**CLIENT:**

# NEW UNIVERSITIES

# SOL PLAATJE UNIVERSITY

# THE ASSESSMENT TO USE NON POTABLE WATER FOR IRRIGATION ON AND AROUND THE NEW CAMPUS

## REPORT : DRAFT 01

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**MARCH 2014**

# REPORT: THE ASSESSMENT TO USE NON-POTABLE WATER FOR IRRIGATION ON AND AROUND THE NEW CAMPUS

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# 1. INTRODUCTION

The new Sol Plaatje University will be established in the Inner City of Kimberley. A large portion of the area earmarked for the university will comprise of sport fields and open green areas. The current high cost of potable water that is distributed by Sol Plaatje Municipality will result in high irrigation costs. This is evident from discussions that took place with surrounding schools currently experiencing problems with very high costs to irrigate their sport fields.

An existing non-potable water supply system is already in operation in Kimberley. This scheme transfers excess non-potable water from the northern located Homevale Waste Water Treatment Works to green areas in Kimberley (CBD) and Galeshewe. The excess water originates from treated effluent from the Homevale Waste Water Treatment Works (WWTW), storm water and mine dewatering. In the recent pass the increasing water level in the Kamfersdam poses threats to a railway line passing the dam site and the ecosystem of the pan itself. The municipality has been investigating options to address this excess water problem and to supply this water into different "green belt" nodes in Kimberley and as such complement the proposed green belt throughout the city which has been identified and described in their Comprehensive Urban Planning Report.

This study will therefore focus on the following:

- Assessment of the existing Infrastructure - Assess the condition and capacity of the existing scheme and in particular the mechanical and electrical components and capacity of installed pipelines,
- Stakeholders and potential beneficiaries – identify and consult all stakeholders and potential beneficiaries that will benefit from the supply of non-potable water,
- Water demands - Determine the water demands for these beneficiaries for irrigation water, considering summer peaks,
- Yield - Assess the yield of the non-potable water source considering the seasonal runoff of water both from treated effluent return flows and from the storm water system,
- Route evaluation - Identify alternative routes to service all stakeholders that will take part in the venture,
- Water quality – evaluate the historic water quality results from this source and the appropriateness for use as irrigation water for sport fields and parks areas. Check also

the long term impact of using the non-potable water for irrigation of sport fields and on social environment around these irrigation points,

- Legislation – ensure that the use of non-potable water complies to existing legislation,
- Determine the Capital cost and Operating costs of the scheme,
- Determine the Operational Requirements and roles and responsibilities.

# 2. ASSESSMENT TO USE NON-POTABLE WATER FOR IRRIGATION PURPOSES

## 2.1 ASSESS THE EXISTING INFRASTRUCTURE

The existing infrastructure was assessed and the following recorded:

### Homevale WWTW to Eddie Williams

A pump system at the Homevale WWTW delivers water (treated effluent) at a set rate of 75 l/s through a 3,2km 250mm diameter pipeline to a 712 Kl reservoir at Eddie Williams (EW). The Asbestos Cement (A.C.) pipe line is more than 25 years old. The pump system is capable of delivering water at a rate more than 100 l/s but had to be restrained because of the size and structural limitations presented by the old A.C. pipe line. The pump system consist of dual twin pumps each capable/set to delivering 75 l/s regulated by a switch gear programmed to use the pumps alternatively. Meaning while one pump is on duty the other is resting but ready as a stand by. The pumps are frequently alternated to manage the pump hours.

Current Infrastructure Conditions

The pump set at Homevale WWTW is currently non-operational. The pumps are sharing a common sump with a pump set delivering water to De Beers. The effluent pumps are experiencing priming problems due to the rate the De Beers pumps are abstracting water from the sump, subsequently leaving inadequate water levels for the effluent pumps to operate. To counter this problem the sump inflow has to be increased or the effluent pumps have to be replaced with newer technology self-priming pumps. Sol Plaatje Municipality is currently forced to irrigate their parks with potable water and is investigating this situation.

### Eddie Williams to Queens Park

A pump system boosts water from the EW Reservoir through a 3,8km 200mm diameter A.C. pipeline to a 440 Kl reservoir at Queens Park.

Current Infrastructure Conditions

The pump station at Eddie Williams has been vandalised and completely destroyed. The municipality made a direct connection between the 250mm and 200mm diameter pipe lines which means the main pumps at Homevale WWTW now by-passes the Eddie Williams reservoir and pump the full 7km route to discharge directly into the 440kl reservoir at Queens Park. A connection has also been made to the 200mm diameter mPVC pipe line to Witdam, Galeshewe.

