KGETLENGRIVIER LOCAL MUNICIPALITY

KOSTER SEWAGE TREATMENT WORKS UPGRADE RBIG APPLICATION IMPLEMENTATION READINESS STUDY PRELIMINARY DESIGN AND TECHNICAL RESEARCH AND INVESTIGATION PHASE 2B & 3 (IRS)

REPORT PHASE 2B: PRELIMINARY DESIGN AND RESEARCH PHASE 3: IMPLEMENTATION READY STUDY REPORT

IRS DISCUSSION DOCUMENT

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ABBREVIATIONS:

DWA - Department of Water Affairs
KRLM - Kgetlengrivier Local Municipality
MwB - Moedi Wa Batho Consulting Engineers and Project Managers
WSDP - Water Service Development Plan
IDP - Integrated Development Plan
PSP - Professional Service Provider
STP - Sewage Treatment Plant
PS - Pumping Station
SPS - Sewage Pumping Station
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NOTE:

This document forms part of the comprehensive IRS study document and report. This document was extracted from the comprehensive report with lots of appendices to condense for discussion purposes. The document was also condensed for email and distribution purposes.
1. INTRODUCTION

1.1 General

The terms of reference for “Feasibility Study and Implementation Ready Study for the Regional Bulk Infrastructure Grant Programme (RBIG)”, specifies a number of reports to be compiled in a specific sequence. These are:

- Phase 1 : Scoping and Inception - Attached as Appendix 2;
- Phase 2A : Technical Feasibility - Attached as Appendix 3;

This report is Phase 2B: Preliminary Design and Research.

The Terms of Reference clearly indicates the topics to be addressed in the Phase 2B report. For ease of reference the Terms of Reference have been attached as Appendix 1 and the headings have been used as paragraph headings in this report.

1.2 Scope of Works

The scope of works for the new Koster Sewage Treatment Plant is generally as follows:

- The installation of outfall sewers to transfer the sewage from “pick-up points” in Reagile to the proposed new sewage treatment plant. These “pick-up points” are generally the pumping stations transferring the sewage to the old works. These pumping stations are hard to maintain and one of the factors that determined the position of the new sewage treatment plant is the eradication of these pumping stations to ease the operational and maintenance burden on the municipality.

- The proposed new sewage treatment plant will be designed as a nutrient removal activated sludge plant with a design capacity of 3Mℓ per day. The plant will be designed for expansion to 6Mℓ per day, as and when required. It is unlikely that Koster will expand to generate more than 6Mℓ of sewage within normal design horizons. Readers have to accept that if a chicken abattoir, brewery or related infrastructure develops in town, the impact on the plant will be beyond the above mentioned capacity.
2. FURTHER RESEARCH / INVESTIGATIONS

2.1 Supply of electricity must be investigated

The sewage treatment plant will be constructed next to an existing 11kV distribution line that is currently part of the main supply to Reagile. Electricity for the plant will be drawn from this supply.

In general, the electricity supply to Koster is currently upgraded from a different 88kV substation close to Rustenburg. The proposed supply is therefore more than adequate to drive the sewage treatment plant.

An electrical engineer will be appointed during the final design stage of the project. The estimated demand of the plant is 500kVA. The above mentioned supply is rated to supply the required demand.

2.2 Borehole exploratory yield testing; (this may be needed to decide on the most appropriate option)

Not applicable on this project.

2.3 Land survey

A detailed survey was conducted. These drawings form part of the preliminary design drawings attached as Appendix 4.

2.4 Geological investigations

These investigations are still outstanding. A service provider will be appointed as soon as the expense has been approved by The Department of Water Affairs. The estimated costs for a detailed Geotechnical report is R550 000 (excl VAT). This includes recommendations on the impact of the sewage treatment plan on ground water and ground water quality.

2.5 Further water quality tests

Water quality tests are not applicable on this project.

The final effluent of the sewage treatment plant will be released in the Koster River. This river is currently polluted. Raw sewage finds its way into the river. The final effluent to be produced by the proposed sewage treatment plant will be of high quality and the water quality in the river will improve as soon as the plant is commissioned.

2.6 Further WC / WDM analysis

Money has been budgeted to commence with WC / WDM in Koster. Service providers will be appointed shortly.

2.7 Topographical survey

Please refer to paragraph 2.3.
2.8 Surge and water hammer analysis

Not applicable on this project.

3. PRELIMINARY DESIGN

3.1 Survey

Please refer to paragraph 2.3.

3.2 Geotechnical

Please refer to paragraph 2.4.

3.3 EIA

A service provider has been appointed.

The project has been registered with the Department Environmental Affairs (NW DACE). The reports for both the outfall sewers and the proposed sewage treatment plant have been completed and submitted. The service provider is currently awaiting comments or alternatively approval and the ROD.

Attached as Appendix 6 is an assessment of the project done by a service provider. The intention of the assessment was to indicate the implications of the project on the environment. In accordance with this document it is unlikely that a ROD should not be granted.

3.4 Preliminary Design

3.4.1 Introduction

With reference to the comments in the introduction to this document, the following:

- Expansion of town
- Existing oxidation lagoon system
- Elimination of pumping stations (PS)
- Sewage treatment plant
- Effluent quality and discharge

3.4.1.1 Expansion of town

An overview and the analysis of future sewage demands were addressed in detail in Paragraph 5 of the Scoping and Inception Report. The sewage generated in Koster and Cidrella is currently estimated to be 763 m$^3$ per day and the theoretical amount of sewage to be generated in Reagile is 2014 m$^3$ per day. The sewage to be generated in Reagile is called “theoretical” for two reasons:

- Everybody in Reagile is currently not enjoying water born sanitation. Expansions on the sewage networks is virtually a continuous process; and
• The previous reports indicated in detail why Reagile is served by multiple sewage pumping stations and why more will be constructed as the town expands. These pumping stations are hard to maintain and sewage spills into the environment. All the sewage generated is therefore not piped to the existing lagoon system. Broken pipes and overflowing manholes, especially on the end of lines are ignored by maintenance crews and this sewage is discharged into the veld.

