 years.

Burning Program - Wildfires

Burning of the pan and surrounding area occurs frequently, mainly due to Arson from vagrants as well as cable theft in the area. Frequent fires at the incorrect time of the year have disturbed the limited underlying grass and forb vegetation within the fallow agricultural lands (southern areas of the pan) which were dominated by dense stands of weedy plant species such as Khaki Bush (*Tagetes minuta*), Black-Jacks (*Bidens pilosa, Conyza albida, Verbena bonariensis*). The majority of the site was recently burned in 2012 during the winter months. Remnant patches of rank grassland occur around the southern portions of the pan.

These areas provide important refuge habitat for any remaining faunal species including Greater Cane Rats, Scrub Hares and Marsh Owls. Fire has an important ecological role and it is imperative that the vegetation on the site is not burned annually although this might be difficult to control if vagrants continue to set fires.

The implementation of adequate fire breaks around the pan is a recommendation as a management tool to try control annual wildfires. This would require the slashing of the rank grassland vegetation around the entire perimeter of the conservation area as depicted by the blue line in aerial photograph above (**Figure 1**).

Further Recommendations

The installation of foraging posts should be erected at a number of locations within the conservation areas to allow African Grass Owls and Marsh Owls and other predatory birds, suitable vantage points from which to hunt and feed upon. It is further recommended that the surrounding commercial properties place bat boxes within their sites as an environmentally friendly way of controlling problematic insects such as mosquitoes which are often associated with urban wetland habitats.

First hydro-seeding undertaken in **2010**

Hydro-seeding taking but exotic plants an issue **(2010)**

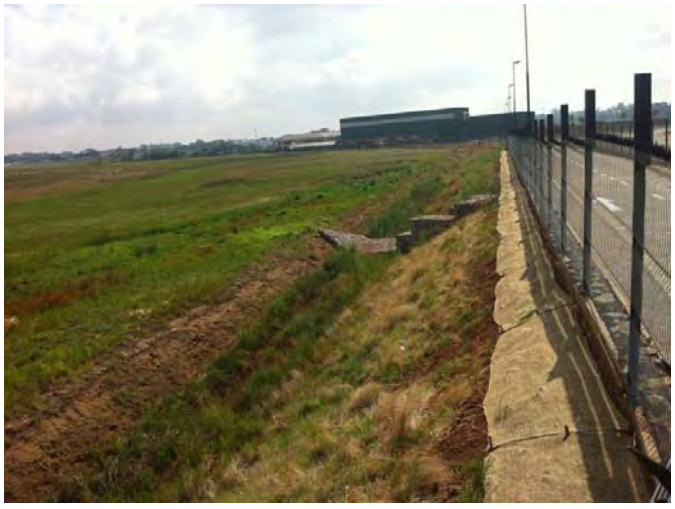
Rehabilitation of an embankment in the bio-swale using erosion control and hydro-seeding **(2011)**

Embankment prior to erosion control measures and hydro-seeding required after new Clear-vu fence installed **(2011)**.

Pampas grass on the southern edge of the storm water swale. Not as urgent to remove but will spread into pan area **(2011)**

Eradication of the Pampas grass (*Cortaderia selloana*), a Category 1 weed, as part of the eradication program **(2012)**

Old farm fence and perennial weeds were removed as part of the rehabilitation plan



The next eradication schedule is set for the beginning of **December 2012**

Exotic Spiny Thorn-Apple (*Datura stramonium*) – Cat 1 weed that has invaded the exposed embankments of the bio-swale. These have been manually removed or slashed

Exotic plants along the Toyota site as well as within the bio-swale buffer area (**2010**)

Figure 2: Most recent aerial photo of Parkhaven Ext 5 and Pan taken from Google Earth, dated **31st March 2012**. A fire has burnt most of the eastern properties however the pan itself is unburnt due to a high water table. The pan however did experience a large burn which resulted in a favourable condition, in that a greater internal percentage of the pan experienced a burn which has not occurred in at least 5 years. Fire is a requirement of any natural veld / wetland system however **fires must not occur every year, a more favourable fire cycle is every 3 – 5 years.**

SPECIALIST REPORT ON THE ENVIRONMENTAL STATE OF THE PAN AND WETLAND AREA

Compiled by Clayton Cook

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Specialist Faunal Consultant

P.O.Box 39357
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September 27, 2012

Greg Crookes

Dear Sir:

RE: CURRENT ECOLOGICAL STATUS OF THE PARKHAVEN PAN

Parkhaven Pan

Pans (also commonly known as playas in geomorphological literature) are common in many of the world's arid zones. In South Africa they are represented in the Western, Southern and Eastern Plateau wetland regions with their highest concentration being found in the area with a mean annual rainfall of less than 500 mm and an annual net evaporation loss of 1000 mm per annum. Endorheic pans are defined as being typically circular to oval in shape, shallow (less than 3 metres deep) even when fully inundated, and having a closed drainage system. Major water loss from pans is by evaporation, which plays some part in their salinity. Inundation is characteristically ephemeral, some pans in the dry western regions standing dry for years between flooding, but in the wetter eastern regions many pans are seasonal.