**Eddie Williams to Witdam and Witdam to RC Elliot**

A pump system also abstracts water from the EW Reservoir and feeds a 1Ml reservoir at Witdam through a 3.0km 200mm diameter mPVC pipe line.

Another pump station abstracts water from Witdam reservoir and feeds an elevated reservoir near the Legislature building through a 5.5km 200mm mPVC pipe line.

Current Infrastructure Conditions

These infrastructure has never been in use since commissioning almost 10 years ago. All pumps will need refurbishment before re-commissioning. No problems are foreseen for the pipe line and electrical equipment.

**Queens Park to Oppenheimer Park**

A pump set at Queens Park pumps non-potable water through a 200mm diameter 1,17km pipeline to the Civic Centre and the Oppenheimer Gardens.

Current Infrastructure Conditions

This A.C. pipe line is also more than 25 years old.

## 2.2 POTENTIAL BENEFICIARIES AND STAKEHOLDERS

The proposed irrigation area has been divided into Phase A and Phase B beneficiaries.

Phase A Beneficiaries (See schematic layout 107NC14_04 – Annexure C):

a) The new university including
    i. Oppenheimer memorial park on the north campus,
    ii. Sport fields on the central campus, and
    iii. Sport fields on the South Campus (existing Hoffe park)
b) Northern Cape High School
c) Kimberley Boys High School
d) Kimberley Junior Primary School
e) Diamond Field High School
f) CBC School
g) Vooruitsig Primary School
h) GWK rugby club near Hoffe park
i) AR ABASS Sport Facility
j) Kimberley Bowling Club

k) Neutral Sportground

l) Sol Plaatje Municipality recreational areas

i. Square Hill Park gardens,

ii. Queens Park gardens

iii. Trim Park gardens

Phase B Beneficiaries (See schematic layout 107NC14_05 – Annexure C):

a) Galeshewe Stadium

b) Yorkshire Cricket Facility

c) Tshiamo Primary School

d) Thabane Public Secondary School

e) Tlhokomelo Thusong Service Centre

f) Moremogolo College

g) Phastimang Teachers College

h) Emang Mmogo Comprehensive

i) Sol Plaatje Higher Primary School

j) Peme Primary School

k) Greenpoint School

l) Boichoko H.P. School

m) Reneilwe School

n) Sol Plaatje Municipality Recreational Areas

i. Witdam Park gardens,

ii. Community Park gardens

iii. Philip Mpiwa Park gardens

iv. Legislature Building gardens

v. RC Elliot Park gardens

The beneficiaries were chosen mainly based on their location alongside the existing infrastructure route and around the new Sol Plaatje University's footprint in the Kimberley CBD.

Most of the **Phase A beneficiaries** have been consulted and are interested to become part of the scheme if the infrastructure is extended to the Sol Plaatje University's planned footprint which currently includes the area from the existing Oppenheimer gardens near the Sol Plaatje Municipal chambers to Hoffe Park south of the Kimberley CBD. The mentioned schools are currently experiencing high irrigation costs to maintain their sport facilities and can benefit from a scheme which may be able to distribute water for a discounted rate. The other Phase A

beneficiaries includes existing sport facilities and municipal recreational areas alongside the existing pipe route.

**Phase B beneficiaries** are situated in Galeshewe alongside existing infrastructure constructed between 2003 and 2006 as part of the Galeshewe Urban Renewal Project for the very same purpose to distribute cheaper water for irrigation. These beneficiaries includes schools, municipal parks, community sport facilities and the Legislature Building. This infrastructure have not been efficiently utilised since commissioning but the Sol Plaatje Municipality feel strongly that it should be included in the larger irrigation scheme.

**Other important stakeholders** that need to be consulted and that will/can also play a role in this venture include:

a) The Sol Plaatje Municipality as the Water Services Authority and manager of the non-potable water system,
b) De Beers as a potential user and contributor to the future yield of the non-potable water,
c) DWA as custodian and regulator of water use,
d) Potential funders such as the Sol Plaatje University,
e) Others?

A concerted effort will be undertaken to approach these stakeholders and users to partake in the sharing of the non-potable water supply. A water services/supply agreement will have to document all roles and responsibilities of the different role players concerning the supply and use of non-potable water.