In the previous reports, details are provided of the multiple water sheds identified in Koster and Reagile. This forced design engineers to install many sewage pumping stations to transfer sewage from the different drainage areas into the main outfall sewer that eventually discharges into the oxidation lagoon system. As indicated before, the position of the new sewage treatment plant was chosen to eradicate pumping stations and to rather construct outfall sewers. This adopted design guideline entails that the “old Koster” will keep on discharging into the old outfall sewer and the oxidation lagoon system will be retained to treat the sewage generated in the traditional Koster and the CBD of the town. All the suburbs of Reagile and Cidrella will discharge into outfall sewers that will transfer sewage to the new plant.

The first two reports indicated that the expansions of Reagile will be towards the new plant. Foreseeable expansions in the greater Koster and Reagile will therefore fit in with the proposed outfall sewers and the new plant.

3.4.1.2 Existing oxidation lagoon system

The existing oxidation lagoon system is in an appalling condition. The lagoons are overloaded, need to be de-sludged and backlog maintenance has to be done.

A successful ACIP application was launched and R8 million was allocated for renovations on the lagoon system, budgeted over two financial years. (2013 / 2014 and 2014 / 2015). As indicated before, the sewage generated in “old Koster” will not be re-routed to the proposed sewage treatment plant. The renovations planned for the oxidation lagoon system will therefore not be fruitless expenditure for the following reasons:

• Sewage from old Koster will drain to the lagoons (to re-route this sewage to the proposed plant will require a sewage pumping station);
• The newly constructed abattoir discharges an estimated 60m³ of effluent to the lagoon system per day; and
• The operation and maintenance costs of oxidation lagoons are minimal. Retaining the lagoon system as part of the total sewage treatment train will save costs in the long run.

3.4.1.3 Elimination of pumping stations (PS)

The Phase 2A report, attached as Appendix 3, in Paragraphs 4 and 5, indicates that four sewage pumping stations can be eradicated if the proposed outfall sewers and sewage treatment plan is constructed.

Attached to this document are 2 drawings indicating the proposed outfall sewers. Please note that these outfall sewers commence at existing sewage pumping stations and are designed to replace these pumping stations.

3.4.1.4 Sewage treatment plant
The proposed new Koster Sewage Treatment Plant (STP) is designed with the following features:

- All the sewage will flow under gravity from all the drainage areas into an inlet works;
- Sewage will drain through the plant, including the inlet works. Pumps will be installed for sludge re-circulation only. The impact of this design is that in case of a power failure, raw sewage will drain through the inlet works, into the reactor. The best quality water will be displaced into the secondary clarifiers and in turn the best quality effluent will leave the plant. These statements indicate that the plant will be virtually immune against power failures for durations up to an estimated 6 – 8 hours.
- Standby electricity will be installed but it will be limited to safety / area lighting only.
- The plant is a biological nutrient removal plant. Effluent quality will meet the traditional “Special” effluent standard.

**Process**

The process selected for the Koster STP is the patented HYBACS process. This process was successfully used in Swartruggens and is preferred for the following reasons:

- The process proved to be extremely stable;
- The operators employed by Kgetlengrivier Local Municipality understands the process;
- The process proved to require less electricity than conventional activated sludge plants;
- The process, due to its stability is easy to operate; and
- The effluent quality can be guaranteed.

A layout drawing of the proposed sewage treatment plant is attached to this document.

**Inlet works**

The inlet works proposed for the new plant will comprise of the following unit processes:

- The head of works will be protected by a rock trap.
- The rock trap will be followed by a course, hand raked screen to protect the following mechanical screens from oversize floating materials.
- Two mechanical screens in series will be provided. Two screens in series remove more floating debris from the sewage stream than a single fine screen. The two screens will be designed to be lifted or swung from the stream in case of mechanical failure.
- Two hand raked screens in series will be provided as back-up facility during power failures or when both mechanical screens fail.
- Each mechanical screen will be supported by a screenings washing and press mechanism. Screenings will be sterilized to allow the discharge of the screenings on a normal solid waste dump.
- Two mechanical grit removal systems will be provided. Grit will be removed from the stream and separated from the excess water by a grit classifier.
- Flow measurement will be done before the effluent from the inlet works flows into the next process.
Anaerobic reactor

The first reactor in the process train is an Anaerobic reactor. This reactor is required for phosphate release and a small percentage of elutriation.

SMART Units

The SMART units form the basis of the HYBACS process. The complicated process configuration cannot be described in this report. Details can be obtained from the website of the patent holders of the HYBACS process. This company, BLUE WATER BIO is based in the United Kingdom and has a local office, Headstream Water.

Most of the beneficial and unique biomass develops in the SMART units.

Aerobic reactor

The aerobic reactor comprise of four basins of equal volume in series. The first basin has no aeration equipment installed and is operated as an anoxic reactor to facilitate denitrification.

The subsequent three following reactors are all equipped with aeration equipment and the DO is maintained on 1.2 to 1.5 mg/ℓ.

Mixed liquor is re-circulated from the last aerobic zone to the anoxic reactor to facilitate denitrification.

Clarifiers

Traditional secondary clarifiers will be provided. The plant will be designed with two clarifiers of which only one will be constructed. The second will be constructed when the plant is upgraded to 6Mℓ/d.

A percentage of the sludge return from the clarifiers will be returned to the inlet works to curb smells. The sludge produced by the HYBACS process is odor-free and the increased percentage of bacillus bacteria in the MLSS assists in the eradication of sulphate reducing bacteria. The balance of the sludge return will be returned to the denitrification zone of the aerobic reactor.

Disinfection

Some form of disinfection will be provided. Ozone and UV will be considered at the time but it is unlikely that state of the art disinfection systems will be installed. Chlorination of the final effluent is preferred.

Normally chlorination with chlorine gas is preferred. This system is the cheapest and normally preferred. Chlorination with calcium chloride and related products will be considered.

Chlorine contact channels form part of the standard design. The retention period in the channels shall be designed to be 10 minutes under peak flow conditions.