Parkhaven Pan is a seasonally inundated endorheic pan. The relatively small catchment area of the pan, and the fact that the pan is fed only by rainwater and possibly groundwater, makes the ecology of the pan sensitive to any changes/impacts within the catchment area. The entire pan with its associated hydrophilic grass (*Leersia hexandra*) shorelines are extremely sensitive habitats and have an extremely high conservation importance. These seasonal pans and inundated grasslands are vital habitats for numerous animal species including numerous threatened species (Giant Bullfrog, African Grass Owl, Marsh Sylph).

The altitude of the site is approximately 1 660 m above mean sea level (amsl). Parkhaven Pan collects and stores surface stormwater, before it reaches a certain levels upon which it drains or decants through an artificially created drainage furrow on the eastern portion of the pan. The local topography is characterised by very low gradients, typically between 2 and 3%. Two other pans are located to the north (Blaauw Pan) and the south (Clearwater's Pan).

Geology and Soils

The geology of the site based on an assessment of the 1:250 000 geological map indicate that rocks (shale, sandstone and mudstone) of the Karoo Supergroup (Vryheid and Dwka Formations) underlie most of the study area. Dolerite dykes have been encountered in these materials immediately to the north of the site. Exposed ferricrete was observed outside the eastern boundary of the site adjacent to an artificially created drainage furrow from the pan. Ferricrete usually forms due to fluctuating water levels within the soil. The hard plinthite results in a perched aquifer or raised water table. The majority of soils on and surrounding the site are transported (Colluvial and alluvial) soils of varying thickness. The lower sections of the transported layers; as well as the upper parts of the soils residual from the underlying bedrock, are ferruginised. The majority of the soils outside the pan area are mantled by open textured “collapsible” colluvial soils. Many, if not most, of the soils exposed have a fine texture

Hydrological Regime

From an eco logical perspective it is of paramount importance that the ‘natural’ hydrological regime and current seasonality and water levels and water quality of the pan are maintained. Constant flooding of the shallow margins (Eulittoral zone) of the pan may alter the vegetation (*Leersia hexandra*) and ultimately the habitat suitability of the pan. If the pan becomes a permanent water body the presence of permanent predators such as fish (Mosquito Fish *Gambusia affinis*, Bass *Micropterus salminoides*, Carp *Cyprinus carpio*, Barbell *Clarius gariepinus*) may negatively affect remaining faunal species, especially frogs, which breed or live in the pan. From a water quality perspective, the optimal situation is for the pan to desiccate or “dry up” or “flood” fairly frequently. The drying out of the pan basin encourages the growth of plant species which utilise the accumulation or build up nutrients and thus “purify” the pan before it becomes inundated again. Flooding, essentially “purges” the pan by flooding and forcing water out of the closed system along the artificially created eastern drainage furrow. From a water quality perspective the worst case scenario is a perennial pan/dam where little variation in water depths occur. The present drying out of the majority of the pan can be considered as a natural phenomenon and a positive impact on the pan’s vegetation and water quality. It also illustrates that the stormwater spillway is functioning correctly.

Spillway

An artificially created spillway was constructed post 2006 for stormwater management or attenuation purposes for the recently constructed warehouses and offices. The spillway has been constructed around the perimeter of the pan. This prevents excess stormwater runoff from the adjacent hardened surfaces entering directly into the pan. The spillway has been successfully re-vegetated with an indigenous grass seed mix. Certain sections were re-vegetated with a single grass species (*Chloris virgata*). Dense patches of Cottowool Grass (*Imperata cylindrica*) were observed on the southern portions in areas of elevated soil moisture levels. The hygrophilous Rice Grass (*Leersia hexandra*) was observed within the southern section of the spillway as well as several sedges such as *Schoenoplectus corymbosus*. The rank anthropogenic Common Thatching grass *Hyparrhenia hirta* stands should be cut around the margins of the stormwater spillway during the dry winter months (June-August). Several feral cats were observed within the concrete stormwater pipes from the church as well as around the newly established warehouses as well as degraded grasslands. These feral cats should be humanely removed from the conservation areas as they will have a high negative impact on remaining amphibians, reptiles, birds and smaller mammal species. Stormwater outlets should be screened to trap debris and litter before it enters the detention basin of the pan.