## 2.3 WATER REQUIREMENTS/ IRRIGATION DEMAND

The water requirements for the applicable public open spaces were derived from the SAPWAT computer program, which can be described as the 'ideal' situation, where water is supplied to meet the theoretical crop water demand.

For the purpose of the report the turf specie assumed on all the open spaces is Kikuyu. Kikuyu is a common lawn and pasture grass grown throughout South Africa in gardens and on cattle farms and sport fields. It is bright green with creeping rhizomes and leafy runners, which root from the nodes and form a dense mat of grass.

Factors employed to determine the irrigation requirement:

- Plant water requirement or evapotranspiration based on weather conditions.

- Functional objective and quality standard of the turf.
- Irrigation system application efficiency.
- Soil type and water holding capacity.
- Plant root zone depth.

The irrigation requirement for the area of 73.50 ha for a given period was based on climatic, agronomic, turf quality and system performance factors. The outcome is monthly water consumption targets, based on long term average climatic conditions, in mm depth of water as highlighted in the figure below.

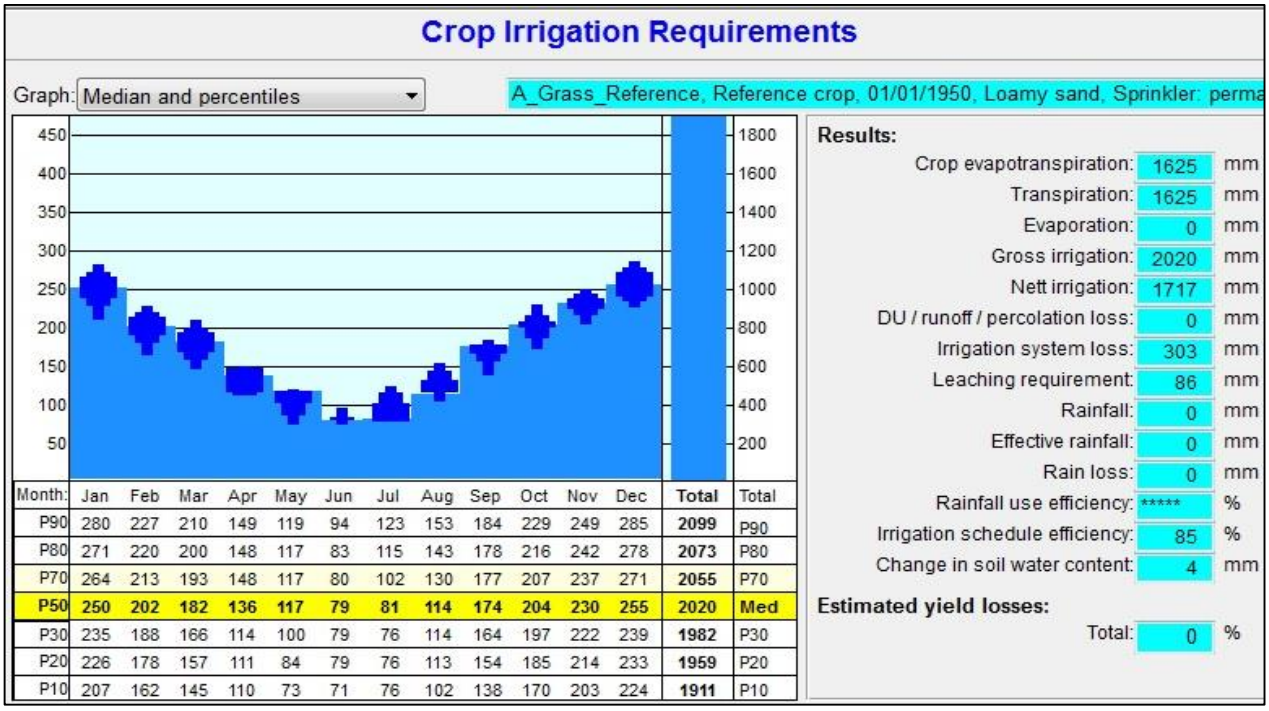


Figure 1. *SAPWAT Irrigation Requirement Calculation*

Irrigation systems do not apply water at 100% efficiency. The optimum performing irrigation system is subject to inherent system inefficiencies. Factors such as wind, misting, poor sprinkler spacing, nozzle loss and other system performance faults impact on the uniformity of water application. Therefore a factor must be applied to account for irrigation system performance. The water balance assumed a distribution uniformity of greater than 85% (in-field) which effectively means poorly functioning systems must be upgraded and or replaced.