Sludge Wasting

Sludge will be wasted from either the aerobic reactor or from the underflow of the clarifier. Waste sludge will be de-watered by a modified filter press. These machines are lately widely installed and if the waste sludge is sterilized by pasteurization, the sludge can be applied to
fields without further composting or related processes. There are no industries in Koster and it is expected that the sewage treatment plant will produce sludge of high quality that could be reused in agriculture.

3.4.1.5 Effluent quality and discharge

A few streams will leave the plant or can be perceived to leave the plant. These are:

- **Final effluent** – The final effluent will leave the plant sterilized and of a chemical quality that can be discharged into the environment. The flow rate will be continuously measured and totalized.
- **Screenings** – As indicated before screenings and grit will leave the plant as washed and sterilized debris. The water content in these screenings can be ignored.
- **All other streams will be circulated back for re-treatment.**

3.5 BoQ

As indicated in paragraph 3.4 a detailed preliminary design with bills of quantities have been prepared. These bills have been priced as accurately as possible to derive the costs indicated below. The priced bills of quantities are attached to this document as Appendix 4.

**Please note that the priced BoQ’s have a base date of March 2013.**

3.6 Cost Estimates

The estimated project cost is detailed in Table 3.1 below.

**Table 3.1: Project cost estimates**

<table>
<thead>
<tr>
<th>Description</th>
<th>Estimated cost (R)</th>
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<td>IRS Study</td>
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<td>Disbursements</td>
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<tr>
<td>• Land survey</td>
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<td>• Geotechnical Studies</td>
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<tr>
<td>• EIA</td>
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<td>Outfall sewers</td>
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<tr>
<td>Land Acquisition for Plant and Servitudes</td>
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<td>Construction costs</td>
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<td>Professional Fees</td>
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<td>Sub Total</td>
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<td>Escalation (2013 to 2015) – 15%</td>
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<tr>
<td>Total Project Cost (excl VAT)</td>
<td>96 200 000</td>
</tr>
<tr>
<td>Total Project Cost (incl VAT)</td>
<td>109 668 000</td>
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</tbody>
</table>
3.7 Surge and water hammer analysis

Not applicable on this project. All pumping stations and rising mains have been omitted.

3.8 Pipe material selection

All the outfall sewers will be constructed in PVC. This material is currently the most widely used material for sewers. The other materials cannot be provided at realistic cost in the diameter ranges required to transfer the sewage.

Manholes could either be precast concrete or HDPE. Bills of quantities and specifications will be drafted to allow competitive tendering in the two available materials.

3.9 Cathodic Protection

Cathodic protection will not be applicable on this project. All pipes and related infrastructure will be manufactured from non ferrous materials.

3.10 Servitudes

The proposed outfall sewers will be installed on municipal land. Where private land is crossed, servitudes will be registered.

Negotiations with the private land owners are currently in process. The outcome of these will be documented in the EIA. Preliminary discussions with the land owners indicated that they are in favor of the development.

A sworn evaluator has been appointed to:

- Determine the value of the farm where the plant will be constructed; and
- Propose costs for land to be expropriated for servitudes.

The report from the evaluator will be used to negotiate the purchase price of the land from the landowner.

4. WATER USE LICENSE APPLICATION

Water use license applications form part of the EIA.

5. EIA APPROVAL PROCESS

This process has and it is projected that the ROD should be available towards December 2013.

6. PROJECT IMPLEMENTATION PLAN: COST ESTIMATE AND TIME SCHEDULE

6.1 Cost estimate

The project cost estimate was determined through the compilation of preliminary bills of quantities and pricing of these. A summary of all costs is given in paragraph 3.6 above.
Please note that the total project cost is estimated on R84.2 million excluding VAT and with a base date of March 2013. It is proposed that escalation be allowed for. The table in paragraph 3.6 proposes 15% assuming that construction will be completed in 2015. If the proposed escalation of 7% per annum is accepted the total project budget should be R96.2 million, excluding VAT.

6.2 Project implementation and time schedule

6.2.1 Project implementation

A sewage treatment plant has four distinct features. These are:

- The process;
- The layout and shape of the civil structures;
- The mechanical equipment; and
- The electrical supply to the mechanical equipment and the control of the mechanical equipment.

The process to be selected is the process or combination of processes that the design engineer specify, believing that these processes are the best available technology to purify the raw sewage to an effluent quality that will meet the standards to be implied on the plant. The process is often also selected with low operating costs in mind.

As indicated before, the mechanical equipment could form up to 45% and even 50% of the total construction value of the sewage treatment plant. Optimizing the mechanical equipment entails optimization of purchase price (capital) and the optimization of the maintenance of this equipment. Often civil structures have to be designed to accommodate this mechanical equipment. It is therefore proposed that tight but accommodating specifications be compiled for all the mechanical equipment. Once the equipment has been selected, the civil structures and control features of the equipment can be designed.

The high level implementation programme indicated in the chart below reflects the proposal.

6.2.2 Time schedule

The project will be implemented in a period of 16 months. This period includes the period required for the procurement processes.

<table>
<thead>
<tr>
<th>Month</th>
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The time schedule can be translated as follows:

- Mechanical procurement to commence in November 2013.
- Appointment of Mechanical contractor in January 2014 on condition that delivery may only commence in July 2014.
- Electrical design and control systems to be completed by end Feb 2014.
- Final design to be completed by end Feb 2014.
- Procurement procedures for electrical and civil contractors to commence in March 2014.
- Civil and Electrical contractors to be appointed by end April 2014.
- Construction to commence in May 2014.

A zero risk supply chain process

To date only one risk was identified that could de-rail the proposed project schedule. The ROD has to be issued before DWA would allow the procurement process for mechanical contractors to commence. If possible, DWA could relax the above mentioned rule and the tendering mechanical contractors could be informed that a contractor will only be appointed if the ROD for the project is granted. The above will speed-up the process and final design will be completed well in advance of the procurement process for civil and electrical contractors. The following advantages could be realized:

- It will allow for a broader spectrum of the industry to tender and provide alternatives from a mechanical perspective;
- Economy of scale can be better applied;
- The civil design will be based on the best selected mechanical system that is selected.

7. O & M AND ASSET MANAGEMENT PLANS

O & M and Asset Management Plans will be compiled for the Kgetlengrivier Local Municipality, at some later stage. Information on the equipment will only be available when the tenders have been evaluated and the contractors have been appointed.