Dumping and Littering

Historically; extensive illegal dumping of organic materials and building rubble occurred throughout the site. The majority of rubble has been removed from the site; except for a few concrete pipes which have been retained for refuge habitat for remaining faunal species. Extensive illegal dumping activities still occurs towards the south-east of the site adjacent to Atlasville. The current stormwater outlets should be screened to trap debris and litter before it enters the detention basin of the pan. Large amounts of plastics and litter are entering the western portions of the pan through the Church's stormwater pipes as well as adjacent to the Toyota Warehouse and Telkom site. All litter must be removed for the conservation areas as well as spillway. Fines should be implemented for continual littering activities into the conservation area.

Kikuyu Invasion

The planting of exotic grasses (Kikuyu) should be prevented, especially adjacent to the pan and non-invasive indigenous grasses (*Cynodon dactylon*) should be used. No exotic invasive lawn species of grasses should be used in the conserved open spaces (buffer zones, biological corridors) or in properties adjacent to the pan. Kikuyu *Pennisetum clandestinum* is expressly prohibited. The Telkom site has used kikuyu for the re-vegetation of there stormwater drains. This is strongly condemned by the consultant. The kikuyu needs to be removed and replaced with an indigenous grass species to prevent further infestations.

Alien Vegetation Removal Programme

Several alien invasive plant and tree species historically occurred around the pan. An extensive alien vegetation removal programme was successfully initiated within the disturbed areas around the illegal dumping sites. Species removed included Chinese Elm (*Ulmus parvifolia*), Common Thorn Apple (*Datura stramonium*), Giant Reed (*Arundo donax*), Black Wattle (*Acacia mearnsii*), Pampas Grass (*Cortaderia selloana*), Black Locust (*Robinia pseudoacacia*), Kikuyu (*Pennisetum clandestinum*), Sisal (*Agave americana*) and Pom-pom Weed (*Campuloclinium macrocephalum*). A few scattered alien invasive species were observed adjacent to the stormwater outlet adjacent to the church site during the site visit on the 23rd August 2012. A follow-up eradication programme will be undertaken by a suitably qualified landscaper prior to the coming rains (pers. comm. Greg Crookes).

Fire

The use of open fires for cooking and heating purposes by surrounding vagrants results is a potential fire hazard and results in frequent burning of the site (degradation of natural vegetation). Burning of dumped waste material results in frequent burning of the surrounding vegetation. Arson from vagrants as well as cable theft in the area results in frequent fires. Frequent fires at the incorrect time of the year, has disturbed the limited underlying grass and forb vegetation within the fallow agricultural lands which are dominated by dense stands or weedy plant species such as Khaki Bush *Tagetes minuta*, Black-Jacks *Bidens pilosa, Conyza albida, Verbena bonariensis.* The majority of the site was burned during the winter months. Remnant patches of rank grassland occur around the southern portions of the pan. These areas provide important refuge habitat for remaining faunal species including Greater Cane Rats, Scrub Hares and Marsh Owls. Fire has an important ecological role. It is imperative that the vegetation on the site is not burned annually. The maintenance of adequate fire breaks around the pan may be a management tool that could be implemented. This will require the slashing of the rank grassland vegetation around the spillway during the winter period.

Illegal hunting and poaching activities and access to the pan

Illegal vagrants live on property and surrounding open areas. Intensive poaching throughout the site using wire snares as well as herding larger mammal species into the Toyota fence. Several pelts of Greater Cane rats have been observed during previous site visitations. It must be stressed however that the levels have decreased since the erection of a perimeter fence. Access still occurs on the eastern portions of the pan with the driving of off-road vehicles (4x4), quad-bikes as well as motorcycles through the pan as well as adjacent hillslope seepage wetlands as well as valley bottom wetland to the east of the site. A section of the outer perimeter fence was destroyed during a recent vehicle accident and needs to be replaced.

Further Recommendations

The installation of several foraging posts should be erected at a number of locations within the conservation areas to allow African Grass Owls and Marsh Owls and other predatory birds, suitable vantage points from which to hunt and eat prey. The installation of bat houses around the pan will be an environmentally friendly way of controlling problematic insects such as mosquitoes which are often associated with urban wetland habitats.