Rainfall was not taken into account since it can be variable and is not always effective. Small rain events are lost by evaporation and do not soak into the soil, whereas large events may deliver more water than the soil can hold and can be lost either through drainage or run off.

In order to determine how much water the bulk water supply system from Homevale has to supply to sustain the area to the accepted standard, the peak month requirement of 255 mm (or 8.2 mm per day) for December was used. The system peak flow was calculated at 98 ℓ/s with the parameters as indicated in the table below.

*Table 1. System Flow*

| Description | Units | Qty |
|---|---|---|
| Net Irrigation requirement (peak demand) | mm/d | 8.20 |
| Soil Water Holding Capacity | mm/m | 100.00 |
| Effective Plant Root Zone Depth | mm | 300.00 |
| Readily Available Water | mm | 15.00 |
| System efficiency | % | 85.00 |
| Bulk pump duration | hours | 20.00 |
| System flow | L/s | 98.21 |

Note that passive irrigated areas require a lower standard and have lower risk ratings than active sports grounds. The standard to which turf is maintained has significant impact on water sage. Turf must be maintained at a level that ensures safety for users and meets the functional objective. A passive irrigated area can be maintained using up to 50% less water than an active sports ground. For the purpose of the report all areas was assumed to be active sports grounds.

An irrigation schedule of 16mm of application every second day was proposed for all beneficiaries. The scheme must therefore be divided into two parts of 37 hectare each receiving 16mm irrigation every second day which means 5.92Ml/day during the peak month for the entire scheme.

A daily and monthly irrigation limit was determined for each beneficiaries based on the abovementioned criteria. Please see Annexure A and Annexure B (beneficiaries' profiles) for the demand calculations and individual allocations per beneficiary.

## 2.4 WATER AVAILABILITY (YIELD) AND QUALITY

### 2.4.1 Water Availability

According to Sol Plaatje Municipality the incoming flow to Homevale suddenly dropped from 37Ml/day to approximately 22.5 Mℓ/day since November 2011. Metering data has been monitored from January 2014 to date and is evident that the average daily inflow to Homevale is currently in the order of 22.Mℓ/day. The estimated average effluent yield from the Homevale Waste Water Treatment Works is therefore 22.5 Mℓ/day of which 11 Mℓ/day is allocated to De Beers Consolidated Mines (DBCM) and the Kimberley Golf Course by means of existing MoA's signed between the parties and the Sol Plaatje Municipality.

In a study done in 2006 it was determined that Kamfersdam needs an average inflow of 11 Mℓ/day to counter evaporation and seepage in order to sustain suitable water levels. No effluent is discharge to Kamfersdam since October 2013 as the suitable operating level of the pan is exceeded by 2 meters.

Surplus water can be discharged into the Kamfersdam, transferred to Langleg 55 pan/dam and/or distributed for irrigation of existing parks. The current water (effluent) balance is therefore as per table 2.

*Table 2. Water Balance*

| MONTH | HOMEVALE AVERAGE EFFLUENT FLOW [m³/d] | ALLOCATION TO DE BEERS & GOLF COURSE [m³/d] | WATER AVAILIBLE FOR IRRIGATION AFTER 11 ML [m³/d] | IRRIGATION REQUIREMENTS FOR 74 ha GRASS | | | SURPLUS AVAILABLE FOR KAMFERSDAM [m³/d] |
|---|---|---|---|---|---|---|---|
| | | | | [mm/md] | [mm/d] | [m³/d] + 15% | |
| June | 22500,0 | 11000,0 | 11500,0 | 79 | 2,6 | 2241,0 | 9259,0 |
| July | 22500,0 | 11000,0 | 11500,0 | 81 | 2,6 | 2223,6 | 9276,4 |
| August | 22500,0 | 11000,0 | 11500,0 | 114 | 3,7 | 3129,5 | 8370,5 |
| September | 22500,0 | 11000,0 | 11500,0 | 174 | 5,8 | 4935,8 | 6564,2 |
| October | 22500,0 | 11000,0 | 11500,0 | 204 | 6,6 | 5600,1 | 5899,9 |
| November | 22500,0 | 11000,0 | 11500,0 | 230 | 7,7 | 6524,3 | 4975,7 |
| December | 22500,0 | 11000,0 | 11500,0 | 255 | 8,2 | 7000,2 | 4499,8 |
| January | 22500,0 | 11000,0 | 11500,0 | 250 | 8,1 | 6862,9 | 4637,1 |
| February | 22500,0 | 11000,0 | 11500,0 | 202 | 7,2 | 6139,4 | 5360,6 |
| March | 22500,0 | 11000,0 | 11500,0 | 182 | 5,9 | 4996,2 | 6503,8 |
| April | 22500,0 | 11000,0 | 11500,0 | 136 | 4,5 | 3857,9 | 7642,1 |
| May | 22500,0 | 11000,0 | 11500,0 | 117 | 3,8 | 3211,8 | 8288,2 |