8. O & M ACTIVITIES REQUIRED

Operations and Maintenance is plant and equipment specific. Once again these activities can only be compiled once the equipment has been procured. It goes without saying that O & M activities, requirements and costs will be taken into account in the tender evaluation process.

9. O & M BUDGET REQUIREMENTS

The proposed sewage treatment plant is an activated sludge plant. These plants require operations and maintenance budgets. Indicative figures are as follows:

- Electricity requirements

The Koster sewage treatment plant will be designed to treat 3 000m³ of sewage with an estimated COD load of 800mg/ℓ or 2 400kg per day. For budgeting purposes, it can be assumed that 1kWh per kg COD will be required. At design capacity, an estimated 2 400kWh per day will be required.
• Manpower requirements

Details are discussed in paragraph 10 below.

• Chemicals

Three types of chemicals will be required. These are:

* Lime;  * Chlorine;  and  * Flocculants

*Lime* is often required to adjust the pH in sewage treatment plants, especially with low alkalinity water. The Koster water treatment plant treats low alkalinity raw water and pH adjustment and stabilization is often not done – hence the proposal to make provision for the addition of lime at the sewage treatment plant. For the purposes of calculating the operational costs of the plant, the lime dosing will be omitted (assuming stabilized water). Normally it is more cost effective to rather stabilize the water at the water treatment plant than to treat the symptom at the sewage treatment plant.

*Chlorine* is one of the most widely used chemicals for the sterilization of the final effluent of a sewage treatment plant. During final design, alternative technologies like ozone and UV will be considered. For budgeting purposes it can be assumed that 2mg/L of chlorine will be required. When the plant runs at capacity, 6kg of chlorine per day will be required.

*Flocculants* will be required in the sludge de-watering process. The type and amount of flocculants are equipment specific. Details in this regard will be provided when the de-watering equipment is procured.

• Maintenance costs

The maintenance costs on mechanical and electrical equipment are difficult to establish with the specifics not known. For the purposes of the IRS report, it is proposed that a budget of 2% of the installation costs per annum be budgeted for.

10. HUMAN RESOURCES REQUIRED

10.1 Assessment of existing human resources of benefiting institution

The Kgetlengrivier Local Municipality currently operates the Swartruggens sewage treatment plant. This plant is similar to the proposed Koster sewage treatment plant. The mere fact that activated sludge plants are currently successfully operated within the Kgetlengrivier Local Municipality indicates the following:

• Human capital is available;
• Skills can be obtained;  and
• Training can be done at more than one sewage treatment plant.

The “will” to operate these plants is illustrated through the quality of the effluent generated by the Swartruggens sewage treatment plant.

10.2 Water management plan associated with project (i.e. zone meters, valves, telemetry)

Not applicable on this project.
10.3 Strategy to minimize performance failures of proposed project

The Koster sewage reticulation systems are depending on functioning sewage pumping stations. The Kgetlengrivier Local Municipality has a challenge to maintain these pumping stations, especially because these pumping stations have to pump raw sewage. Screening and related mechanisms were installed in the past and these have their own unique challenges in terms of operations and maintenance.

This project will remove all pumping stations and raw sewage will flow under gravity to the sewage treatment plant where the inlet works will be designed to remove all the floating matter that can block pumps.

The sewage treatment plant will further be designed with minimal pumping requirements and where pumps are installed it will be for process related functions only. The main stream of sewage will flow under gravity through the plant which will render the plant efficient even during periods of power failures.

10.4 Strategy on how to optimize the proposed infrastructure

Optimization of sewage treatment plants revolve around efficient use of electricity. The proposed plant is a HYBACS plant, well known for its process advantages and the SMART units reduce the electricity requirements. Further the aeration will be carefully designed to install the most efficient system available on the market.

11. BANKABILITY ANALYSIS

<table>
<thead>
<tr>
<th>Items</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overview of the business</td>
<td>Since the intention of the bankability study is to ensure that the project makes both technical and financial sense, it is important that the business be clearly identified and described in the study. This has been done in the previous two reports and has been summarized in section 1.2 of this report.</td>
</tr>
<tr>
<td>Market analyses</td>
<td>Moedi wa Batho together with Magalies Water have identified all potential customers such as the mines, agriculture and public bodies and quantified the extent of waste that will be produced by these entities. Furthermore the growth factor has also been taken into account to allow for the design of the plant to accommodate such growth.</td>
</tr>
<tr>
<td>Technical Design</td>
<td>Following the determination of the market and setting out the individual needs, it was required to determine the design of the final waste water treatment plant to service the broader Koster community. The initial steps taken were to develop a scoping and inception report followed by the technical feasibility study to determine the best technical solution with the appropriate process design. Power requirements, land requirements have addressed in Phase 1 and 2A. Once the EIA is completed and ROD issued can the land be finalized.</td>
</tr>
<tr>
<td>Financial Projections</td>
<td>The municipality’s financial statements and expenditure reports will be the bases of projecting the future budget planning for Operations and Maintenance of the plant.</td>
</tr>
<tr>
<td>Securing of funds</td>
<td>This project will be funded by the Department of Water Affairs through the RBIG Programme.</td>
</tr>
</tbody>
</table>
12. STRATEGIC & PLANNING ISSUES

12.1 In line with Water Services Development Plan and Integrated Development Plan

The project is in line with the IDP. The document will be provided if required.

Annexure 8 is an extract of the KRLM IDP indicating the need for an upgraded sewer treatment works

12.2 In line with Provincial Growth & Development Strategy

The PGDS which is in the process of being aligned with the National Development Plan, recognizes Kgetlengrivier through Swartruggens and Koster as key development nodes.

Swartruggens lies on the N4 which is a major regional link with other SADC Countries whilst Koster is the main connector to Gauteng which partly forms part of the tourism development belt linking North West with Gauteng. It is predicted further that there will in future be a rapid urban development in Kgetlengrivier once Rustenburg start to become over populated and expensive.