Yours sincerely

Clayton Cook*
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* DWA accredited to undertake wetland delineations and assessments (2008)

WATER QUALITY REPORT ON THE STATE OF THE PAN

Compiled by Clean Stream in 2010

CLEAN STREAM
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ATTENTION: Mr Greg Crookes **15 October 2010**

BASELINE WATER QUALITY ASSESSMENT: PARKHAVEN PAN, KEMPTONPARK DRY SEASON SURVEY

1. INTRODUCTION

Clean Stream Scientific Services were commissioned by GMCE Environmental Services to establish baseline water quality conditions at the Parkhaven Pan in Kemptonpark. An assessment for both a dry and wet season was recommended to establish the baseline water quality. This report focuses on the samples taken in September 2010, and represents the dry season survey.

DISCLAIMER:

SANAS (South African National Accreditation System) schedule of accreditation for Clean Stream Scientific Services: http://www.sanas.co.za/schedules/testing/T0374-06-09.pdf. Opinions and interpretations expressed herein are outside the scope of SANAS accreditation.

2. SAMPLED LOCALITIES

Table 2-1 indicates the various sampled localities around the Parkhaven Pan. These include an unnamed river/stream flowing towards the east of the pan, various inflows into the pan, and a stream flowing out of the pan towards the previously mentioned river. Table 2-1 also indicates the logged GPS coordinates (WGS84) of the localities, locality description, and remarks made in the field at the particular locality. Figure 2-1 illustrates the sampled localities around Parkhaven Pan. Locality photographs are illustrated in **Appendix C**.

Table 2-1: Sampled localities around Parkhaven Pan to establish baseline water quality conditions, September 2010.

Parkhaven Pan Water Quality Monitoring Localities - September 2010					
Site Name	**Ycoord (S)**	**Xcoord (E)**	**Site Type**	**Description**	**Field Remarks**
Inflow 01	26.268890	28.268890	Channel	Inflow 1 into Parkhaven Pan	Dry, Not Sampled
Inflow 02	26.269360	28.269360	Channel	Inflow 2 into Parkhaven Pan	Dry, Not Sampled
MH1	26.132828	28.275216	Manhole	Telkom Manhole	Sampled, metallic sheen
PHR 01	26.130391	28.278535	River	River upstream of Parkhaven Pan	Medium flow, clear but with some suspended solids
PHR 02	26.135655	28.280683	River	River downstream of Parkhaven Pan	Medium flow, clear but with a metallic sheen
PHS 01	26.134034	28.272175	Pan	Parkhaven Pan	Medium capacity, clear with some suspended solids
PHS 02	26.274975	28.274975	Stream	Outflow from Parkhaven Pan	Dry, Not Sampled
Pit	26.138460	28.270917	Pit	Excavated trench	Sampled, some suspended solids

Figure 2-1: The water quality monitoring localities at the Parkhaven Pan, September 2010.

3. LABORATORY ANALYSIS

Clean Stream Scientific Services maintains a state of the art water laboratory in Pretoria and is a SANAS Accredited Testing Laboratory, No T0374. This analytical laboratory is operational since July 2006 and takes part in the SABS Inter-laboratory Testing Scheme as required in the Scope of Work. The SANAS accreditation certificate and schedule is provided in **Appendix A.**

The Parkhaven Pan localities were analysed for a range of variables to establish baseline water quality condition, as indicated in Table 3-1.

Table 3-1: Analysis included for the Parkhaven Pan sampled localities, September 2010.

Hydrochemical Analysis for the Parkhaven Pan water quality monitoring localities, September 2010		
Package No		**Available Package**
CSP 04	**A**	Alkalinity, Cl, SO_4, NO_2, NO_3, PO_4, NH_4, Fluoride
	A	Ca, Mg, Na, K, Fe, Al, Mn, Cr, Cu, Ni, Pb, Zn, Cd, Co
	A	pH & Conductivity, TDS
	A	Total Hardness

4. WATER QUALITY RESULTS AND DISCUSSION

Water quality results are compared against various DWAF target water quality guidelines such as; Domestic Use (Table 4-1), Livestock Watering (Table 4-2), and Aquatic Ecosystems (Table 4-3). Analysis certificates can be viewed in **Appendix B**.

As indicated in Table 4-1, only selected metals concentrations exceed the proposed water quality guideline ranges for domestic use. It should be noted that at the neutral/alkaline pH levels recorded for the localities, it is likely that these metals are present in biologically unavailable colloidal complexes. The Pan (PHS01) and the upstream river locality (PHR01) can be described as having a good water quality.

Table 4-1: Parkhaven Pan water quality results compared against the DWAF target water quality guideline range for Domestic Use: Tolerated.