The figure below graphically illustrates the water balance of the Homevale WWTW

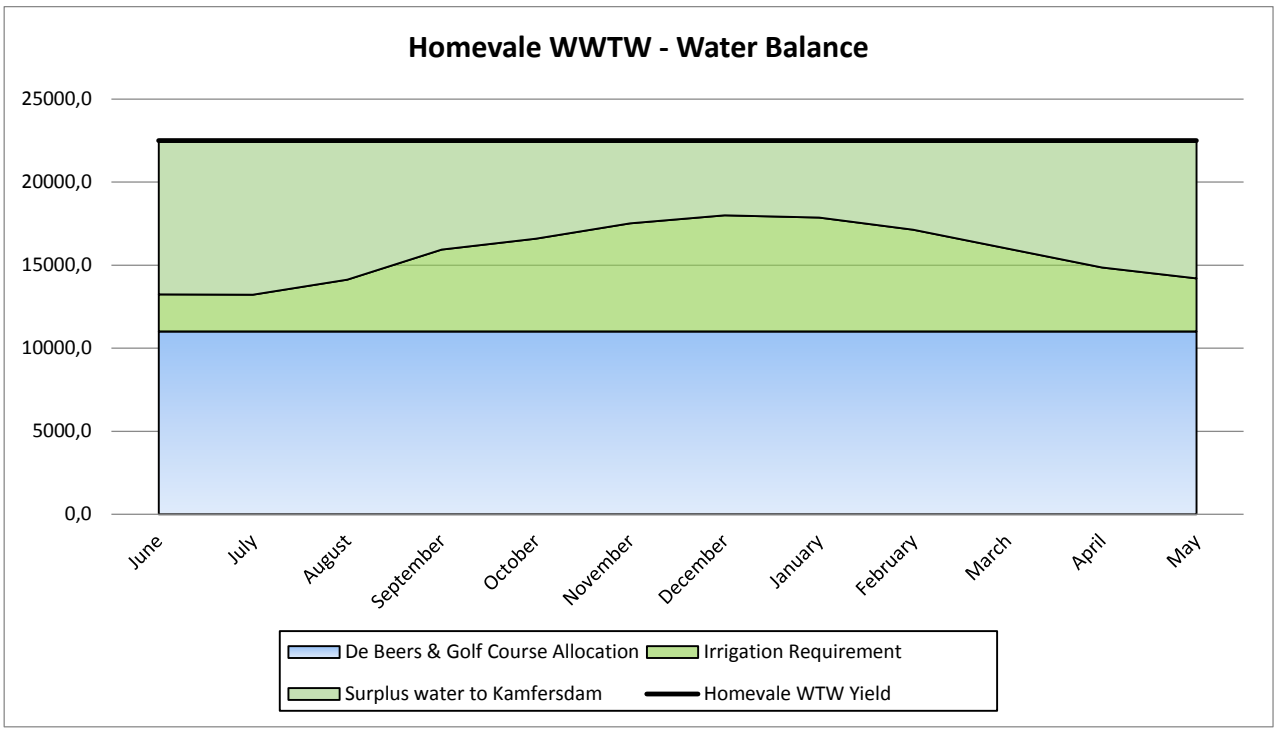


Figure 2. *Homevale WTW Water Balance*

As indicated the water discharge into the Kamfersdam is dependent on the irrigation requirement and is below 7 Mℓ/day in the summer months and approximately 12 Mℓ/day in the winter. The average flow into the Kamfersdam or Langleg pan can be 9.3 Mℓ/day.

### 2.4.2 WATER QUALITY

Irrigation water quality affects the growth potential of crops, soil properties, the biological balance of soils as well as the irrigation equipment. In this case it can also affect the health of the end users (humans) using the sport and recreational facilities.