12.3 Are other parts of the water / sanitation supply chain in place

The Kgetlengrivier Local Municipality is a water services provider. Water is obtained from two sources. These are:

- The Koster Dam; and
- Boreholes

Raw water from the Koster Dam is purified in a dedicated water treatment plant. The capacity of the raw water pipeline from the dam matches the treatment capacity of the plant.

Boreholes have to supply the deficit in water demand.

Currently demand is bigger than supply. Money has been budgeted to get water demand management and water conservation in place. This will probably bring demand and supply in line. Feasibility Studies are also in process to determine from where the next water will be imported.

Most of the town currently enjoys water borne sanitation. Where this system is not in place, water borne sanitation will be installed as a matter of priority.

12.4 Strategic importance, delivery targets

Pollution is the main driver for the project.
All sewage is currently treated in the oxidation lagoon system. This system is currently overloaded.

The scoping report provides details regarding the sewage pumping stations that fail. These pumping stations are virtually impossible to maintain unless inlet works are constructed to rid the raw sewage from floating material that block the pumps. The position of the proposed new sewage treatment plant was carefully selected to ensure that all the raw sewage will flow under gravity to the plant. The layout of the plant is carefully designed to minimize the impact of power failures.

12.5 Do all parties agree to the need & technical proposal

Moedi Wa Batho was appointed in 2012 to consider backlog maintenance and new development of infrastructure in the Kgetlengrivier Local Municipality. Over time proposals have been brainstormed with all interested and affected parties. It is believed that all stakeholders are well informed.

The technology proposed for the sewage treatment plant is well known to the Kgetlengrivier Local Municipality. A similar plant has been constructed for Swartruggens and the duplication of this plant in Koster assist in the training of operators. Two plants in the same local municipality also provide career opportunities for those involved.

Magalies Water renders operating services to the Kgetlengrivier Local Municipality. This provides the skills to train local operators in the operation of activated sludge plants.

12.6 Level of service

The Kgetlengrivier Local Municipality embarked on the implementation of water borne sanitation to all. The town expanded and no other technology will be acceptable to the inhabitants of the greater Koster.

Sewage has to be treated. Many technologies were developed over the years. DWA enforces minimum standards on effluent qualities. The chemical quality of the effluent from the sewage treatment plant to be enforced on Koster will only be achievable through activated sludge processes or more modern and expensive technology. The technology proposed will meet the effluent standards. The technology was specifically chosen for its low power requirement and high effluent quality.

12.7 Economical growth requirements

The proposed sewage treatment plant is designed as a 3Mℓ/day activated sludge plant. The inlet works to the plant and the main reactor are however designed to be upgraded to treat 6Mℓ of sewage per day with additions and upgrades to mechanical equipment only.

The plant is therefore designed to be adapted to the economic growth in town.

Development in Koster was to date hampered by water supply and sanitation infrastructure. With water supply under scrutiny and the sewage treatment in place, investors will consider investing in town.
12.8 Water scarcity, etc

The project will not address water scarcity per se. The final effluent from the treatment plant will be discharged in a stream that eventually ends up in the Koster Dam, the major source of potable water to town. The existing oxidation lagoon systems, when its spills, discharges water into a tributary to the above mentioned stream. Proper treatment of sewage effluent will therefore benefit the entire community by keeping the bulk supply systems clean.

12.9 Functional criticality of total scheme and specific components

Sewage spills are currently polluting the environment in and around the greater Koster. Renovation or as proposed the eradication of sewage pumping stations and the construction of a suitable sewage treatment facility will eradicate the pollution in the area.

12.10 Extent of cost

The total estimated cost for the project is detailed in Paragraph 3.6 above.

12.11 Available co-funding

It is unlikely that the Kgetlengrivier Local Municipality will be in the position to provide any co-funding. To date no industry developed in town. No funding from the private sector will therefore be levied.

13. SOCIAL CRITERIA

13.1 Number of households & people to be uplifted to basic and higher service levels

Details in this regard are given in the scoping report attached as Appendix 2. The total of 5230 households will benefit from the project.

It is not possible to identify who will get higher level of services. In the past, developers provided infrastructure to houses without assessing where sewage will be going.

13.2 Number of poor households to be served and the social cost (capital and operation)

Details in this regard are given in the scoping report, attached as Appendix 2.

4475 of the above mentioned 5230 households in the greater Koster are classified as poor households.

Since the majority will be indigent households, there will be reliance on the equitable share to maintain the services and a possible cross – subsidization from affluent areas.
13.3 Number of jobs to be created (temporary and permanent, by gender & age category)

Temporary jobs will be created during the construction phase of the project. The following is estimated:

<table>
<thead>
<tr>
<th>Description</th>
<th>Number of jobs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction of outfall sewers</td>
<td>20 - 30</td>
</tr>
<tr>
<td>Construction of sewage treatment plants</td>
<td>40 – 50</td>
</tr>
</tbody>
</table>

Permanent jobs will be created through the appointment of operators to operate the proposed activated sludge plant. The plant has to be permanently manned and in accordance with the DWA specifications, the following will be required:

<table>
<thead>
<tr>
<th>Class of persons as operators</th>
<th>Number of operators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trainee</td>
<td>1</td>
</tr>
<tr>
<td>Class 1</td>
<td>2</td>
</tr>
<tr>
<td>Class 2</td>
<td>1</td>
</tr>
<tr>
<td>Class 3</td>
<td>1</td>
</tr>
<tr>
<td>Supervisor - Class 4</td>
<td>1</td>
</tr>
<tr>
<td>Weekly inspection - Class 5</td>
<td>1</td>
</tr>
</tbody>
</table>

Please note: The above are only proposed numbers. It is believed that the number of operators could be reduced but cleaners (unskilled labor) have to be appointed to keep the plant clean. Numbers were calculated in accordance with DWA guidelines (Refer to Appendices’7A & 7B)

13.4 Affordability of proposed water tariffs (per service level and community)

Not applicable on this project.

13.5 Contribution towards poverty eradication, social upliftment and health improvement

Development in Koster was to date seriously hampered by the lack of water supply and sewage treatment. Rainbow Chickens seriously considered the construction of a chicken abattoir in Koster but moved the development to Rustenburg for the reasons indicated above.