Parkhaven Pan water qualities compared against the DWAF Target Water Quality Range for Domestic Use: Tolerated						
SiteName	**Domestic Use: Tolerated**	**PHS 01**	**PHR 01**	**PHR 02**	**Pit**	**MH1**
pH	5.0 - 9.5	7.36	8.04	7.56	7.81	6.98
EC mS/m	150	23.30	28.47	34.22	22.32	36.30
TDS mg/l	1000	106.00	137.00	173.00	105.00	153.00
Ca mg/l	150	12.21	22.34	26.49	8.09	14.82
Mg mg/l	100	6.48	9.67	11.00	9.40	10.03
Na mg/l	200	14.85	14.07	27.88	21.11	26.48
K mg/l	50	3.77	3.65	2.33	1.53	6.74
MALK mg/l	-	33.80	88.50	158.60	60.10	69.70
Cl mg/l	200	10.30	5.70	4.70	19.60	37.40
SO4 mg/l	400	37.92	28.34	5.24	8.34	14.90
N NO3mg/l	10	0.50	0.50	0.60	0.72	0.66
F mg/l	1	<0.182	<0.182	0.26	<0.182	0.21
Al mg/l	0.5	0.02	0.17	0.11	**1.82**	<0.006
Fe mg/l	1	0.81	0.78	**4.87**	**12.32**	**1.52**
Mn mg/l	0.4	0.01	0.34	**1.03**	0.02	0.35
N_Amonia mg/l	2	0.05	<0.014	<0.014	0.10	<0.014
TotHardness mg/l	300	57.00	96.00	111.00	59.00	78.00
PO4 mg/l	2	<0.025	<0.025	<0.025	<0.025	<0.025
Cd mg/l	0.005	<0.001	<0.001	<0.001	<0.001	<0.001
Co mg/l	0.05	<0.002	<0.002	0.002	0.002	0.003
Cr mg/l	0.05	<0.002	<0.002	<0.002	0.003	<0.002
Cu mg/l	1.3	0.041	0.043	0.037	0.038	0.038
Ni mg/l	1	0.012	<0.003	0.008	0.010	0.010
Pb mg/l	0.01	<0.009	0.030	<0.009	0.020	0.010
Zn mg/l	20	0.013	<0.004	0.018	0.021	0.064
SAR	-	0.85	0.63	1.15	1.20	1.30

Table 4-2 compares the water quality results against the DWAF target water quality guideline range for Livestock Watering. Only locality Pit recorded a high Fe concentration exceeding the proposed guideline. Once again it is suspected that at the alkaline pH level, the iron will be present as suspended iron hydroxides.

Table 4-2: Parkhaven Pan water quality results compared against the DWAF target water quality guideline range for Livestock Watering.

Parkhaven Pan water qualities compared against the DWAF Target Water Quality Range for Livestock Watering						
SiteName	**Livestock Watering**	**PHS 01**	**PHR 01**	**PHR 02**	**Pit**	**MH1**
pH	-	7.36	8.04	7.56	7.81	6.98
EC mS/m	500	23.30	28.47	34.22	22.32	36.30
TDS mg/l	1000	106.00	137.00	173.00	105.00	153.00
Ca mg/l	1000	12.21	22.34	26.49	8.09	14.82
Mg mg/l	500	6.48	9.67	11.00	9.40	10.03
Na mg/l	2000	14.85	14.07	27.88	21.11	26.48
K mg/l	-	3.77	3.65	2.33	1.53	6.74
MALK mg/l	-	33.80	88.50	158.60	60.10	69.70
Cl mg/l	1500	10.30	5.70	4.70	19.60	37.40
SO4 mg/l	1000	37.92	28.34	5.24	8.34	14.90
N NO3mg/l	100	0.50	0.50	0.60	0.72	0.66
F mg/l	2	<0.182	<0.182	0.26	<0.182	0.21
Al mg/l	5	0.02	0.17	0.11	1.82	<0.006
Fe mg/l	10	0.81	0.78	4.87	**12.32**	1.52
Mn mg/l	10	0.01	0.34	1.03	0.02	0.35
N_Amonia mg/l	-	0.05	<0.014	<0.014	0.10	<0.014
TotHardness mg/l	-	57.00	96.00	111.00	59.00	78.00
PO4 mg/l	-	<0.025	<0.025	<0.025	<0.025	<0.025
Cd mg/l	0.01	<0.001	<0.001	<0.001	<0.001	<0.001
Co mg/l	1	<0.002	<0.002	0.002	0.002	0.003
Cr mg/l	1	<0.002	<0.002	<0.002	0.003	<0.002
Cu mg/l	0.5	0.041	0.043	0.037	0.038	0.038
Ni mg/l	1	0.012	<0.003	0.008	0.010	0.010
Pb mg/l	0.1	<0.009	0.030	<0.009	0.020	0.010
Zn mg/l	20	0.013	<0.004	0.018	0.021	0.064
SAR	-	0.85	0.63	1.15	1.20	1.30

Table 4-3 indicates the Parkhaven Pan water quality results compared against the DWAF target water quality guidelines for Aquatic Ecosystems. As with Tables 4-1 and 4-2, only the metal concentrations exceed the proposed water quality guidelines. The solubility of metals in water is highly dependent on the pH level of the water. At lower pH levels (Acidic water conditions) metals are more likely to go into solution to buffer the dropping pH. At higher pH levels (Alkaline conditions) metals tend to precipitate out of the water and form various colloidal complexes which could be suspended in the water. These colloidal metal complexes are usually biologically unavailable to the aquatic fauna, and hence nontoxic.