The water quality report was obtained from Homevale Wastewater Treatment Works. The results were compared to the Department of Water Affairs' guidelines for irrigation water quality (Volume 4). The results are indicated in the table below.

A water classification could not be conducted due the absence of test results for sodium (Na), calcium (Ca) and magnesium (Mg). The concentration of these elements is used to calculate the sodium absorption ratio (SAR) of the water which together with the electrical conductivity is an indication of propensity of salinization.

From the available results, the water quality is suitable for irrigation of sport fields and parks.

*Table 3. Water quality*

| Water Quality Parameters | Possible Risk | Units | Homevale WTW Average | Acceptability Levels | | | |
|---|---|---|---|---|---|---|---|
| | | | | Good | Acceptable | With Proviso | Un-acceptable |
| pH at 25°C | Absorption of N (5% loss at pH of 8) | pH units | 7.5 | 7 | | | |
| Turbidity | Filtration | NTU | 580 | < 200 | | | |
| Electrical conductivity at 25°C | Salinization hazard | mS/m | 100 | 0 - 40 | 40 - 90 | 90 - 270 | 270 - 540 |
| SAR | | mmol/L | Not available | 0 - 1.5 | 1.5 - 3.0 | 3.0 - 5.0 | 5.0 - 10.0 |
| Chloride Cl | Toxic | mg/L C | 0.5 | 0 - 105 | 105 - 140 | 140 - 350 | >350 |
| Nitrate N | | mg/L N | 1.5 | 0 - 3 | 3 - 5 | 5 - 7 | 7 - 9 |
| Fluoride F | Trace Elements | mg/L F | Not available | 0 - 2.0 | 0 - 2.0 | 2.0 - 7.5 | 7.5 - 15.0 |
| Aluminium Al | | mg/L Al | Not available | 0 - 5.0 | 0 - 5.0 | 5.0 - 10.0 | 10.0 - 20.0 |
| Iron Fe | | mg/L Fe | Not available | 0 - 5.0 | 0 - 5.0 | 5.0 - 10.0 | 10.0 - 20.0 |

Government Gazette Vol 579 No.36820 dated 06 September 2013, The General Authorisation (GA), Section 21(e) in terms of Section 39 of the National Water Act 36 of 1998, refers to irrigation of land with Waste or Water Containing Waste, See Annexure D for the relevant abstract from the Gazette. The Authorisation is summarised as follows:

1. The authorisation gives options for irrigating 2000kl/d or 500kl/d or 50kl/d on any given day.
2. For irrigation more than 2000 kl on any given day, an application for a water use licence, instead of registration under the GA requirements, need to be submitted to DWA.
3. Generally, the more water use for irrigation, the better the water quality will have to be.
4. Based on the analyses, the water quality will not constantly meet with the requirements for irrigating 2000kl, because of the ammonia and *E.coli* values.

5. A better option will be to comply with the irrigation requirements for **500kl/day**. But in this case, test for **Ca, Mg and Na**, need to be conducted in order to determine the Sodium Adsorption Ratio (**SAR**).
6. The total scheme exceeds the **2 000 kl/day** by far as it will be **5 920 Kl/day** during the peak month and **1 940Kl/day** during nadir the month. The General Authorisation will therefore had to be for individual beneficiaries. Most of the beneficiaries falls with the **500kl/day** threshold except Sol Plaatje Municipality and Sol Plaatje University.
7. A test for **Faecal Coliform**, not E.coli, as Faecal coliform gives the same or higher counts, and is a requirement in the Authorisation need to be conducted.
8. The authorisation lays out the Registration Process, Location of Irrigation with Wastewater, Record-keeping Requirements, and Precautionary Practices.

Upon submission of your proposed water use to the DWA, they might request the provision of additional information not contained in the Authorisation. An issue that the DWA might have is that of public health. As part of the management techniques, you will have to ensure that the public will not be exposed to mist, and that the effluent will at all times comply with a Faecal Coliform count of Nil count/100ml.

## 2.5 ROUTE EVALUATION

A new pipe route has been planned based on the location of prospective beneficiaries. Pipe line routing, sizing and strategic positioning of reservoir and elevated towers has been done to cater for the irrigation demand and calculated system flow as indicated under section 2.3.

The pump station at Homevale WWTW to be upgraded with variable speed self-priming twin pumps which can deliver a range of 75 l/s to 105 l/s. The existing 250mm A.C. pipe line will still be the link between Homevale WWTW and Eddie Williams Reservoir. It is further recommended that planning must start for the replacement of this pipe line as it is already older than 25 years and are restricting the entire scheme to 75 l/s (6.48ML/day base on a 24 hour pump day).