If a sewage treatment plant is constructed and if water supply can be sustained, developers will most certainly consider developing in Koster for the following reasons:

- Koster is a rural town but only 80km from Gauteng;
- Koster is connected to Gauteng with an acceptable tar road and the road is not a toll road;
- A road branches off the N4 at Swartruggens and connects Botswana through Swartruggens / Koster to Gauteng.

The above are all motivations why it is believed that Koster will develop and the sewage treatment plant will contribute towards job creation (poverty eradication) and social upliftment.

When sewage is not discharged into the environment and malfunctioning sewage pumping stations do not contribute to sewage spills in the townships, health improvement is a given.
14. **ECONOMIC CRITERIA**

14.1 **Number of current businesses and industries to be served (by type and water use category)**

Koster is virtually depleted of any businesses of reasonable scale that will benefit from the project. Please note that all potential businesses that would require sewage treatment were discouraged to settle in town.

A few “dry” businesses developed in town. The sewage requirements of these businesses are limited to normal domestic use of office and industrial workers. In other words, the impact on the sewage treatment plant by the office and industrial workers is similar whether the person works or whether he stays at home.

14.2 **Expected economic value to be generated by the new businesses (GPS before and after) as result of the project**

As indicated before, the economy of Koster was slowed down in the past due to the irregular water supply and lack of sanitation processes. It is unlikely that everything will dramatically change with the construction of a new sewage treatment plant. The plant is however of crucial importance to keep the inhabitants of Koster healthy and to curb pollution of the environment.

14.3 **Number of SMME’s and BEE enterprises to benefit (by type & monetary value/benefit) during project and as an indirect result of the project**

SMME’s and BEE enterprises will benefit during the construction phase of the project. All of the project will be put out to tender and these enterprises will get preference in accordance with the applicable procurement legislation in place.

In terms of the development of new opportunities in town, the same goes for SMME’s and BEE enterprises as discussed in Paragraph 14.2 above.

14.4 **Regional economic benefit from the proposed water users and their value chain integrated development objectives (socio-economic benefits, provincial growth & development objectives, IDP’s and associated sector programmes like housing)**

Not applicable on this project.

15. **TECHNICAL CRITERIA**

15.1 **Is the project part of a Master Plan Proposal?**

Yes. The project forms part of the IDP of Kgetlengrivier Local Municipality. Please refer to Appendix 8.

15.2 **Appropriateness an acceptability of solution**

The proposed sewage treatment plant will discharge its effluent in a tributary to the Koster River. This river is dammed to form the Koster Dam, the main source of raw water to the Koster community. It is therefore of utmost importance that the sewage not be spilled into the
environment but that well treated effluent is discharged because a form of recirculation of water do exist.

The proposed activated sludge sewage treatment plant is state of the art technology, specially adapted for power saving and ease of operation and maintenance.

15.3 **Appropriate water resource choice & adequate water allocation (confirmed / approved by DWA WRM re choice, water license – volume, assurance & quality)**

Not applicable on this project.

15.4 **Compliance to water demand / water conservation objectives (acceptable water losses and appropriate plans to reduce / control water demand). Is a WDM /WC Strategy / Plan in place?**

Not applicable on this project.

For the sake of the reader it is confirmed that money has been budgeted for a WDM/WC study. A service provider will be appointed soon.

15.5 **Optimal choice of bulk distribution networks (pipeline routes, pump stations and bulk storage) considering full life-cycle cost (capital, financing, operating & maintenance cost)**

Not applicable on this project.

15.6 **Proof of best suited technology (pro’s and con’s per option)**

As indicated before, the technology is well known to the Kgetlengrivier Local Municipality. The technology was chosen for the following reasons:

- The technology can provide the required effluent standards;
- The technology was developed for its low electricity requirements; and
- Kgetlengrivier Local Municipality has experience in the operation and maintenance of the system.

16. **INSTITUTIONAL CRITERIA**

16.1 **Indicate who will own the infrastructure**

The infrastructure will be owned, operated and maintained by the Kgetlengrivier Local Municipality.

16.2 **Confidence in the capacity of the institution to implement**

The Kgetlengrivier Local Municipality implements similar projects through their service providers on a regular basis. The institution can implement the project.
16.3 **Agreements on infrastructure ownership (per scheme component)**

Not applicable to this project. The Kgetlengrivier Local Municipality will be the only beneficiary for the project.

16.4 **Agreement on implementation responsibility (per scheme component)**

Not applicable to this project. The Kgetlengrivier Local Municipality will be the only beneficiary for the project.

16.5 **Proof of implementation capacity (e.g. capital expenditure over last 3 years)**

The Kgetlengrivier Local Municipality implemented capital projects to a total value of R47.5 million over the past 3 years. The Municipality renewed the contract of their Technical Director to secure institutional memory in the implementation of projects and entered into a contract with Magalies Water to strengthen this capacity.

16.6 **History on past implementations quality & performance (e.g. functionality audits)**

Please refer to 16.5

16.7 **Agreement on operating responsibilities (per scheme component)**

The Kgetlengrivier Local Municipality entered into an agreement with Magalies Water to assist them in the operation and maintenance of water related infrastructure. A copy of the agreement is attached as Appendix 9.

16.8 **Proof of adequate staff numbers and skills level (per scheme component)**

The Kgetlengrivier Local Municipality does not have the staff numbers and skills levels to operate and maintain the sewage treatment plant – hence the above mentioned agreement.

As indicated before the Swartruggens sewage treatment plant is similar to the proposed Koster sewage treatment plant. Staff to operate and maintain the plants can already be trained at Swartruggens.

16.9 **History on water services interruptions (annual interruptions in household-days)**

Not applicable on this project.

Please refer to the Scoping report attached as Appendix 2 to this report for details on the conditions and the sewage pumping stations and the existing oxidation lagoon system. Also attached to this report as Appendix 11 is the ACIP application done by the RRU representative in the area to obtain funds for renovations to be done on the lagoon system.

16.10 **Commitments for above by institutional leadership (e.g. municipal mayor and council)**

Council resolution in this regard is attached as Appendix 12.
16.11 Cooperation agreements between key stakeholders

Not applicable on this project.