Table 4-3: Parkhaven Pan water quality results compared against the DWAF target water quality guideline range for Aquatic Ecosystems.

Parkhaven Pan water qualities compared against the DWAF Target Water Quality Range for Aquatic Ecosystems						
SiteName	**Aquatic Ecosystems**	**PHS 01**	**PHR 01**	**PHR 02**	**Pit**	**MH1**
pH	-	7.36	8.04	7.56	7.81	6.98
EC mS/m	-	23.30	28.47	34.22	22.32	36.30
TDS mg/l	15% variation	106.00	137.00	173.00	105.00	153.00
Ca mg/l	-	12.21	22.34	26.49	8.09	14.82
Mg mg/l	-	6.48	9.67	11.00	9.40	10.03
Na mg/l	-	14.85	14.07	27.88	21.11	26.48
K mg/l	-	3.77	3.65	2.33	1.53	6.74
MALK mg/l	-	33.80	88.50	158.60	60.10	69.70
Cl mg/l	400	10.30	5.70	4.70	19.60	37.40
SO4 mg/l	-	37.92	28.34	5.24	8.34	14.90
N NO3mg/l	-	0.50	0.50	0.60	0.72	0.66
F mg/l	0.75	<0.182	<0.182	0.26	<0.182	0.21
Al mg/l	0.005	**0.02**	**0.17**	**0.11**	**1.82**	<0.006
Fe mg/l	-	0.81	0.78	4.87	12.32	1.52
Mn mg/l	0.18	0.01	**0.34**	**1.03**	0.02	**0.35**
N_Amonia mg/l	-	0.05	<0.014	<0.014	0.10	<0.014
TotHardness mg/l	-	57.00	96.00	111.00	59.00	78.00
PO4 mg/l	0.1	<0.025	<0.025	<0.025	<0.025	<0.025
Cd mg/l	0.0004	<0.001	<0.001	<0.001	<0.001	<0.001
Co mg/l	-	<0.002	<0.002	0.002	0.002	0.003
Cr mg/l	0.007	<0.002	<0.002	<0.002	0.003	<0.002
Cu mg/l	0.003	**0.041**	**0.043**	**0.037**	**0.038**	**0.038**
Ni mg/l	-	0.012	<0.003	0.008	0.010	0.010
Pb mg/l	0.0012	<0.009	**0.030**	<0.009	**0.020**	**0.010**
Zn mg/l	0.002	**0.013**	<0.004	**0.018**	**0.021**	**0.064**
SAR	-	0.85	0.63	1.15	1.20	1.30

5. CONCLUSIONS AND RECOMMENDATIONS

Clean Stream Scientific Services were commissioned by GMCE Environmental Services to establish baseline water quality conditions at the Parkhaven Pan in Kemptonpark. This report focuses on the samples taken on 27 September 2010, and represents the dry season survey.

Water quality results are compared to the DWAF target water quality guidelines for domestic use, livestock watering, and aquatic ecosystems. Except for a few metal concentrations, the water quality conditions can be described as good. The high metal concentrations are suspected to be due to suspended matter in the water, as the alkaline water quality conditions would rather precipitate metals than induce solution thereof.

It is recommended to do a wet season survey, around March 2011, to compliment the dry season data. Various localities, such as the inflows into the pan, were recorded as dry and no water quality results are available for these localities. The wet season survey would also give an indication of “fresher” water quality conditions in the Pan and surrounding rivers after an influx of cleaner rain water.

6. REFERENCES

Department of Water Affairs and Forestry (DWAF). (1996a): South African Water Quality Guidelines (second edition). Volume 1: Domestic Use.

Department of Water Affairs and Forestry (DWAF). (1996c): South African Water Quality Guidelines (second edition). Volume 5: Livestock Watering.

Department of Water Affairs and Forestry (DWAF). (1996d): South African Water Quality Guidelines (second edition). Volume 7: Aquatic Ecosystems.