A new pump station to be introduced at Eddie Williams and the existing 712 KL reservoir refurbished and re-commissioned. The pump station to include two pump sets dividing the distribution between Galeshewe and Kimberley CBD. A twin pump set will therefore transfer water through the existing 200mm pipeline to Witdam at a rate of at least 68.5 l/s (5.92ML/day). Another twin pump set will transfer water through the existing A.C. 200mm pipeline. These pumps must also operate 24 hours a day to ensure at least 5.92ML/day at Queens Park.

It is also recommended that planning must start for the replacement of this pipe line as it is already older than 25 years.

Queens Park will become the new control centre for the Phase A development which will includes the new Sol Plaatje University sport grounds/parks, surrounding schools and sport facilities. A 600 KL reservoir will be added to the existing 440 kl tank to establish at least 1ML of storage capacity at the central station to counter the limitations caused by the 250mm and 200mm A.C. pipe lines from Homevale to Queens Park. A new 4.3km 315mm diameter pipe line to be constructed to distribute non potable water to all sport grounds and parks of the Sol Plaatje university, all other prospective beneficiaries as listed in sections 2.2 and existing recreational facilities of the Sol Plaatje Municipality and other sporting bodies. The pump station at Queens Park to be upgraded to transfer non potable water through the 4.3km pipe line at a flow rate of at least 98 l/s. A 20m high 500 KL elevated tower to be constructed at the highest point of the pipe line (Hoffe Park). The elevated tower will ensure pressures of between 2 and 3.8 bar (ignoring friction and minor losses) alongside the 4.3km pipe route at all times even if the pumps at Queens Park are in rest mode.

A telemetric system to be introduce to control the functioning of the entire irrigation scheme by means of radio signals communication.

<u>The scope of Works can therefore be summarised as follows:</u>

- Upgrade and refurbishment the Homevale WWTW pump Station
- New Pump Station and refurbishment of the 712 Kl reservoir at Eddie Williams
- Upgrading of Queens Park pump Station
- New 600 Kl reservoir at Queens Park
- New 500 Kl elevated reservoir (with 20m stand) near Hoffe Park
- New 4.3km 315mm diameter class 9 uPVC pipe line from Queens Park to Northern Cape High School via Sol Plaatje University sport grounds at Hoffe Park. See image 107NC14_003.
- Interconnecting pipe work, minor refurbishment of existing mechanical equipment and general site works
- Telemetric Communication

## 2.6 LEGISLATION

### 2.6.1 National Environmental Manage Act 56 of 2002

A basic assessment is required under the following conditions:

- The construction of facilities or infrastructure exceeding 1000 m in length for the bulk transportation of water, sewage or storm water –

  (i) With an internal diameter of 0.36 m or more; or

  (ii) With a peak throughput of 120 litres per second or more,

Excluding where:

(a) Such facilities or infrastructure are for bulk transportation of water, sewage or storm water or storm water drainage inside a road reserve; or

(b) Where such construction occurs within urban areas but further than 32 m from a watercourse, measured from the edge of the watercourse.

- Construction of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, with a combined capacity of 50 000 m3 or more, unless such storage falls within the ambit of Activity 19 of Notice 545 of 2010.

A full environmental impact assessment (EIA) is required for the physical alteration of virgin soil to agriculture, afforestation for the purposes of commercial tree, timber or wood production of 100 hectares or more.

It is therefore evident that non of the proposed activities in this report necessitates a basic assessment nor a full EIA.

### 2.6.2 Legislation Regarding the use of Purified Effluent for Irrigation Purposes

The only reference that could be found regarding the use of treated effluent on public open spaces and sport ground were the *Guide: Permissible Utilisation and Disposal of Treated Sewage Effluent - 30 May1978.*

According to the Guideline the Homevale WWTW is STD calcification - Primary, Secondary and Tertiary Treatment which entail that the final effluent complies with the General Standard with the E.coli count relaxed to a maximum of 1000 E. coli /100 ml.

Irrigation is permissible for Sports fields where contact is often made with the surface, i.e. Rugby fields, athletics tracks, etc School grounds and public parks are included with the exclusion of lawns at swimming pools, nursery schools and children's playgrounds. However, such activities have to be registered in order to comply with the General Authorisation (GA), Section 21(e) in terms of Section 39 of the National Water Act 36 of 1998 as regulated by DWA and as describe in section 2.4.2 of this document.