16.12 Approval of institutional arrangements

Not applicable on this project.

16.13 Cost recovery system (including policy on free basic water and non-payment)

Cost recovery from consumers not directly applicable in sewage treatment.

16.14 Water conservation and demand performance by institution

Not applicable on this project.

16.15 Responsibilities & accountability

<table>
<thead>
<tr>
<th>Description</th>
<th>Institution</th>
<th>Individual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Management during implementation</td>
<td>KRLM / DWA</td>
<td>TT Chiloane / Amos Leteane</td>
</tr>
<tr>
<td>Procurement process during implementation</td>
<td>KRLM</td>
<td>TT Chiloane / Amos Leteane</td>
</tr>
<tr>
<td>Financial Management and accountability of project funds</td>
<td>KRLM / PSP</td>
<td>TT Chiloane / Ben Mothogoane</td>
</tr>
<tr>
<td>Operational and Maintenance responsibilities of proposed project</td>
<td>KRLM</td>
<td>Magalies Water</td>
</tr>
<tr>
<td>Legal agreements</td>
<td>KRLM / PSP</td>
<td>Sipho Ngwenya / MwB</td>
</tr>
<tr>
<td>Planning of Water services and the planning of the proposed</td>
<td>KRLM / PSP</td>
<td>TT Chiloane / MwB</td>
</tr>
<tr>
<td>project/scheme</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

KRLM = Kgetlengrivier Local Municipality  
PSP = Professional Service Provider  
DWA = Department of Water Affairs

17. FINANCIAL CRITERIA

17.1 Available funding (grant, loan & investment)

Funding for the entire project is through DWA from their RBIG Programme.

17.2 Funding conditions (repayment period, interest)

THE DWA RBIG Programme funding conditions will apply.

17.3 Financial analysis of cost projections (cash flows)

The municipality’s financial statements and expenditure reports will be the bases of projecting the future budget planning for Operations and Maintenance of the plant.

17.4 Financial modeling of projected income taking into account affordability

Not applicable on this project. No cost recovery on sewage treatment plants.
17.5 **Proposed tariff adjustments to reconcile cost and projected income**

The municipality has been identified by the Minister as one of the municipalities that needs LOCAL GOVERNMENT TURN-AROUND PLAN (LGTAP) INITIATIVE. Through this process the tariff and financial remodeling will be addressed.

17.6 **Financial viability and expected return on investment over expected useful life**

This project is not financially viable but has to go ahead. Sewage treatment is one of those services to be rendered without a direct rate of return. The Kgetlengrivier Local Municipality has to budget funds to operate and maintain the plant from water sales or other sources of income.

17.7 **Financial status, performance and creditworthiness of municipality and implementing agents**

The operating revenue of the Municipality for its last financial year was about R8, 415 400 which was later adjusted to R9 006 300 and a collection rate of more than 100%. The stark reality is that the Koster town has a high rate of unemployment and indigence.

Although the municipality often experiences cash flow problems and is grant reliant, the financial statements show that it closed its books with a positive balance, opening with R592 000 and closing with R1 143 000. Its debtors stood at R220 732.00.

On the creditor’s side last financial year, Kgetlengrivier municipality owes Bulk Water purchases amounting to R355 thousand and R1, 7 million is owed to the Auditor General’s findings.

18. **LEGAL CRITERIA**

18.1 **Has a water license with adequate allocation for all uses been approved**

Not applicable on this project.

18.2 **Has an environmental authorization been granted for the construction of the scheme (based on accepted environmental impact assessment and public participation process)**

EIA is in process. ROD is expected towards end of the year.

18.3 **Have all land and property rights issues been addressed (land acquisition & servitudes)**

Preliminary negotiations with landowners are in process. Land will probably be purchased by the Local Municipality to construct the plant. The land acquiring process will not go ahead before the ROD has not been granted. The Municipality cannot run the risk of purchasing land to construct the plant only to learn that the ROD is declined.
19. **SUSTAINABILITY CRITERIA**

19.1 **Financial viability**

The sewage treatment plant is one of the services to be rendered by the municipality that will not generate any direct revenue. There will be reliance on the equitable share to carryout preventative maintenance and other measures can be explored to utilize alternative sources of energy for its operation in order to minimize costs.

19.2 **Operating and management capacity, performance and commitment**

The Kgetlengrivier Local Municipality are currently operating and maintaining two water treatment plants and the sewage treatment plant in Swartruggens. The municipality admitted their lack of capacity and contracted Magalies Water to assist. For the purposes of the IRS it is accepted that admitting the lack of capacity and contracting capable service providers to render the service is a common phenomenon applicable in everybody's lives from individuals to companies. The arrangement should be acceptable and should be preferred to appointing individuals in the hope that they could render the service.

19.3 **Environmental and social acceptability and impact**

The project has to be implemented. The environmental and social acceptability and impact of the project should rather be measured against the catastrophic implications if pollution of the environment continues.
APPENDIX 1