Appendix A

Accreditation Certificate

CERTIFICATE OF ACCREDITATION

This is to certify that:

Clean Stream Scientific Services

Facility Accreditation Number: **T0374**

is a South African National Accreditation System accredited Testing laboratory provided that all SANAS conditions and requirements are complied with

This certificate is valid as per the scope on the accompanying schedule of accreditation bearing the above accreditation number for

CHEMICAL ANALYSIS

The facility complies with the general requirements of

ISO/IEC 17025:2005

This accreditation demonstrates technical competency for a defined scope and the operation of a laboratory quality management system and shall remain in force subject to continuing compliance with SANAS accreditation criteria, ISO/IEC 17025:2005 and any further requirements specified by SANAS

While this certificate remains valid, the Accredited Facility named above is authorised to use the relevant SANAS logo to issue facility reports and/or certificates

---

Mr MA Peet
Chief Executive Officer

Initial Accreditation: 12 February 2008

Certificate Commences: 12 February 2008
Certificate Expires: 12 February 2013

"Recognised as the official national accreditation body by the Department of Trade and Industry of the Republic of South Africa"

This certificate is only valid when accompanied by its schedule of accreditation.

S C H E D U L E O F A C C R E D I T A T I O N

Testing Laboratory Number: T0374

Permanent Address of Laboratory:
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489 Jacqueline Drive
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0042

Tel : 012 348 2813/4
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Technical Signatories : Ms H Holtzhausen
: Ms N Buckle

Nominated Representative : Ms H Holtzhausen

Issue No. : 01
Date of issue : March 2008
Expiry date : March 2013

Materials/Products Tested	Types of Tests/Properties Measured, Range of Measurement	Standard Specifications, Equipment/ Techniques Used
CHEMICAL		
Water (including waste and process)	Automated photometric determination of Total Alkalinity Chloride (Cl) Ammonia (NH_4) Nitrate (NO_3) Nitrite (NO_2) Orthophosphate (PO_4) Sulphate (SO_4)	CSM 01
	Determination of dissolved metals Calcium (Ca) Magnesium (Mg) Sodium (Na) Potassium (K) Iron (Fe) Manganese (Mn) Aluminium (Al) Chromium (Cr) Copper (Cu) Nickel (Ni) Lead (Pb) Zinc (Zn) Cadmium (Cd) Cobalt (Co) with ICP-OES	CSM 02
	Total Dissolved solids (dried) 180^{o}C	CSM 04
	pH, Electrical Conductivity and Fluoride by potentiometric determination	CSM 05

ISSUED BY THE SOUTH AFRICAN NATIONAL ACCREDITATION SYSTEM

Field Manager

SCHEDULE OF ACCREDITATION

Testing Laboratory Number: T0374

Permanent Address of Laboratory:
Clean Stream Scientific Services
489 Jacqueline Drive
Garsfontein
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Technical Signatories : Ms H Holtzhausen
Ms N Buckle

Nominated Representative : Ms H Holtzhausen

Issue No. : 01
Date of issue : March 2008
Expiry date : March 2013

Materials/Products Tested	Types of Tests/Properties Measured, Range of Measurement	Standard Specifications, Equipment/ Techniques Used
CHEMICAL		
Water (including waste and process)	Enumeration of Coliforms and Escherichia coli by IDEXX Quanti-tray Colilert-18	CSM 03
	Calculations: Total hardness, Magnesium hardness, Calcium hardness, Sodium Absorbtion Ration (SAR), Total dissolved solids, Cations, Anions, Cations & Anions balance, Bicarbonate alkalinity (HCO_3), Carbonate alkalinity (CO_3) Hydroxide alkalinity (OH) Free carbon dioxide (CO_2) Total carbon dioxide Langlier saturation index (LSI) pH_s Converting PO_4 as P to PO_4 Converting NO_2 as N to NO_2 Converting NO_3 as N to NO_3 Converting NH_4 as N to NH_4	CSM 06
	Automated photometric determination of fluoride	CSM 11
	Automated photometric determination of hexavalent chromium (Cr^{+6})	CSM 12
	Qualitative (absent/present) determination of Coliforms and Esherichia coli by IDEXX Colilert-18	CSM 15

ISSUED BY THE SOUTH AFRICAN NATIONAL ACCREDITATION SYSTEM

Field Manager

Appendix B

Water Quality Results

CLEAN STREAM
Scientific Services (Pty.) Ltd.