# 3. COST ANALYSIS

## 3.1 CAPITAL COSTS

The capital cost breakdown below is as per activities listed under section 2.5 of this document and includes construction costs, professional fees, contingencies, escalation and VAT.

| Description | Amount |
|---|---|
| Upgrade and Refurbishment of Homevale WWTW Pump Station and Sump | R 1 250 000.00 |
| Proposed Pump Station and refurbishment of 712 Reservoir at Eddie Williams | R 2 250 000.00 |
| Upgrading of Queens Park Pump Station | R 1 250 000.00 |
| Additional 600 KL Reservoir at Queens Park | R 2 050 000.00 |
| Proposed 400 KL elevated Reservoir (with 20m stand) at Hoffe Park | R 2 750 000.00 |
| Proposed 4.3km, 315mm diameter uPVC distribution main (pump line) | R 8 600 000.00 |
| Telemetric Communication | R 600 000.00 |
| Interconnecting Pipe Work, minor refurbishment to existing mechanical equipment and general site works | R 750 000.00 |
| **Sub Total 1** | **R 19 500 000.00** |
| Contingencies/Escalation (10%) | R 1 950 000.00 |
| **Sub Total 2** | **R 21 450 000.00** |
| **Professional Fees** | **R 3 003 000.00** |
| **Sub Total 3** | **R 24 453 000.00** |
| VAT (14%) | R 3 423 420.00 |
| **Total Estimated Project Costs** | **R 27 876 420.00** |

## 3.2 OPERATING COSTS

The operation and maintenance cost associated with the proposed infrastructure listed above can be determined as follows:

| OPERATION RELATED COSTS | AMOUNT |
|---|---|
| **Operational Cost per year (1 484 704Kℓ/annum)** | |
| Effluent Costs (R 0.00)/KL of 1 484 704 Kℓ / annum | R 0.00 |
| Treatment cost | R 742 352.00 |
| Labour (use existing operators) | R 350,000.00 |
| **SUB TOTAL 1** | **R 1 092 352.00** |
| **Maintenance Cost per year (1 484 704Kℓ/annum)** | |
| Mechanical/Electrical (4% of R 6 250 000.00) | R 250 000.00 |
| Civil/Buildings (2% of R 6 500 000.00) | R 130 000.00 |
| Pipelines (0.5 of R 8 600 000.00) | R 43 000.00 |
| **SUB TOTAL 2** | **R 423 000.00** |
| **O&M COST PER ANNUM** | |
| **TOTAL** | **R 1 515 352.00** |

| | |
|---|---|
| Average annual water supply | 1 484 704 Kℓ/annum |
| **O&M Cost per kilo litre** | **R 1-02/Kℓ** |

**Notes:**

1. **Annual maintenance cost used (DWA Guidelines)**
   - Mechanical / Electrical Installations – 4 % of capital cost p.a
   - Civil / Building installations – 2 % of capital cost p.a
   - Pipelines – 0.5 % of capital cost p.a
2. **Annual operating cost based on the following (DWA Guidelines)**
   - Treatment cost of R0-50/Kℓ (chemicals and electrical)

# 4. OPERATIONAL REQUIREMENTS

Sol Plaatje Municipality is currently operating and maintaining the existing distribution of purified effluent system. It is therefore recommended that the proposed expansion must also be assigned to Sol Plaatje Municipality. The assets should than be registered to Sol Plaatje Municipality, irrespective of whom the funder or funders will be, to enable the municipality to operate and maintain the scheme.

Operation and maintenance costs can be covered by a tariff structure that can be agreed upon for the distribution of the non-potable water, per kilolitre, to the applicable beneficiaries.

# ANNEXURE A

# BENEFICIARIES PROFILE -

# PHASE A BENEFICIARIES

# ANNEXURE B

# BENEFICIARIES PROFILE -

# PHASE B BENEFICIARIES

# ANNEXURE C

# Schematic Layout Drawings

1. 107NC14_001 – Proposed Irrigation Network
2. 107NC14_002 – Existing Pipeline
3. 107NC14_003 – New Pipeline
4. 107NC14_004 – Phase A
5. 107NC14_005 – Phase B

# ANNEXURE D

# WATER QUALITY REPORT

1. Water Quality Test Results
2. Government Gazette No.36820