- Comments on first draft of document by Mr. Jasper Fourie
- Response from Kgetlengrivier Local Municipality/MwB on the above mentioned comments
<table>
<thead>
<tr>
<th>Comments by Mr J Fourie</th>
<th>Response by KRLM / MwB</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong> Please provide page numbers in the final document</td>
<td>Page numbering have been inserted.</td>
</tr>
<tr>
<td><strong>2</strong> The application for electricity supply / connection</td>
<td>Electricity will be tapped from the ESKOM line and engagements with</td>
</tr>
<tr>
<td>should be done as soon as the location of the WWTW is</td>
<td>ESKOM have already started. The application is currently being</td>
</tr>
<tr>
<td>confirmed – especially if it is Eskom</td>
<td>processed with them.</td>
</tr>
<tr>
<td><strong>3</strong> Licensing for discharging final effluent in a natural</td>
<td>A consultant has been appointed to assist with the licensing</td>
</tr>
<tr>
<td>water course needs to be done with DWA</td>
<td>procedures.</td>
</tr>
<tr>
<td><strong>4</strong> Please always include VAT in all costing quoted</td>
<td>VAT have been included into the final costing breakdown.</td>
</tr>
<tr>
<td><strong>5</strong> It is suggested that the necessary trespassing</td>
<td>Noted.</td>
</tr>
<tr>
<td>agreements be put in place with owners before construction</td>
<td></td>
</tr>
<tr>
<td>starts</td>
<td></td>
</tr>
<tr>
<td><strong>6</strong> O&amp;M / Asset management plan/s need to form part of the</td>
<td>Noted</td>
</tr>
<tr>
<td>close-out report</td>
<td></td>
</tr>
<tr>
<td><strong>7</strong> Is maintenance cost indicators from the Swartruggens</td>
<td>The mechanical contractors maintain the Swartruggens STP in the</td>
</tr>
<tr>
<td>WWTW not available to use as input on this project</td>
<td>compulsory 12-month guarantee period. The average operational cost is</td>
</tr>
<tr>
<td></td>
<td>R70 000/month. This is made up of 4 operators working a double shift,</td>
</tr>
<tr>
<td></td>
<td>chemicals and electricity.</td>
</tr>
<tr>
<td><strong>8</strong> Please insert contents of Annexure 8 (it’s empty)</td>
<td>This section refers to the IDP. KRLM will be sitting on the 30 May ‘13</td>
</tr>
<tr>
<td></td>
<td>to adopt their reviewed IDP. Once this is done, an extract from the</td>
</tr>
<tr>
<td></td>
<td>document will be provided.</td>
</tr>
<tr>
<td><strong>9</strong> The social component as was confirmed during the NW</td>
<td>The social component will be re-visited. The oxidation lagoons will be</td>
</tr>
<tr>
<td>PCC meeting held on 26 November 2012, is 94.5%, which</td>
<td>renovated and upgraded to partially treat the raw sewage during the</td>
</tr>
<tr>
<td>implies that the KRLM has to counter fund 5.5% (R6.05</td>
<td>construction and reporting period. The system will be retained for the</td>
</tr>
<tr>
<td>million on R110 million) – A council resolution by KRLM</td>
<td>treatment of the sewage generated on the south facing slopes of Koster</td>
</tr>
<tr>
<td>confirming the counter funding is required before the DWA</td>
<td>and the industrial area – hence eliminating the need for the</td>
</tr>
<tr>
<td>Capex Committee will consider the final approval of the</td>
<td>construction and operation of a sewage pumping station. Unfortunately</td>
</tr>
<tr>
<td>project.</td>
<td>the referred area is also the more affluent area of the town – hence the</td>
</tr>
<tr>
<td></td>
<td>higher social component.</td>
</tr>
<tr>
<td></td>
<td>KRLM is part of the Provincial support to get their LGTAS up and</td>
</tr>
<tr>
<td></td>
<td>running. Although the strategy is developed the recommendations</td>
</tr>
<tr>
<td></td>
<td>cannot be implemented as there are no funds available to address</td>
</tr>
<tr>
<td></td>
<td>them.</td>
</tr>
<tr>
<td></td>
<td>Additional support is currently from MISA.</td>
</tr>
<tr>
<td><strong>10</strong> Sections 13.4 &amp; 16.13</td>
<td>• KRLM has recently updated their Indigent register that will</td>
</tr>
<tr>
<td>Surely KRLM revise sanitation tariffs on a yearly basis in</td>
<td>affect the equitable share to them. This will become effective</td>
</tr>
<tr>
<td>its municipal bylaws – the cost for O&amp;M of the WWTW and</td>
<td>from the 1st July ‘13.</td>
</tr>
<tr>
<td>related infrastructure will form part of that. Please</td>
<td>• Each household that earns less than R2 600/month is also</td>
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<td>indicate as to how this project will affect the current</td>
<td>included in the register.</td>
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<td>tariffs. How is the equivalent of FBW and non-payment dealt</td>
<td>• Regarding nonpayment the municipality has recently adopted</td>
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<td>with by KRLM, also provide policy documentation.</td>
<td>a revenue enhancement strategy.</td>
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<td></td>
<td>• Currently the municipality is entering into agreements with</td>
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<td></td>
<td>the community to recover some of the outstanding payments.</td>
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<td></td>
<td>KRLM is part of the Provincial support to get their LGTAS up and</td>
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<td></td>
<td>running. Although the strategy is developed the recommendations</td>
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<td></td>
<td>cannot be implemented as there are no funds available to address</td>
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<td></td>
<td>them.</td>
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<td>Additional support is currently from MISA.</td>
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<td>**b. What are the time lines around the LGTAP Initiative which will</td>
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<td>include tariff &amp; financial remodeling?</td>
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<td><strong>11</strong> Sections 15.4 &amp;16.14 – WDM/WC has a direct influence on the</td>
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<td></td>
<td>infrastructure provided and operational costs, and therefore it cannot</td>
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<td></td>
<td>be ignored. Please provide the business plan developed to deal with</td>
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<td></td>
<td>WDM/WC</td>
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<td><strong>12</strong> DWA prefers for Magalies Water to be the implementing agent for</td>
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<td>the project. Please confirm this with the DWA NW office, from where</td>
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<td></td>
<td>the necessary actions should be put in place to ensure execution of</td>
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<td></td>
<td>same. After approval by the DWA Capex committee an implementation</td>
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<td></td>
<td>agreement between DWA / MW / KRLM will be signed.</td>
</tr>
</tbody>
</table>
APPENDIX 2

• Maps indicating the outfall sewer to be installed. Please note the 4 sewage pumping stations that will be replaced by gravity sewers.

• The sewage treatment plant is deliberately positioned to “open” vast areas for development. (Area north of Swartruggens / Derby Road). All these areas will discharge raw sewage to the outfall sewers.
Proposed sewage treatment plant based on the patented HYBACS sewage process. The plant comprise of the following unit processes:

- Inlet works with screening grit removed and flow measurement
- Anaerobic reactor
- SMART units
- Aerobic reactor
- Clarifiers
- Sludge return pumps
- Chlorination of final effluent
- Sludge dehydration
- Diffused

Please note that the aerobic reactor is designed to facilitate the bypass of any reactor. Once bypassed the reactor can be drained and maintenance performed.