489 Jacqueline Drive, Garsfontein, Pretoria, 0042
P.O. Box 905008, Garsfontein, 0042
Tel (012) 348 2813/4, **Fax** 012 348 8575

Specialists in environmental monitoring

Test Report

Client: GMCE Venture Captial (Pty) Ltd
Address: 55 Alanglades, Pilgrim Street , Lonehill east, 2191
Report No: 3966 **Project:** Parkhaven Pan

Date of certificate: 11 Oct 2010
Date accepted: 27 Sep 2010
Date completed: 05 Oct 2010

Lab no:			45361	45362	45363	45364	45365
Date sampled:			27 Sep 2010	27 Sep 2010	27 Sep 2010	27 Sep 2010	27 Sep 2010
Sample type:			Water	Water	Water	Water	Water
Locality description			PHR 01	PHR 02	PHS 01	Pit	MH1
Analyses:		**Method**					
A	pH	CSM 05	8.04	7.56	7.36	7.81	6.98
A	Electrical conductivity (EC) mS/m	CSM 05	28.47	34.22	23.30	22.32	36.30
N	Temperature (degree Celsius)	CSM 05	22.1	21.9	21.8	21.8	21.7
A	Total dissolved solids (TDS) mg/l	CSM 06	137	173	106	105	153
A	Total alkalinity mg/l	CSM 01	88.5	158.6	33.8	60.1	69.7
A	Chloride (Cl) mg/l	CSM 01	5.7	4.7	10.3	19.6	37.4
A	Sulphate (SO4) mg/l	CSM 01	28.34	5.24	37.92	8.34	14.91
A	Nitrate (NO3) mg/l as N	CSM 01	0.502	0.599	0.495	0.721	0.663
A	Ammonium(NH4) mg/l as N	CSM 01	<0.015	<0.015	0.052	0.105	<0.015
A	Orthophosphate (PO4) mg/l as P	CSM 01	<0.025	<0.025	<0.025	<0.025	<0.025
A	Fluoride (F) mg/l	CSM 11	<0.183	0.264	<0.183	<0.183	0.210
A	Calcium (Ca) mg/l	CSM 02	22.338	26.492	12.210	8.088	14.822
A	Magnesium (Mg) mg/l	CSM 02	9.673	11.002	6.479	9.397	10.035
A	Sodium (Na) mg/l	CSM 02	14.07	27.88	14.85	21.11	26.48
A	Potassium (K) mg/l	CSM 02	3.648	2.328	3.774	1.530	6.740
A	Aluminium (Al) mg/l	CSM 02	0.166	0.109	0.018	1.820	<0.006
A	Iron (Fe) mg/l	CSM 02	0.777	4.866	0.812	12.320	1.520
A	Manganese (Mn) mg/l	CSM 02	0.343	1.033	0.015	0.016	0.354
A	Total chromium (Cr) mg/l	CSM 02	<0.002	<0.002	<0.002	0.003	<0.002
A	Copper (Cu) mg/l	CSM 02	0.043	0.037	0.041	0.038	0.038
A	Nickel (Ni) mg/l	CSM 02	<0.003	0.008	0.012	0.010	0.010
A	Zinc (Zn) mg/l	CSM 02	<0.004	0.018	0.013	0.021	0.064
A	Cobalt (Co) mg/l	CSM 02	<0.002	0.002	<0.002	0.002	0.003
A	Cadmium (Cd) mg/l	CSM 02	<0.001	<0.001	<0.001	<0.001	<0.001
A	Lead (Pb) mg/l	CSM 02	0.03	<0.01	<0.01	0.02	0.01
A	Total hardness mg/l	CSM 06	96	111	57	59	78
A	Sodium Adsorption Ratio (SAR)	CSM 06	0.63	1.15	0.85	1.20	1.30
A	Anions	CSM 06	2.56	3.46	1.79	1.98	2.81
A	Cations	CSM 06	2.69	3.81	1.94	3.01	2.99

A = Accredited (Included in the SANAS Schedule of Accreditation); N = Not accredited (Excluded from the SANAS Schedule of Accreditation)
OSD = Outsourced; S = Sub-contracted; NR = Not requested; RTF = Results to follow; TNTC = To numerous to count; ND = Not detected
NATD = Not able to determine

sanas Testing Laboratory
T0374

Report checked by: H. Holtzhausen (Analytical Scientist)

Appendix C

Locality Photographs

Locality photographs taken on 27 September 2010 at the various sampled localities - Parkhaven Pan.		
Locality	**Description**	**Photograph**
Inflow 01	Inflow 1 into Parkhaven Pan	
Inflow 02	Inflow 2 into Parkhaven Pan	
MH1	Telkom Manhole	
PHR 01	River upstream of Parkhaven Pan	
PHR 02	River downstream of Parkhaven Pan	
PHS 01	Parkhaven Pan	

Locality photographs taken on 27 September 2010 at the various sampled localities - Parkhaven Pan.		
PHS 02	Outflow from Parkhaven Pan	
Pit	Excavated trench